Impact of Development Assistance for Health in Developing Countries: the public vs the private channels

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Abstract

This paper examines the efficient allocation of Development Assistance for Health (DAH) through public and private channels. We built a simple macroeconomic model which considers an endogenous allocation of DAH mixed between Public and Private channels. We derive a non-cooperative interaction-game involving the private sector, the donor, and the recipient government. We compare the equilibrium of the game to the optimal level of DAH allocation, showing a gap between both. The empirical analysis is based on the IHME and WHO data sets. Our preliminary results show that DAH has significant negative impact on adult mortality in developing countries. Furthermore, we show that the actual allocation of aid-mix between government and private channels is not health efficient and there is room for reallocation.

1 Introduction

Every year rich countries give billions of dollars ($21.8 billion in 2007) to developing countries in account of development assistance for health (DAH). Total development assistance for health quadrupled from 1990 to 2007, from a volume of $5.6 billion to $21.8 billion IHME (2009). DAH has become point of focus at the start of the last decade. First, unprecedented amounts have been made available for both foreign aid in general and development assistance for health (DAH) in particular, partly motivated by the rise of the HIV/AIDS epidemic in sub-Saharan Africa. Second, private philanthropy and public-private partnerships for global health have emerged as new players during the first decade of the new millennium. Large-scale contributions by many multimillionaires or even billionaires helped to establish new private foundations, for instance Bill and Malinda Gates Foundation. Such a financial contribution is small compared to government funds for foreign aid but large compared to the average small-scale donor Bishop and Green (2009). This has led to significant changes in the composition of DAH. In the 2000s, bilateral and multilateral aid agencies are still the most prominent aid intermediaries but the importance of NGOs, global health partnerships and private foundations increased considerably. Particularly the absolute changes are significant because of the bigger volume of development assistance for health IHME (2009). Last, the global health movement has become an important driving force for aid with a powerful voice for prioritizing health. The predominance of health concerns within the eight Millennium Development Goals are only example. The transfer of financial resources links a donor government to a recipient country. Interaction between donor and aid recipient country is a continuous process. In this paper, we focus on the interactions between donors and aid recipient country. For the purpose, we develop a

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1Roughly speaking, between 1990 and 2008, sub-Saharan Africa received two thirds of total official development assistance from bilateral donors and one third from multilateral agencies. In 1990, bilateral donors provided approximately $12 billion and multilateral $7 billion. In 2008, bilateral donors provided approximately $30 billion and multilaterals $15 billion, after a peak of $50 billion and $13 billion, respectively, in 2007. DAH varied considerably between 1995 and 2008.
simple macroeconomic framework, illustrating the game process of allocation of DAH, with three players; the donor, the aid recipient government and the households. The aid recipient government is assumed to maximize health/GDP subject to his own resources. The donor is assumed to maximize a population health objective by allocating donations between government and private sector i.e. donor can disburse donation through public channel or through private channel (NGOs) or use a mix of two. Two types of equilibrium are studied. The rst one focuses on the interactions between donor and a government when there is no cooperation. The second, the optimal equilibrium, assumes that a unique planner is able to allocate aid with taking into account the consecutive level of the tax rate (as if the donor knows the government policy).

The analysis of the aid allocation process and the interaction between the players allows us focusing on one important aspect, the heterogeneity of channels through which donor disburse health aid. Through mix of aid, donors may try to influence the government’s decision of the developing country and expect to get positive results of their donations. In this paper, we show that allocation of aid through public/private mix when there is no cooperation between recipient government and donor can generate a sub-optimal equilibrium and then a room for reallocation.

The empirical part of the paper is based on the IHME and WHO data sets. Our preliminary results show that the actual allocation of aid-mix between government and private channels is not health efficient, a result that we can link to our theoretical modeling. Statistical analysis suggest that reallocation of aid in favor of the private sector would be needed.

To summarize, the structure of the paper is as follows. Section 2 links the relevant literature on DAH. In section 3, we model the strategic interactions between donor and aid recipient government. Section 4 discusses the empirical results. Section 5 concludes.

