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Marginal Benefit Incidence of Public Health Spending:
Evidence from Indonesian sub-national data

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Abstract

We[1] examine the marginal effects of decentralized public health spending by incorporating estimates of behavioural responses to changes in public health spending through benefit incidence analysis. The analysis is based on a panel dataset of 207 Indonesian districts over a 4-year period from 2001 to 2004. We show that district-level public health spending is largely driven by central government transfers, with an elasticity of public health spending with respect to district revenues of around 0.9. We find a positive effect of public health spending on utilization of outpatient care in the public sector for the poorest two quartiles. We find no evidence that public expenditures crowd out utilization of private services or household health spending. Our analysis suggests that increased public health spending improves targeting to the poor, as behavioural changes in public health care utilization are pro-poor. Nonetheless, most of the benefits of the additional spending accrued to existing users of services, as initial utilization shares outweigh the behavioural responses.

JEL: H72, H75, I18

Keywords

Decentralization, public spending, health care utilization, benefit incidence, Indonesia.

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1. Introduction

In recent years most developing countries have introduced decentralization policies, which to varying degrees delegate the provision of local services (including key health services) to sub-national governments. Given the significance of this trend and of the new responsibilities vested in local administrations, it is particularly important to understand how sub-national government revenues –and their composition- translate into health spending and this in turn translates into benefits for their populations.

There is a rich literature on the effectiveness of public health spending (World Bank 2004). Based on cross country variation Filmer and Pritchett (1999) note the lack of correlation between public health spending and child mortality and conclude that governance, or the way in which resources translate into actual programs, and crowding out of the private sector by the public sector are the *missing chains* that explain the low correlation.

Supporting empirical evidence for the first – governance matters – claim is provided by Rajkumar and Swaroop (2008), who show that more public health spending reduces child mortality in good governance countries. Making a similar argument, McGuire (2006) shows that in a cross section of developing countries, access to maternal and infant health programs is correlated with decreased under-five mortality, while public health spending is not. This indicates that it is the quality of the implemented programs that matter, and not the spending per se. The effects of public health spending may also vary by population segment. Using cross-country data, Gupta et al. (2003) show that higher public health spending reduces child mortality among the poorest quintile, while no effects can be detected among the rich.

Supporting evidence for the second - public sector crowds out the private sector - claim comes from several authors, who note that total health spending is closely correlated with GDP, with an elasticity around one (Gerdtham & Jönsson 2000; van der Gaag & Štimac 2008). The share of public spending devoted to health however varies a lot across governments, suggesting that the size of the private sector adjusts to the size of the public sector.

However, conclusions regarding the determinants and effectiveness of public health spending based on cross-country analysis should be interpreted with caution. Omitted variable bias, resulting from country specific unobserved historic and institutional factors that influence both public spending decisions and health outcomes, make it difficult to interpret the estimated relationships as causal. Moreover, cross-country studies are typically prone to measurement error, due to inconsistencies between countries in data quality, data collection tools, and underlying sources of (micro) data. Perhaps the most serious problem is that public health spending is endogenously determined by a fiscal and public health policy that could be influenced by the outcome variables of interest.

Analyzing sub-national expenditures in a decentralized context overcomes many of the problems associated with cross country analysis. As sub-national governments operate within the same institutional setting and often share data collection tools, the analyses are less plagued by omitted variable biases. Bhalotra (2007) analyzes the effects of state health expenditures in India on child mortality using a 29-year panel of 15 states. She finds generally small effects, with a negative significant effect appearing in the third

lag of public health expenditures for rural areas. Nevertheless, Bhalotra (2007) does not control for endogeneity of state government revenues and thus state spending.

Another strand of literature looks at benefit incidence analysis and is widely used in policy circles to analyze the benefits of public health spending (Shah 2005, page 21-22). Benefit incidence analysis focuses not so much on the impact of public spending but rather on who the beneficiaries of public spending are. Since many benefits are derived by obtaining services from public providers, a standard procedure is to assume that benefits are proportional to utilization rates. The share of total benefits received by the poor is then directly deduced from their observed use of public services. Several authors have noted that this average benefit incidence may not be a good predictor of who would benefit from changes in public spending. For example, Lanjouw and Ravallion (1999) argue that the distributional effects of public spending reforms may differ from static average patterns due to political processes that drive such reforms, while van de Walle (1995) notes the importance of considering behavioural responses in benefit incidence analysis. Changes in utilization rates resulting from public spending need to be taken into account. Younger (2003) notes that a lot of progress can be made by looking in more detail at the specific categories of spending in which changes would take place. For instance, additional spending to finance an expansion of services will impact different groups than a similar increase channelled toward a general quality upgrade, which will largely benefit existing users.

This paper seeks to contribute to these different strands of literature. First, we analyze sub-national public health care spending, its determinants, and impacts, in 207 Indonesian districts. We look at mechanisms through which changes in local government

resources affect district level public spending on health. The analysis covers the period from 2001 to 2004, immediately after Indonesia's push to decentralize, and district governments received far reaching authority to determine the size and composition of their spending. This period just after decentralization, when budgets were still in flux, provides a unique opportunity to analyze the determinants and impacts of public health spending, across governments that inherited a similar institutional setting.

The second contribution of this paper is the development of a method to analyze the marginal benefit incidence of public health spending that takes account of behavioural responses to changes in public spending, thus avoiding the arbitrary assumptions used in earlier studies. By linking the fiscal data to district income-specific utilization rates of public services obtained from household surveys, we can estimate the elasticity of demand for public services with respect to changes in public spending. We show that marginal benefit incidence can be calculated by multiplying average benefit incidence rates with a simple correction factor based on these elasticities.

The third contribution is that we explicitly test whether changes in public spending crowd out private spending in the health sector. We do so by estimating the cross elasticity of utilization of services in the private sector with respect to changes in public spending directed to the public sector. We also test whether changes in public health spending crowd out out-of-pocket (OOP) health expenditures by households.

We find that public health spending is elastic with respect to district revenues, which is mainly driven by untied transfers from the central government and district own revenues. Public health spending has a positive effect on utilization of outpatient care in the public sector for the poorest two quartiles. Increased public health spending improves

targeting to the poor, as behavioural changes in public health care utilization tend to be pro-poor. But these behavioural changes are relatively small compared to initial utilization shares. Hence, most of the benefits of the additional spending accrue to existing users of services. We find no impact of changes in public health spending on utilization of health services from the private sector or on OOP health expenditures, thus casting doubt on the earlier claims that the public sector crowds out the private sector in health.

The paper is organized as follows. Section 2 provides an overview of decentralization in the health sector in Indonesia. We describe the sources of revenues of districts, and the trends in central and district government expenditures over the period of study. Section 3 analyzes the determinants of public health spending by districts. Section 4 presents a behavioural benefit incidence analysis of changes in district health spending, evaluates the impact of public spending and provides a sensitivity analysis. Section 5 concludes.

2. Institutional Setting and Data

Indonesia's health sector is highly decentralized. Bossert (1998) developed a classification method to characterize the extent of centralization in the health sector. Table 1 shows where Indonesia stands in this classification. Districts have the legal responsibility to provide basic health care. They are free to set user fees for public health services (to be used as a revenue stream for local government operations) and there are no rules or guidelines for allocating resources and carrying out particular programs. Districts are not required to justify local spending to the central government based on

outputs or pre-defined objectives. Instead, district governments are accountable to district parliaments. Indonesia's health care system also retains important centralist features. The central government sets employment conditions for civil servants, including those working in public health service providers financed by district governments. It also finances and runs social safety net programs for the poor, such as targeted price subsidies for public care. Total health spending is split almost evenly between the central/provincial level on one hand and the district level on the other hand; in 2005, they accounted for 48 percent and 52 percent of public health expenditures respectively (World Bank 2008).

In spite of their high share of expenditures, districts remain highly dependent on the central government for their revenues, 90 percent of which they receive as transfers from the center (World Bank 2008). The largest transfer, 56 percent of total district revenues, is the general allocation grant (*Dana Alokasi Umum* – DAU), which is a formula-based untied grant (Hofman *et al.* 2006). The other main transfers are shared tax revenues - 11 percent of total revenues - and shared non-tax revenues - 12 percent of total revenues. The former consists largely of property and income taxes that are administered by the central government and transferred back to the districts. The shared non-tax revenue is largely a natural-resource revenue that is also distributed back to the districts (World Bank 2007). Finally, there is the specific allocation grant (*Dana Alokasi Khusus* – DAK), a tied resource whose use is determined centrally but which only accounts for a modest share of district revenues (3 percent in 2005). District own revenues are non-negligible and have been increasing as a share of the total from 10 to 16 percent between 2001 and 2004 (World Bank 2007), but they are unequally distributed.

Overall public resources for health increased considerably between 2001 and 2004 (Table 2). Total health expenditures increased on average 23 percent on a year to year basis. For comparison, the average inflation rate equalled 9 percent over this period and total nominal public expenditures at all levels of government grew by 10 percent.[1] Indonesia is no anomaly in this respect; other countries that decentralized also increased spending in the public sector (Granado *et al.* 2005). Both local and central governments contributed to rising health expenditures. Therefore, the elasticities reported in this paper mostly reflect the impact of *increases* in public spending, which may differ from the ones resulting from downward adjustments (Lago-Penas 2008).

The empirical analysis in this paper draws on two main data sources. The first is Indonesia's national household survey, *Susenas*, fielded every year and representative at the district level. It contains information on household socio-economic characteristics, health services utilization, and private expenditures, including on health. The second source, compiled by the Ministry of Finance, contains detailed records of local government revenues and expenditures for the post-decentralization years; both routine and development expenditures can be broken down by sector, including health. Routine expenditures consist of salaries and operational costs of providing health services at public facilities. Development expenditures are investments, such as upgrading of health facilities and training. However, the data do not allow a facility level stratification.

We combined the two data sources to construct a district level panel. Since the household survey data are collected around February, while the fiscal data reflect expenditures during the calendar year, the effects of changes in public spending are observed in the *Susenas* of the subsequent year. Therefore we constructed a panel that

[1] Source: IMF 2009 World Economic Outlook and World Bank (2008), respectively.

contains district revenues and spending data of 2001 to 2004, linked with the *Susenas* data for 2002 to 2005.

During the 4 years analyzed, new districts emerged as a result of district splits. In such cases, we aggregated the data from the split districts, and assigned those to the original district definition. We applied the 2000, pre-decentralization, district definition frame, which comprised 305 districts. Unfortunately some of these districts had to be dropped from the sample, for several reasons. First, the capital Jakarta comprises 6 districts but is treated as one observation, since the budget data is consolidated for the larger metropolis. Second, over the period under investigation, Indonesia faced a number of local conflicts that made it unsafe for surveyors to collect information. Only those districts for which we have complete *Susenas* data are included in the analysis. Third, budget data is not available for all districts, and those with missing entries were therefore dropped from the analysis. Finally, two provinces, Aceh and Papua, are excluded since both have been granted a special autonomy status in 2001 and their budgets are not included in the dataset compiled by the Ministry of Finance. The balanced panel therefore contains data from 207 districts, which represent 70 percent of total public health spending by districts at the time of decentralization and include 40 districts that split after 2001.