2 Related Literature

DAH is widely believed to improve health outcomes in developing countries (Kristof (2006)) and its effect on health outcomes is also associated with enduring debate over aid effectiveness in general. Critics argue that aid can adversely affect a country’s competitiveness (Rajan and Subramanian (2005)) and overwhelm the management capacity of governments (Kanbur et al. (1999)). While, supporter are of the view that aid leads to improved outcomes in poor countries through better health service delivery and relaxing resource constraints (Levine (2004)).

Besides, previous literature largely ignores the heterogeneity of aid channels used by donor countries. Few empirical papers that refer to aid channels in a donor country-specific context almost exclusively do so by comparing the allocation of aid through public and private channels. Schulpen (1997) provides an earlier and more detailed comparison of Dutch ODA and co-financed aid through clerical organizations in selected Indian states. Similarly, Nunnenkamp et al. (2009) are interested primarily in the distinction between Swiss ODA and Swiss NGO aid. However, these authors seem to be the first in considering various aid channels of one particular donor country. In particular, Swiss aid statistics allow for comparing the allocation of ODA from different public sources. Indeed, they find that it depends on the source of NGO: financially autonomous NGOs provide better targeted aid than their counterparts relying on state financing. Masud and Yontcheva (2005) examine the effect of foreign aid on poverty as measured by infant mortality and illiteracy rate, using panel data from 58 countries over the period 1990-2001. They looked at two distinct categories of aid: bilateral aid and Non(Governmental Organization (NGO) aid. They found that NGO aid reduces infant mortality and does so more effectively than bilateral aid. On the other hand, they find no evidence that bilateral aid helps reduce infant mortality and illiteracy rates, instead it reduces government spending in education and health sectors.

The differentiation between public and private aid channels is of interest in order to assess the widely held view that aid channeled through NGOs is better targeted to the needy than through government. (detailed discussion by Koch et al. (2009) of hypothesis related to pros and cons of NGO aid compared to ODA). NGOs may be closer to the poor by circumventing (often corrupt) governments. Moreover, aid channelized through NGOs is less likely to be distorted by political and commercial self-interest that official donors tend to have
when deciding on the allocation of ODA. On the other hand, NGOs may be reluctant to address the most entrenched forms of poverty and to work in particularly difficult local environments. Rather, they may have to demonstrate visible and short-term results in order to secure future funding through private donations and/or official co-financing.

3 The Basic Framework

We are interested in exploring the comparison between equilibrium (actual) and optimal (poverty / health efficient) allocations of health aid through public and private channels. In our model we assume that health level is affected by public and private expenditures on health complemented by health aid respectively. The important issue must be confronted in this set-up is not typically dealt with in the literature on foreign aid. It concerns the distinction between health aid channelized through government and private sector in developing countries. Our model allows aid flows of both types and demonstrates the significant differences in aggregate behavior to which they may affect health level. It is assumed that the government maximizes the GDP by raising revenue via taxes on income and adopts an optimal level. The donors’ objective is to maximize health by spending through public or private channels.

The originality of our work lies in our exclusive focus on the interaction between the public and private expenditures on health supported by health aid and its macroeconomic consequences. The study is different in the sense that it employs a health production function where public and private expenditures interact in population’s health outcomes which in turn contributes to the national output. We derive the equilibrium and optimal allocations of health aid between public and private channels.

In our model, there are three players the donor, the government and the households. Government levy tax \( \tau \) on Income \( Y_t \) and spends \( G_t \) amount on health. Donor is the source of foreign aid \( A \) which is either given to the government \( G_A^t \) or to the household \( S^A_t \) or to both. This aid is specifically for health purpose and is spent on health only. The households maximize their utility and spend their income on consumption \( C_t \) and health \( S^h_t \). Health of household depends on the public and private spending.