Table 3 shows descriptive statistics for the balanced panel of districts[2], including (i) per capita district revenues by source, and health spending for budget years 2001 to

[2] District revenue, public spending and OOP health payments are reflected in 2001 constant prices. Rupiah – USD exchange rate for 2001 is 10,246 (IMF article IV consultation 2004).

2004, and (ii) average district utilization rates and OOP health spending by households in the month prior to the survey in 2002 to 2005[3].

Both district revenues and public health spending increased strongly during the first four years of decentralization in Indonesia. Total per capita district revenues increased from 415,987 Rupiah in 2001 to 563,934 Rupiah in 2005. The bulk of district income comes from DAU allocations, but its share decreased from 75 percent in 2001 to 66 percent in 2004. This is mainly due to increases in shared non tax revenue and DAK allocations. Public health spending by districts also increased per capita, from 26,057 Rupiah in 2001 to 41,959 Rupiah in 2004. This change is driven by development health spending, whose share increased from 22 to 42 percent.

Average utilization of public outpatient care in districts increased from 0.073 out patient visits per person per month (vppm) in 2002 to 0.094 vppm in 2005, with a slight dip in 2004. This trend is in contrast to private health care utilization, which decreased slightly from 0.079 vppm in 2002 to 0.072 vppm in 2005. We observe somewhat similar patterns for the poorest quarter of the Indonesian population. District average for utilization of public health care by the poorest quartile increased from 0.074 vppm in 2002 to 0.083 vppm in 2005, most of which occurred after 2003. Utilization of private care decreased from 0.053 vppm in 2002 to 0.046 vppm in 2005. This gradual move from private to – largely subsidised – public utilization is reflected in average per capita OOP health spending by the poorest, which decreased from 3,339 Rupiah per capita per month to 2,386 Rupiah in 2005.

[3] Note that utilization and OOP spending do not reflect national averages, but the average of the district averages (i.e. the observations for our balanced panel).

3. Determinants of decentralized public health spending

Public spending on health is closely correlated with overall levels of district government revenues (Figure 1). Comparing the pattern of 2004 with that of 2001, the slope is steeper and the fit of the curve improves, indicating that districts are converging towards a common spending pattern. This is also reflected in simple cross section regressions, as the gradient increases from 0.91 to 0.99 and the R-squared from 0.58 to 0.70. When we compare the changes in district ranking by revenue with changes in ranking by health spending, the Spearman rank correlation coefficient between district per capita revenue in 2001 and 2004 is 0.706, while for district health spending it is 0.674, indicating that district revenue rank is more stable over time than spending rank. Although this cannot be interpreted as a causal effect, it does suggest that spending is adjusting to revenues, rather than the other way around.

To investigate the causal relationship between local revenues and public health spending patterns, model (1) relates district per capita public health spending (H_{it}) to district per capita revenues (R_{it}), time variant district observable variables, time invariant district unobservable variables, a time trend and an error term:

$$\log H_{it} = c + \beta \log R_{it} + \sum_{r=2}^{6} \gamma_r s_{rit} + \phi X_{it} + \alpha_i + \delta_t + \varepsilon_{it} \quad (1)$$

where i denotes the district and t the year. Imposing this log-log specification, we interpret β as the elasticity of health spending with respect to revenues at the district level. We also investigate whether the source of revenue matters for health spending, by including the share of each main revenue source, s_{rt} in the regression, excluding the share of DAU funding. The case of perfect fungibility of district revenue sources would imply the testable hypothesis that $\gamma_r = 0$, for all revenue sources r. The set of control variables

X_{it} includes demographic variables (average age, household size, and percentage of female population), the fraction of the population living in a rural area, and region fixed effects[4]. Time dummy variable, δ_t, picks up aggregate time shocks, while α_i is modelled as a district fixed or random effect. For the fixed effect models, the region fixed effects are absorbed by the district fixed effects. Since the panel is based on the district definition of 1998, we also include a variable that tracks the number and timing of district splits.

Our aim is to identify the causal effect of revenues on health spending. District unobservable factors, such as the number of civil servants employed at the time of decentralization, could influence both revenues and health spending and if ignored could lead to false inferences. By treating α_i as a district fixed effect, we correct for such time invariant district specific omitted variables.

Table 4 summarises the estimates of the elasticity of per capita district health expenditures with respect to per capita district revenue. Equation (1) is estimated first without the interaction terms, and separately for total public health spending, routine spending and development spending. A Hausman test rejects the random effects model in favour of the fixed effects model, although the elasticities are fairly robust to the choice of specification. The elasticity of total health spending with respect to revenue is slightly below one, at 0.88. Development spending is more sensitive to district revenue than routine spending: a one percent increase in revenue is associated with a 1.12 percent increase in development health spending, whereas routine expenditure increases by only 0.83 percent. We conclude that the share of development health expenditures increases as districts have access to more resources.

[4] We define 5 regions: (i) Java and Bali, (ii) Sumatra, (iii) Sulawesi, (iv) Kalimantan and (v) Other Islands.

The fixed effects approach leaves a potential source of bias through endogeneity in changes in revenues and spending over time. But the scope for time variant confounding effects is small, as all major sources of district revenue are determined exogenously with respect to public health spending. The only revenue source that is potentially susceptible to endogeneity is own revenues, for example if increased public spending would be used to reduce user fees. We therefore estimated equation (1) excluding own revenues from total revenues, and find the results to be robust.[5]

We examined the relationship between categories of expenditure and sources of revenue in Table 5, by including the share of revenue source s_{rt} in the specification. Economic theory predicts that, money being fungible (except for DAK revenues), the revenue sources should not affect expenditure allocation decisions. Even for earmarked grants, such as the DAK, an increase does not necessarily translate in an equal increase in the associated sector spending, as government can adjust the allocations to other budget lines (Dye & McGuire 1992).

However, the results suggest that the source of funding does matter for public health spending. A higher share of own revenues increases routine spending on health. Possibly local governments feel that the long term commitments (hiring staff) associated with routine spending are more securely covered if there are own revenues. A one percent increase in the share of own revenues increases health spending by 2 percent. For development spending we find a positive effect of the share of DAK spending, which is not unexpected. In the period under investigation, the sectoral coverage of the DAK was limited to education, health, local infrastructure (roads and irrigation), and government

[5] These results are not shown here, but are reported in a supplemental appendix, which is available upon request.

office buildings for newly created local governments (World Bank 2007, p 123). The results suggest that, indeed, these tied grants resulted in a net increase in health spending.

Variation in public spending js driven mainly by DAU transfers and local tax revenues. We find higher public health spending in districts with relatively large DAU revenue vis-à-vis shared tax and non tax revenues. The negative effect of shared non tax revenue is interesting, as it suggests that differences in natural resource endowment do not lead to divergence in public health spending. This implies that central government can have considerable indirect influence on local health budgets, through its decentralized fiscal instruments.

Districts splits tend to reduce public health spending. A district that splits into two districts over the period of investigation – and is treated as one observation throughout – has on average 6 percent lower public per capita health expenditures after the split. It is not possible to separately identify the effect of a split on routine and development spending, as both elasticities are not statistically significant. Considering the externalities associated with public health spending at the district level, the negative effect of a district split is not un-expected. When districts split, these benefits are not internalized anymore when taking district spending decisions.

4. Marginal benefit incidence of decentralized public health spending

4.1. Marginal benefit incidence analysis

To analyze the marginal benefit incidence of public health spending we propose a method that takes account of changes in utilization rates that may result from changes in spending, and apply this in the Indonesian setting. Following standard practice we write the benefit

incidence of public health spending on outpatient care for quartile q as the unit cost times the utilization rate observed in the quartile.[6] This setup is similar to traditional static benefit incidence analysis, except that we let the utilization rate be a function of public health spending:

$$B_q(H,X) = \frac{H_o(H)}{D(H_o(H),X)} D_q(H_o(H),X) \tag{2}$$

where H_o is the per capita public health spending on outpatient care, which is a function of total public health spending H; D is the per capita outpatient care utilization of public services, which is a function of public health spending on outpatient care H_o and a set of other determinants of health care demand, X. In the standard set up, H_o/D reflects the unit cost (or average unit subsidy) of an out patient visit, and B_q is interpreted as the per capita subsidy for utilization of outpatient care allocated to quartile q.

The marginal benefit incidence of public health spending for quartile q is then defined as:

$$\begin{aligned}
\frac{\partial B_q}{\partial H} &= \frac{\partial H_o}{\partial H}\frac{D_q}{D} + \frac{\partial D_q}{\partial H_o}\frac{\partial H_o}{\partial H}\frac{H_o}{D} - \frac{\partial D}{\partial H_o}\frac{\partial H_o}{\partial H}\frac{H_o D_q}{D^2} \\
&= \frac{D_q}{D}\left[\frac{\partial H_o}{\partial H} + \frac{\partial D_q}{\partial H_o}\frac{\partial H_o}{\partial H}\frac{H_o}{D_q} - \frac{\partial D}{\partial H_o}\frac{\partial H_o}{\partial H}\frac{H_o}{D}\right] \\
&= \frac{D_q}{D}\left[\frac{\partial H_o}{\partial H} + \frac{\partial D_q}{\partial H}\frac{H}{D_q}\frac{H_o}{H} - \frac{\partial D}{\partial H}\frac{H}{D}\frac{H_o}{H}\right]
\end{aligned}$$

or:

$$B_q' = d_q\left[H_o' + h_o(\theta_q - \theta)\right] \tag{3}$$

where θ and θ_q denote the elasticity of outpatient care utilization with respect to public health spending for the full population and quartile q, respectively; and d_q is the initial

[6] See Demery (2003) for a general discussion of average benefit incidence analysis.

utilization share of quartile q, and h_o is the share of the health budget devoted to outpatient care.

Unfortunately, we do not have data on public spending on outpatient care provided in the public sector so we cannot estimate $H_o^{'}$ and h_o. If public spending on outpatient care is a linear function of total health care spending, $H_o = \alpha H$, then (3) reduces to:

$$B_q^{'} = \alpha d_q \left(1 + \theta_q - \theta\right) \tag{4}$$

If H_o would be observed directly then α drops out altogether. The marginal benefit incidence of quartile q thus depends on the initial share of the quartile q in total utilization, and the demand response of the quartile to public health spending, relative to the demand response of the entire population.