3.1 Production

Output \( Y_t \), is produced with private physical capital \( K_t \), and Productive Labor \( Lh_t \). Good health ensures higher productivity. With zero population growth, and the population size normalized to unity \((L = 1)\), assuming that the technology is Cobb-Douglas yields

\[
Y_t = (Lh_t)^\alpha K_t^\beta
\]

where \( \alpha, \beta \in (0,1) \)

3.2 Health Level

Health level \( h_t \) depends on total public and total private spending (\( G_t \) and \( S_t \) respectively). \( G_t \) is the sum of public spending on health by her own domestic resources \( G_g^t \) and the foreign aid given to the government \( G_A^t \). \( S_t \) is the sum of household spending on health, \( S_h^t \) and is foreign aid given to the private sector \( S_A^t \). Assuming also a Cobb-Douglas technology yields health level. We assume here that donors does not spend by themselves but channelize their resources through government or private sector.

\[
h_t = BG_t^\mu S_t^\epsilon
\]

where \( \mu, \epsilon \in (0,1) \) and measure the relative efficiency of government and private spending on health.

\[
G_t = G_g^t + G_A^t \quad S_t = S_h^t + S_A^t
\]
we assume that health level of the society depends on amount spend on health by government and private sector.

Combining equation (1) and (2)

\[ Y_t = B G_t S_t^G K_t^g \]  (3)

### 3.3 Households

Each household with disposable income \((1 - \tau) Y_t\) and has a log linear utility function of their consumption and health. They maximize their utility by spending on health and consumption.

\[ U_t = \ln C_t + \gamma \ln h_t \]  (4)

where \(C_t\) is period \(t\) consumption and \(h_t\) is health level at period \(t\). The household resource constraint is given by

\[ (1 - \tau)Y_t = C_t + S_t^h \]  (5)

\[ C_t = (1 - \tau)Y_t - S_t^h \]  (6)

Where \(\tau \in (0, 1)\) is tax rate taken as given and \(S_t^h\), is household’s health expenditure. The individual maximizes its utility subject to the their budget constraint and take public policies \(\tau\) as given when deciding \(C_t\) and \(S_t^h\)

Using the method of substitution the first order conditions results in

\[ S_t^h = \left[ \left( \frac{\gamma \epsilon}{1 + \gamma \epsilon} \right)(1 - \tau) - \left( \frac{1}{1 + \gamma \epsilon} \right) \lambda_p \right] Y_t \]  (7)

\[ C_t = \left[ \left( \frac{1}{1 + \gamma \epsilon} \right)(1 - \tau) + \left( \frac{1}{1 + \gamma \epsilon} \right) \lambda_p \right] Y_t \]

Foreign aid given to private sector decreases

\[ S_t^a = \left( \frac{\gamma \epsilon}{1 + \gamma \epsilon} \right)(1 - \tau + \lambda_p) Y_t \]  (8)

where \(S_t^a = \lambda_p \ Y_t\), where \(\lambda_p = \bar{\lambda} - \lambda_G\)

We assume that aid is given solely to spend for health purposes. Equation (7) reveals that \(\frac{\partial S_t^h}{\partial \lambda_p} < 0\), which means that household displace certain amount from health spending toward consumption in the consequence of aid received by private sector. This shuffling in household’s spending highlights the possibility of aid fungibility(Addison and Roe (2004))\(^2\) because a proportion \(\left( \frac{1}{1 + \gamma \epsilon} \right)\) of health aid is spent on consumption as we assumed that aid given to private sector is solely be spent for health purposes.

### 3.4 Government

The government in the recipient country provides public health to its citizens. It is financed by income tax revenue \(\tau\) and DAH. The government receives DAH \(\lambda_G\). The allocation of aid is exogenous for the recipient country and, in any case, is determined by the donor. It cannot issue debt claims and therefore must keep a balanced budget at each moment in time. The government budget constraint is thus given by

\[ \tau Y_t = G_t^G \]  (9)

Total aid disbursement given to the government are measured in proportion to the total income