This formula encompasses the two cases distinguished in Younger (2003) of a marginal benefit incidence of spending which only affects existing users (the average benefit incidence), and the marginal benefit incidence which is used entirely to finance an expansion of services. In the former, the demand response is assumed to be equal across the population, i.e. $\theta_q = \theta$, and the benefit incidence is entirely determined by existing differences in utilization rates between quartiles d_q. In the latter, the unit cost remains constant, implying that $\theta = 1$ and the benefits of additional public spending are absorbed by increases in demand. In that case the marginal benefit incidence equals:

$$\frac{\partial B_q}{\partial H} = \frac{D_q}{D}\left[1 + \frac{\partial D_q}{\partial H}\frac{H}{D_q} - \frac{\partial D}{\partial H}\frac{H}{D}\right] = \frac{D_q}{D}\left[1 + \frac{\partial D_q}{\partial H}\frac{H}{D_q} - 1\right]$$
$$= \frac{H}{D}\frac{\partial D_q}{\partial H} = \frac{\partial D}{\partial H}\frac{H}{D}\frac{\partial D_q}{\partial D} = \frac{\partial D_q}{\partial D}$$

which is the change in demand of quartile q relative to that of the entire group. This is what Lanjouw and Ravallion (1999) estimate when they relate the average enrolment in a region to the income group specific enrolment using data from 62 regions in India's national sample survey. Hence, to interpret the Lanjouw and Ravallion marginal benefit incidence results as marginal effects of public spending, one has to assume constant unit costs.

4.2. Demand responses to district public health spending

To calculate the marginal benefit incidence of decentralized public health spending for Indonesia we need estimates of the national and quartile specific elasticities of demand with respect to decentralized health spending. We model the utilization rate of public services as a log-linear function of one-year lagged per capita district health spending and a set of control variables:

$$u_{it} = c + \pi \log(H_{it-1}) + \eta_{dk} d_{it-1} + \lambda X_{it} + \alpha_i + \delta_t + \nu_{it} \quad (5)$$

Where u_{it} is the number of visit per person per month to a public provider. We present the effect on utilization both in levels and logarithms, where the latter is used for the marginal benefit incidence analysis. The control variables X_{it} are the same as in equation (1). We investigate the differential effect of development and routine spending, by including the lagged share of development spending in overall district health spending, d_{it-1}. The equation above is also used to investigate crowding out effects, by estimating the impact of public health spending on the utilization of private services and on OOP health spending.

Again we need to consider possible endogeneity biases that may result from unobserved district specific effects, omitted variables related to local welfare and economic activity that drive tax revenues and health care demand, or even direct reverse causality if increased utilization of public care drives up district health budgets. Time invariant district effects that affect both health spending and utilization are controlled for by including district fixed effects. Dynamic effects, such as a sudden increase in utilization resulting in a sudden increase in health expenditures, are corrected to a large extent by using the previous year's budget as the explanatory variable for this year's utilization. Nevertheless, confounding time variant unobservables could still frustrate identification through serial correlation in v_{it}. We therefore test for endogeneity using a Durbin-Wu-Hausman test, instrumenting H_{it-1} with the shares of different revenues from central government (s_{rt-1}): DAU transfers, shared non tax revenue and DAK transfers. These seem suitable instruments as the previous section has shown these to be determinants of public health spending, while there is no reason to expect correlation of lagged revenue source shares with current health care utilization. The instruments provide sufficient support for identification as they are jointly significant at the 5 percent level and the validity of the exclusion restriction is supported by a Sargan test.[7] Finally the Durbin-Wu-Hausman test results show no evidence of endogeneity of H_{it-1} with respect to u_{it}.[8] We therefore choose the fixed effects specification for the remainder of the analysis. We also estimated a random effects model, but Hausman tests rejected this in favour of

[7] The Sargan Chi-squared test statistics vary between 0.061 to 2.406, with a critical value of 4.61 at 10 percent level and 2 degrees of freedom.

[8] The results are not shown here, but are reported in a supplementary appendix, which is available upon request.

the fixed effects specification for the effect of public spending on public utilization and OOP health payments.[9]

The results of the fixed effect regressions excluding and including the share of development spending (Table 6) suggest that public spending indeed affects the overall level of health care utilization. A one percent increase in district public health spending leads to an increase of 0.016 outpatient visits to a health care provider per person per month. This result is mainly due to the positive effect on public utilization, which increases by 0.011 vppm. The effect on private utilization is positive yet imprecise, but appears statistically significant when the share of development spending is included. This contradicts the crowding out hypothesis, which would imply a negative sign. The positive effect could be explained by the fact that many physicians in public health centres operate a private practice in parallel, often referring public care patients to their private practice. Hence, increased public utilization driven by increased routine budgets for public health clinics appears to have positive spillovers for the private sector. An increase in the share of development spending, on the other hand, is associated with a decrease in private care utilization, probably due to the specific nature of development spending. There seems to be no differential effect of development spending for public health care utilization.

The increase in public sector utilization associated with additional public spending, and the absence of substitution effects, does not lead to increased household health expenditures. Rather, we find negative but statistically insignificant effect in the data. This would suggest that either increased local public health budgets have been partly used to reduce the direct costs of public care for patients through reduction of user

[9] For detailed estimation results we refer again to the supplemental appendix.

fees, that the mix of services has changed through an increase in routine low-cost services, or that prices in the private sector have been cut in response to public sector investments.

We next investigate the distributional effects of public health spending on utilization, by taking the utilization rate of different per capita expenditure quartiles as outcome variable in equation (5)[10]. The fixed effect results are given in Table 7. Additional district health spending increases health care utilization mainly for the poorest half of the population. A one percent increase in public spending increases the utilization rate by 0.014 vppm for the poorest quartile and 0.020 vppm for the second quartile. This mainly occurs at public centers, with no differential effect between routine and development spending. We find no effect of public spending on OOP health spending by households. The coefficients are negative, but not statistically significant.

The marginal benefit incidence estimates can be directly calculated from the quartile specific demand elasticity relative to the demand elasticity of the entire population and the average utilization rates per quartile. The elasticities are given in Table 9, corresponding to the patterns found in Table 7. Elasticities are estimated following equation (5), with $\log(u_{it})$ as dependent variable.

Demand for public outpatient care utilization is relatively inelastic with respect to public spending. A one percent increase in district health spending is associated with a statistically significant increase of 0.09 percent. This implies that the unit cost increases with increased public spending; that is, the average benefit of public outpatient care in terms of public resource increases, for example through increased quality of public care or reduced user fees. The demand elasticity is higher for the poorest quartiles, at 0.14,

[10] Since we only use districts from the balanced panel for which survey data contains at least 50 observation per quartile, for the quartile analysis we lose 8 districts from the balanced panel, reducing it to 199 districts, with 796 observations from 2002-2005.

while the hypothesis of perfectly inelastic demand is not rejected for the two richest quartiles. We find no statistically significant estimates for private outpatient care or OOP.

Table 10 presents the estimated marginal benefit incidence following (5). Because we are primarily interested in relative benefits across quartiles, we omit α for convenience, since this is a constant across quartiles. The distributional pattern in demand elasticities reveals a pro-poor marginal behavioural response ($1 + \theta_q - \theta$), while the initial utilization share does not. The combined result suggests that the benefits from public spending are spread fairly equally across the population. The positive demand response of the poor to public spending results in a marginal benefit incidence that is more pro-poor than the average benefit incidence. Despite the pro-poor behavioural response, the initial utilization shares dominate the marginal benefits.

4.3. Sensitivity analysis

There seems to be little scope for endogeneity bias in the empirical results in the previous section. However, a potential source of bias could be due to spurious correlation between local public health budgets and utilization through omitted variables. Two variables raise particular concerns. The first is economic welfare of the district population, as this is likely to drive demand for health care as well as local revenue raising capacity. Our analysis of health spending patterns finds that district own revenues affect routine health spending, indicating scope for omitted variable bias through district variation in changes in economic welfare. A second possible omitted variable is the social safety net health card scheme, which was introduced during the economic crisis in 1998, and is managed centrally by the ministry of health. This health card was targeted to the poorest

households, entitling recipient to price subsidies at public health care facilities. Public health care providers were compensated through lump sum transfers. If the health card program crowds out local spending, this may cause an upward bias in the observed public spending effects, since the health cards are targeted towards poorer districts with relatively smaller health budgets and lower utilization rates.

Information on both variables is available in *Susenas*. Per capita household consumption serves as indicator of economic welfare, and questions on health card receipt are included in the questionnaire for all years. However, both variables are potentially endogenous in the utilization regressions, while obvious instrumental variables are not at hand. Therefore, we opt for a sensitivity analysis, evaluating the robustness of the results to including these variables. If indeed there was an omitted variable bias, we would expect the health spending coefficients to be sensitive to specification.

The estimated effects of health spending on utilization or OOP payments are robust to including per capita consumption in the specification, as shown in panel A of Table 8. All the estimates are well within one standard error. The coefficients for outpatient care are very similar. For OOP payments the coefficient becomes larger in absolute terms, but remains imprecise. Nevertheless, per capita consumption is strongly correlated with utilization of private outpatient care (but not with public) and OOP health payments.

The results for the specification including health card coverage are given in panel B of Table 8, and show that the health spending coefficients are very similar to the specification without health card coverage. Health card coverage is associated with an

increase in utilization of public care. Interestingly, the increase in subsidized outpatient care goes together with an increase in OOP health spending. This is a similar effect to that found in China by Wagstaff and Lindelow (2008), who argue that increased insurance coverage encourages use of higher cost services due to lumpiness and indivisibility of health care.

We stress however that this sensitivity test does not constitute a rigorous impact evaluation of the health card program, and some caution is warranted when interpreting the results because of possible selection bias introduced by non-random geographic targeting. The main point of this exercise is to show that our results are not sensitive to omitting health card coverage from the empirical specification.

5. Conclusion

This paper analyses spending patterns and utilization of health services during the first years of decentralization in Indonesia. We looked in particular at the relationship between local revenues and health spending categories (development and routine), and their effect on health care utilization. Indonesia's partial decentralization brought a large proportion of the health budget under control of district authorities and induced a massive redistribution of resources across districts.

Local government health spending increased sharply with decentralization, reflecting the transfer of responsibility and authority from the centre to the districts. In parallel, health care utilization increased from 2001 to 2004, in particular in the public sector.

Public health spending appears close to unit elastic (around 0.9) with respect to local revenues. District revenues do not seem completely fungible with respect to health spending, as the source of financing matters. Spending is mostly driven by DAU transfers, while inequalities in local revenues sources play an important role for routine health spending, suggesting divergence in spending due to differences in local endowments. Transfers from the central government (DAU and DAK) are important sources of financing for development spending, while we do not find that resource rich districts allocate more funds to development health spending. These results suggest that the central government retains a strong role in influencing local health budgeting and addressing horizontal inequalities in district public health spending. Tied transfers (DAK) seem particular effective for regulating development spending, as these do not appear to crowd out local health spending.

Local public health spending seems to increase overall health care utilization, in particular for the poorest half of the population, without affecting OOP health payments or utilization of the private sector, once we control for confounding factors. This result provides no support for the hypothesis that public spending crowds out private spending in health. Increased routine spending seems to have positive effects on both public and private health care utilization.