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\(^2\)Fungibility occurs when aid is not used for the purpose intended by donors.
\[ G_t^A = \lambda_G Y_t \]  
\( G_t = G_Y(t) \) (10)

from equation (1) we have that

\[ K_t = \frac{\beta (1 - \gamma) Y_t}{r} \]  
\( K_t = \frac{\beta (1 - \gamma) Y_t}{r} \) (11)

Plugging equations (9),(10) and (11) in equation (2), we have

\[ h = B \ (\lambda_G + \tau)^\alpha \ Y_t^\alpha \ S_t^\gamma \]  
\( h = B \ (\lambda_G + \tau)^\alpha \ Y_t^\alpha \ S_t^\gamma \) (12)

Plugging equations (11) and (12) in equation (1), we have

\[ Y_t = B^{\frac{\beta}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \]  
\( Y_t = B^{\frac{\beta}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \) (13)

where \( \eta = 1 - \alpha \mu - \beta \).

Substituting equation (13) in equation (12), we get

\[ h_t = B^{\frac{1 - \alpha \mu}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \]  
\( h_t = B^{\frac{1 - \alpha \mu}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \) (14)

### 3.5 Equilibrium GDP and Health

Manipulating equation (8) and equation (13), yields equilibrium GDP

\[ Y_t = B^{\frac{\beta}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \]  
\( Y_t = B^{\frac{\beta}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \) (15)

Manipulating equation (8), equation (12) and equation (15), yields equilibrium health level

\[ h_t = B^{\frac{1 - \alpha \mu}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \]  
\( h_t = B^{\frac{1 - \alpha \mu}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \) (16)

where

\[ \tilde{\eta} = 1 - \alpha \mu - \alpha \epsilon - \beta \]

\[ \lambda_p = \tilde{\lambda} - \lambda_G \]

Health level depends on combination government policy \( \tau \) and donor’s allocation of aid between Public sector and private sector.

#### 3.5.1 Government Policy

GDP maximizing government decides tax rate and it has no information about the household expenditures on health, So the govt objective function is given by

\[ \text{Max} Y_t = B^{\frac{\beta}{\gamma}} \left( \frac{\beta}{\tau} \right)^{\frac{\beta}{\gamma}} (\tau + \lambda_G)^{\frac{\alpha + \gamma}{\gamma}} (1 - \tau)^{\frac{\beta}{\gamma}} S_t^{\frac{\alpha + \gamma}{\gamma}} \]  
\[ \tau^*_Y = \frac{\alpha \mu - \beta \lambda_G}{\alpha \mu + \beta} \]  
\( \tau^*_Y = \frac{\alpha \mu - \beta \lambda_G}{\alpha \mu + \beta} \) (17)
Analysis  We assume that the government internalize the response of private sector in the form of physical capital formation given by equation (11) but not in the form of total private spending on health $S_t$, equation (8).

$$\frac{\partial r_t}{\partial \sigma_t} = \frac{\beta}{\sigma_t + \beta} < 0,$$
implies that aid disbursement through government channel reduce tax rate. Also the lower tax rate ease the household to spend more on health and consumption as seen in equations (7). This implies that aid given to the government crowd out government spending and give additional resources to the households through accumulation of $K_t$ and consequently an increase in $Y_t$ to spend more on health.

3.6 Donor’s Policy - Equilibrium

Donor objective is to improve the health of the society. The proportions of aid allocated through government channel and private channel in a recipient country is endogenous and we denote it by $\lambda_G$ and $\lambda_P$ respectively. In other words donors decide how much of the aid should reach its destination through which channel. The donor maximize equation (2) which can be written as

$$\max h_t = B \left( G^G + G^A \right)^{\mu} \left( S^h + S^A \right)^{\epsilon}$$

$$\lambda_G^* = \frac{\Omega \left( \frac{\sigma_t + \beta}{\alpha + \beta} - \sigma_t \right)}{\alpha \left( \sigma_t + \beta \right)}$$

where $\lambda$ is the total amount of aid disbursed by the donor

and

$$\Omega = \frac{\gamma \epsilon}{1 + \gamma \epsilon}$$

3.7 Donor’s Policy - Optimal Equilibrium

When donor internalize the policy response of GDP maximizing government $\tau_Y$ and decides $\lambda_G$. The donor maximize the following equation and decides the optimal allocation of health aid to government.