Translating our results to a marginal benefit incidence analysis, taking into account behavioural responses to changes in publics spending, suggests that increased public health spending improves targeting of public funds to the poor. At the margin, increased local public health spending leads to net public resource transfers from the richest to the poorest quarter of the population, as it increases both public health care

utilization by the poor and the average benefit of public funds through using these services. However, the initial utilization shares still dominate the marginal benefits, such that the bulk of the benefits accrue to the two middle quartiles. Hence, for effective targeting of public resources to the poor, increased public health spending induced through reallocation of central resources could be complemented with more directly targeted demand side interventions, for example price subsidies for the poor or social health insurance.

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Tables

Table 1 Decision space of Indonesia's decentralization in health

Function	**Indicator**	Range of choice Narrow (centralized)	Moderate	Wide (highly decentralized)
Finance				
Source of revenue	Intergovernmental transfers as % of total local health spending		DAU2001/8614.3 billion	
Allocation of expenditures	% of local spending that is explicitly earmarked by higher authorities		Many vertical programs remain. Central/local health exp =72%	
Fees	Range of prices local authorities are allowed to choose			No rules
Contracts	Number of models allowed			No rules
Service organization	X			
Hospital autonomy	Choice of range of autonomy for hospitals		A number of vertical hospitals remain, Many hospital doctors financed out of central budget	
Insurance plans	Choice of how to design insurance plans	Health card for the poor, social insurance for civil servants remain central		
Payment mechanism	choice of how providers will be paid (incentives and non-salaried)			Freedom
Required programs	specificity of normal for local programs		Functions are specified	
Human resources	X			
Salaries	choice of salary range	Centrally decided		
Contract	contracting non-permanent staff			
civil service	Hiring and firing permanent staff		Difficult under civil servant rules	
Access rules	X			
Targeting	defining priority populations		Central guidelines local implementation	
Governance rules	X			
facility boards	Size and composition of boards			Freedom
district offices	Size and composition of local offices	Old system still in place		
Community participation	Size, number, composition and role of community participation		Wide variation	

Table 2 Public spending on health by level of Government (Nominal, in billion Rupiah)

Year	2001	2002	2003	2004
Central Government	3,119	2,907	5,752	5,595
Provincial spending	1,745	2,372	2,821	3,000
District Government	4,387	5,725	7,473	8,108
Total public health spending	9,251	11,004	16,046	16,703

Source: World Bank (2008).

Table 3 Descriptive statistics for balanced panel (district averages)

	2001	2002	2003	2004
Per capita district revenues and spending				
Total revenues	415,987	508,375	557,883	563,934
DAU revenues	316,289	369,773	377,826	371,202
Shared tax revenue	31,218	39,180	44,927	50,786
Shared non tax revenue	20,258	36,496	37,821	40,204
DAK revenue	5,296	2,728	17,559	19,180
Own revenues	27,429	38,724	41,112	41,767
Revenues from other sources	15,497	21,472	38,637	40,795
Total public spending on health	26,057	32,329	39,033	41,959
Development spending on health	5,611	7,735	15,830	17,514
Routine spending on health	20,446	24,594	23,203	24,445

	2002	2003	2004	2005
Household utilization and spending on health				
Full population				
Outpatient utilization rate – public	0.0727	0.0874	0.0827	0.0944
Outpatient utilization rate – private	0.0793	0.0786	0.0753	0.0724
Per capita OOP health spending	8,368	6,526	6,664	7,242
Poorest quartile				
Outpatient utilization rate – public	0.0736	0.0716	0.0892	0.0825
Outpatient utilization rate – private	0.0530	0.0464	0.0476	0.0459
Per capita OOP health spending	3,339	2,668	2,498	2,386
N	207	207	207	207

Note: District revenue, public spending and OOP health payments in 2001 constant prices Rupiah. Outpatient utilization rates reflect the average number of outpatient visits in the last month. OOP health spending reflects per capita household OOP health payments in the last month.
Source: Revenue from fiscal data from ministry of finance, utilization and OOP spending from *Susenas* household survey.

Table 4 Elasticity of per capita district public health spending w.r.t per capita district revenue

	Random effects	Fixed effects	Hausman test
Routine spending	0.8431**	0.8284**	0.0022
	[0.0465]	[0.0657]	
Development health spending	1.2371**	1.1192**	0. 5717
	[0.0723]	[0.1376]	
Total health spending	0.9468**	0.8789**	0. 0133
	[0.0344]	[0.0449]	

Statistical significance: + at 10 percent, * at 5 percent, and ** at one percent level.
Note: balanced panel of 207 districts, 828 observations, 2001-2004. All models control for demographic characteristics (average age, household size and percentage female population), percentage rural population, district splits, region fixed effects and aggregate time shocks. The Hausman test reports p-values for rejecting the hypothesis that the difference in coefficients is not systematic. See the supplemental appendix for detailed estimates. Standard errors in brackets.