$$h_t = B \left( \frac{\beta}{\sigma_t} \right)^{\frac{\mu + \epsilon}{\eta}} \left( \frac{\gamma \epsilon}{1 + \gamma \epsilon} \right)^{\frac{(1 - \beta)}{\eta}} \left( \frac{\beta}{\sigma_t + \beta} \right)^{\frac{\mu + \epsilon}{\eta}} \left( \frac{\sigma_t + \beta}{\alpha + \beta} \right)^{\frac{(1 - \beta)}{\eta}} \left( 1 + \lambda_G \right)^{\frac{\mu + \epsilon}{\eta}} \left( \beta + (\alpha + \beta) \lambda - \alpha \mu \lambda G \right)^{\frac{(1 - \beta)}{\eta}}$$

$$\lambda_G^{opt} = \frac{\mu + \beta \epsilon \left( \beta + \alpha + \beta \lambda \right) - \alpha \mu \epsilon (1 - \beta)}{\alpha \mu (\mu + \epsilon)}$$

3.8 Equilibrium versus Optimal Allocation of health aid

At equilibrium, each agent (donor and government) chooses its own policy taking as given the decision of the other agent, that is without taking into account the externalities of its decision generate on other agent’s decision. Equation (18) gives $\lambda_G^*$, the equilibrium allocation of health aid by the donor. On the other hand when donor internalize the externalities generated by the policy response of government $\tau_Y$ and decides the optimal allocation of health aid $\lambda_G^{opt}$ given by equation (20). We obtained:

$$\lambda_G^{opt} \geq \lambda_G$$

This result is important for the understanding of possible sub-optimality in the allocations of aid in a given country. In this model, the donor always follows the goal of optimizing health. However its donation policy turned to be suboptimal in the non-cooperative case, because he does not internalize the response function of the government in terms of the tax rate.
4 Empirical Results: panel data analysis

We also study our model empirically using data to examine the relationship between health aid and health outcomes (adult mortality) considering the heterogeneous nature of aid as well as the heterogeneity of aid recipients. Specifically, we disaggregate the health aid data into aid received by governments and aid channelized through private sector and analyze the effect of each type of aid on health for 113 low income level countries for the period 1995 to 2006, we find that aid channelized through government and private sector is associated with statistically significant reduction in adult mortality. Thus, by quantifying the health effects of aid, the paper provides some guidance to donors on how effectively aid to be allocated. Our preliminary results show that the allocation of aid-mix between government and private channels is not efficient and there is room for disbursement of aid through private channels.

Our paper presents new, systematic and comprehensive cross-country evidence on the effect of health aid disbursed through public and or private channels (governments and or NGOs) on mortality rates of developing countries. We focus only on foreign aid for health. Many of the studies (Boone (1996); Masud and Yontcheva (2005); Burnside et al. (1998); Mishra and Newhouse (2009)) do not take into account the heterogeneous nature of aid and heterogeneity of aid recipients. The studies that take into account the heterogeneity of aid generally focus on the difference between project and program aid, multilateral and bilateral aid, and grants versus loans (See Mavrotas (2002) for a detailed discussion).

4.1 Data

The data on health aid (both government and NGOs) are both taken from the database for DAH developed by IHME and National Health Accounts, World Health Organization. The panel data set includes all 113 countries. Table 1 summarizes the data.