Table 5 Elasticity of per capita district public health spending w.r.t per capita district revenue source (district fixed effects)

	Routine	Development	Total
Total district revenue	0.8653**	1.0534**	0.8810**
	[0.0663]	[0.1386]	[0.0453]
Revenue shares			
Own revenue	2.0303**	1.2494	1.4428**
	[0.7373]	[1.5422]	[0.5037]
Shared tax revenue	0.3574	-3.3658**	-0.9871**
	[0.5445]	[1.1390]	[0.3720]
Shared non tax revenue	-0.8711	-0.1989	-0.7042+
	[0.6053]	[1.2662]	[0.4135]
DAK revenue	-1.1145	3.0818*	0.1264
	[0.7247]	[1.5158]	[0.4951]
Revenue from other sources	-0.5009	0.4164	-0.2940
	[0.3551]	[0.7427]	[0.2426]
District splits	-0.0218	-0.0027	-0.0612*
	[0.0416]	[0.0871]	[0.0284]

Statistical significance: + at 10 percent, * at 5 percent, and ** at one percent level.
Note: balanced panel of 207 districts, 828 observations, 2001-2004. All models control for demographic characteristics (average age, household size and percentage female population), percentage rural population, district splits, aggregate time shocks and district fixed effects. See the supplemental appendix for detailed estimates. Standard errors in brackets.

Table 6 Effect of (lagged) log per capita district public health spending on outpatient health care utilization rates and household out-of-pocket health spending (district fixed effects)

	Public	Private	Total	OOP
A. Without source of health spending				
District health spending	0.0114**	0.0042	0.0156**	-94.42
	[0.0039]	[0.0036]	[0.0060]	[459.56]
B. With source of health spending				
District health spending	0.0111**	0.0059+	0.0170**	1.40
	[0.0039]	[0.0036]	[0.0060]	[465.43]
Share of development spending	0.0037	-0.0234**	-0.0197	-1,269.52
	[0.0084]	[0.0076]	[0.0129]	[995.61]

Statistical significance: + at 10 percent, * at 5 percent, and ** at one percent level.
Note: balanced panel of 207 districts, 828 observations, 2002-2005. All models control for demographic characteristics (average age, household size and percentage female population), percentage rural population, district splits, aggregate time shocks and district fixed effects. A Hausman test rejects the random effects in favour of the fixed effects specification in all cases except for public utilization. See the supplemental appendix for detailed estimates. Standard errors in brackets.

Table 7 Effect of (lagged) log per capita district public health spending on outpatient health care utilization rates and household out-of-pocket health spending, by per capita expenditure quartile (district fixed effects)

	Public	Private	Total	OOP
Quartile 1 (poorest)	0.0175**	-0.0032	0.0143+	-65.80
	[0.0065]	[0.0039]	[0.0083]	[215.74]
Quartile 2	0.0164**	0.0032	0.0197**	64.38
	[0.0055]	[0.0042]	[0.0075]	[270.08]
Quartile 3	0.0063	0.0005	0.0068	-216.31
	[0.0060]	[0.0050]	[0.0087]	[543.65]
Quartile 4 (richest)	-0.0055	-0.0048	-0.0104	-1,685.68
	[0.0085]	[0.0090]	[0.0149]	[1,878.55]

Statistical significance: + at 10 percent, * at 5 percent, and ** at one percent level.
Note: balanced panel of 199 districts, 796 observations, 2002-2005. The number of districts differs from Table 6 as we only use districts from the balanced panel for which the survey data contains at least 50 observations for each quartile. Model specification similar to Table 6. See the supplemental appendix for detailed estimates. Standard errors in brackets.

Table 8 Sensitivity analysis of the effect of (lagged) log per capita district public health spending on outpatient health care utilization rates and household out-of-pocket health spending (district fixed effects)

	Public	Private	Total	OOP
A. Including log per capita household consumption				
District health spending	0.0116**	0.0022	0.0138*	-478.65
	[0.0039]	[0.0035]	[0.0060]	[441.50]
Per capita consumption	-0.0065	0.0576**	0.0511*	11,473.37**
	[0.0131]	[0.0117]	[0.0200]	[1,475.03]
B. Including district health card coverage				
District health spending	0.0110**	0.0040	0.0150*	-117.07
	[0.0039]	[0.0035]	[0.0059]	[458.97]
Health card coverage	0.0726**	0.0306	0.1032**	4,328.51+
	[0.0207]	[0.0191]	[0.0319]	[2,469.73]

Statistical significance: + at 10 percent, * at 5 percent, and ** at 1 percent level.
Note: balanced panel of 207 districts, 828 observations, 2002-2005. All models control for demographic characteristics (average age, household size and percentage female population), percentage rural population, district splits, aggregate time shocks and district fixed effects. Standard errors in brackets.

Table 9 Elasticity of outpatient health care utilization and household out-of-pocket health spending with respect to district public health spending, by per capita expenditure quartile (district fixed effects estimates)

	Public	Private	Total	OOP
Quartile 1 (poorest)	0.1441+	-0.0922	0.0446	-0.0738
Quartile 2	0.1418*	0.0006	0.0838	0.0224
Quartile 3	0.0821	-0.0028	0.0173	-0.0088
Quartile 4 (richest)	-0.0339	-0.0516	-0.0326	-0.0723
Total	0.0897+	0.0071	0.0583	-0.0173

Statistical significance: + at 10 percent, * at 5 percent, and ** at one percent level.

Table 10 Relative marginal benefit incidence of spending on outaptient services

	$1 + \theta_q - \theta$	$d_{q,2002}$	$d_q (1 + \theta_q - \theta)$
Quartile 1 (poorest)	**1.054**	0.232	**0.245**
Quartile 2	**1.052**	0.257	**0.270**
Quartile 3	0.992	0.272	0.270
Quartile 4 (richest)	0.876	0.243	0.213

Note: results based on statistically significant estimates are reported in bold.

Figures

Figure 1 Correlation between district log per capita health spending and log per capita revenues in 2001 and 2004