4.1.1 Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Mortality</td>
<td>1356</td>
<td>267.2578</td>
<td>144.4069</td>
<td>87.75</td>
<td>730.55</td>
</tr>
<tr>
<td>percapita Health Aid (govt)</td>
<td>1356</td>
<td>2.073996</td>
<td>3.410651</td>
<td>-00179</td>
<td>40.3817</td>
</tr>
<tr>
<td>percapita Health Aid (private)</td>
<td>1356</td>
<td>0.566349</td>
<td>1.958662</td>
<td>0</td>
<td>34.34074</td>
</tr>
<tr>
<td>percapita private health exp</td>
<td>1356</td>
<td>47.51015</td>
<td>65.61526</td>
<td>0</td>
<td>523.6003</td>
</tr>
<tr>
<td>percapita govt health exp</td>
<td>1356</td>
<td>57.83131</td>
<td>84.58466</td>
<td>0</td>
<td>578.022</td>
</tr>
<tr>
<td>percapita GDP</td>
<td>1356</td>
<td>1954.472</td>
<td>2517.955</td>
<td>0</td>
<td>21314.77</td>
</tr>
<tr>
<td>prop of health aid channelized through govt</td>
<td>1322</td>
<td>0.84171</td>
<td>0.2145</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

For each variable, the number of observations, mean, standard deviation, minimum, and the maximum values are provided. The log form of health aid (through public and private channel), the number of deaths, gross domestic product, Private health expenditure, government health expenditure is used in the empirical analysis.

4.2 Empirical Model and Data

The first model presented is a fixed effects regression that is used as the baseline specification. Next, instrumental variable estimation is implemented as the core analysis. Detailed description of the data is also provided in this section, including defining all variables, listing the data sources, and providing the descriptive statistics.

4.2.1 Empirical Framework

We follow the bulk of the previous literature and we use annual data for the period 1995 to 2006. Our most basic OLS regression equation specifies mortality as a function of previous period’s aid disbursed through government
and aid disbursed in current period through private sector (NGOs), as follows

\[
\log M_{it} = \alpha + \beta_1 \log A_{it-1}^G + \beta_2 \log S_{it}^A + \beta_3 \log G_{it-1}^G + \beta_4 \log S_{it}^h + \beta_5 \log Y_{it-1} + \beta_6 \log M_{it-1} + \varepsilon_{it}
\]

Where \( M_{it} \) is the adult mortality rate (health outcome) of aid recipient country \( i \) in period \( t \), \( A_{it-1}^G \) is the aid per capita in country \( i \) channeled through government during the previous period, \( S_{it}^A \) is the aid per capita channeled through private sector in country \( i \) in period \( t \), \( G_{it-1}^G \) is the government’s expenditures on health in the previous period, \( S_{it}^h \) is the private health expenditure on health in period \( t \), \( Y_{it-1} \) is the GDP of recipient country \( i \) in previous period and \( M_{it-1} \) is the previous period’s mortality rate.

Among independent variables, the variable of interest is foreign aid to the health sector. We take the two different flows of data, one aid given directly to the governments and the second aid spent on health through private sectors (NGOs). The data for these variables was taken from Institute of health matrices and evaluation (IHME). This data was also used by Lu et al. (2010). Detailed flow analysis is only available from 1995 to 2006, so this has limited my dataset for only 12 years.

Mortality rate is used to capture the population health outcomes. This variable is also taken from IHME data sets. The death rate is a crude measure that estimates the number of deaths occurring during the time period. It is estimated per 1,000 of the population at midyear. If aid is effective on health, it should have a negative relationship with the mortality rate: as more aid flows to the health sector, the death rate should fall. GDP is used as control variable. It represents the overall level of economic development and should exhibit a negative relationship with mortality rate.

### 4.2.2 Results

Table below shows the results for the Fixed Effects model.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Adult Mortality (per 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \log A_{it-1}^G )</td>
<td>-.0027864*** (0.0008)</td>
</tr>
<tr>
<td>( \log S_{it}^A )</td>
<td>-.0013325*** (0.00041)</td>
</tr>
<tr>
<td>( \log M_{it-1} )</td>
<td>0.9000387*** (0.00835)</td>
</tr>
<tr>
<td>( Constant )</td>
<td>0.6149721*** (0.05181)</td>
</tr>
</tbody>
</table>

A clear result emerges: health aid spent through government or private sector significantly reduce adult mortality. 100 % increase in aid channelized through government and or private sector reduces adult mortality by 0.2% and 0.1% respectively.
Table 3: Results with country Specific Effects

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Log Adult Mortality (per 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\log A_{it-1}$</td>
<td>-0.0025508***</td>
</tr>
<tr>
<td></td>
<td>(0.00084)</td>
</tr>
<tr>
<td>$\log S_{it}^A$</td>
<td>-0.0011496***</td>
</tr>
<tr>
<td></td>
<td>(0.00043)</td>
</tr>
<tr>
<td>$\log G_{it-1}^G$</td>
<td>-0.0057417*</td>
</tr>
<tr>
<td></td>
<td>(0.00326)</td>
</tr>
<tr>
<td>$\log S_{it}^h$</td>
<td>-5.90E-05</td>
</tr>
<tr>
<td></td>
<td>(0.00306)</td>
</tr>
<tr>
<td>$\log Y_{it-1}$</td>
<td>0.003493</td>
</tr>
<tr>
<td></td>
<td>(0.00623)</td>
</tr>
<tr>
<td>$\log M_{it-1}$</td>
<td>0.9041567***</td>
</tr>
<tr>
<td></td>
<td>(0.00872)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.5810691***</td>
</tr>
<tr>
<td></td>
<td>(0.06216)</td>
</tr>
</tbody>
</table>

Results with country Specific Effects  To reduce the possibility that omitted variables are biasing the estimates, we add additional controls to estimate the equation. Table above displays results. the additional control includes the factor that adversely affect adult mortality such as government health expenditures by its own resources, private (households) health expenditures by their own income and the GDP of the country., The goal is to estimate the partial effect of increasing health aid through government and/or private sector controlling important possible variable. The estimated effect of aid through government and private channel is negative and statistically significant.

Table 4: Efficiency of composition of allocation of health aid channelized through government and private sector

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Log Adult Mortality (per 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\log A_{it-1}$</td>
<td>-.0035273***</td>
</tr>
<tr>
<td></td>
<td>0.0006914</td>
</tr>
<tr>
<td>$\lambda_p$</td>
<td>-.0070017**</td>
</tr>
<tr>
<td></td>
<td>(0.0030126)</td>
</tr>
<tr>
<td>$\log G_{it-1}^G$</td>
<td>-.0060266**</td>
</tr>
<tr>
<td></td>
<td>(0.0027051)</td>
</tr>
<tr>
<td>$\log S_{it}^h$</td>
<td>-.0024491</td>
</tr>
<tr>
<td></td>
<td>(0.0028811)</td>
</tr>
<tr>
<td>$\log Y_{it-1}$</td>
<td>0.004286</td>
</tr>
<tr>
<td></td>
<td>(0.0040962)</td>
</tr>
<tr>
<td>$\log M_{it-1}$</td>
<td>.8991231***</td>
</tr>
<tr>
<td></td>
<td>(0.0077112)</td>
</tr>
<tr>
<td>Constant</td>
<td>.837946***</td>
</tr>
<tr>
<td></td>
<td>(0.0492773)</td>
</tr>
</tbody>
</table>

Efficiency of composition of allocation of health aid channelized through government and private sector  Results in the above table show the efficiency of DAH composition between government and private channels. The results reveal that using fund by private sector is more effective and increasing aid through private sector will significantly reduce adult mortality.

5 Conclusion

Total development assistance for health increased remarkably during the last two decades from a volume of $5.6 billion to $21.8 billion. We analized the efficiency of allocation process and the interaction between the players
which allows us focusing on one important aspect: heterogeneity of channels through which donor disburse health aid. Assuming non cooperative interaction between donors and recipient government, we derive the endogenous equilibrium and we compare it to the optimal level of DAH allocation. The empirical analysis suggest that the actual allocation of aid is different from the optimal allocation (health efficient), as in the theoretical modeling. Our preliminary results show that DAH has significant negative impact on adult mortality in developing countries. We also infer that the actual allocation of aid-mix between government and private channels is not health efficient and there is room for more disbursement of aid through private channels instead of the government channel.

References


