Returns to Health Spending in Low- and Middle-Income Countries

Ijeoma Peace Edoka

Subject: Health Economics Online Publication Date: Jun 2019 DOI: 10.1093/acrefore/9780190625979.013.437

Summary and Keywords

Low- and middle-income countries (LMICs) bear a disproportionately high burden of diseases in comparison to high-income countries, partly due to inequalities in the distribution of resources for health. Recent increases in health spending in these countries demonstrate a commitment to tackling the high burden of disease. However, evidence on the extent to which increased spending on health translates to better population health outcomes has been inconclusive. Some studies have reported improvements in population health with an increase in health spending whereas others have either found no effect or very limited effect to justify increased financial allocations to health. Differences across studies may be explained by differences in approaches adopted in estimating returns to health spending in LMICs.

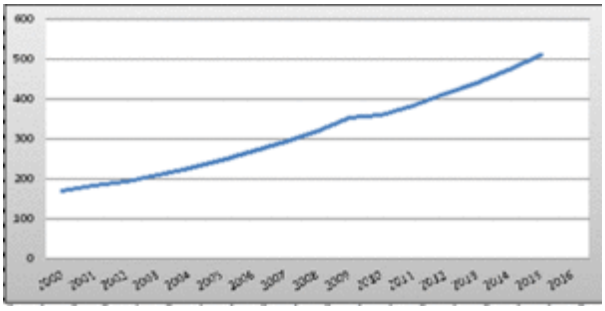
Keywords: health economics, health spending, population health, mortality, marginal returns, low- and middle-income countries

Trends in Health Spending and Population Health Outcomes in Low- and Middle-Income Countries

Compared to high-income countries, low- and middle-income countries (LMICs) bear a disproportionately higher proportion of the global burden of disease (Gottret & Schieber, 2006). Although socioeconomic inequalities may contribute to this disparity, inequalities in the distribution of funds for health may also play an important role (Wagstaff & Claeson, 2004). For example, in 2014 approximately US$9,000 billion was spent on health globally (Bishai & Cardona, 2017). However, only approximately 10% of this was spent in LMICs, which have a total population of approximately 3.66 billion. This was significantly less than health spending in high-income countries for a total population of approximately 3.56 billion (Bishai & Cardona, 2017). Recently, the drive to achieve the United Nations Millennium Development Goals has motivated the introduction of innovative policies for financing healthcare across many LMICs (Escobar, Griffin, & Shaw, 2010; Savedoff et al., 2012; WHO, 2010) and an increased reprioritization of government budgets in favor of health (Dieleman et al., 2018; Jakovljevic & Getzen, 2016; WHO, 2017). For example, between 1995 and 2015, the share of global total health spending rose by approximately 4% in LMICs (Jakovljevic & Getzen, 2016), with middle-income countries experiencing the greatest growth (Dieleman et al., 2018). Over a similar time period (1990–2007), development assistance for health rose from US$5.6 billion to $21.8 billion (Ravishankar et al., 2009). Furthermore, debt relief to LMICs has allowed the redirection of funds from servicing debts to the expansion of health budgets in these countries (IMF,

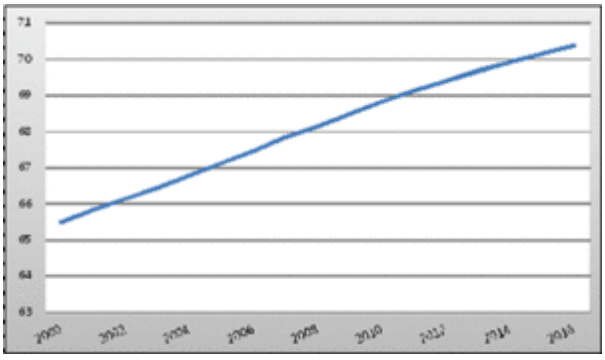
2017). Although high-income countries still account for the largest share of global health spending, the growth in health spending in LMICs demonstrates an increased commitment to tackling the high burden of disease.

As health spending continues to rise across LMICs, there is much interest among governments and donor agencies in understanding the value of health spending to the population, not least because there are opportunity costs to other sectors of the economy. However, the question of the extent to which health spending "causes" improvements in population health outcomes and the optimal level of health spending needed to achieve set health targets have long dogged policymakers and researchers (Savedoff, 2007; Wagstaff & Claeson, 2004). Trends in health spending and population health outcomes suggest that the growth in health spending may have contributed to the gains in population health outcomes. For example, between 2000 and 2015, health expenditure per capita tripled in LMICs (Figure 1). Over this same time period life expectancy at birth rose (Figure 2) while mortality rates declined substantially (Figures 3 and 4). A positive relationship can also be observed between health spending and life expectancy (Figure 5); that is, countries with higher health spending per capita on average have higher life expectancies at birth and a negative relationship between health spending per capita and mortality (Figures 6, 7, and 8). However, this observed relationship cannot be interpreted as causality because of other confounding factors that are also important in explaining population health.



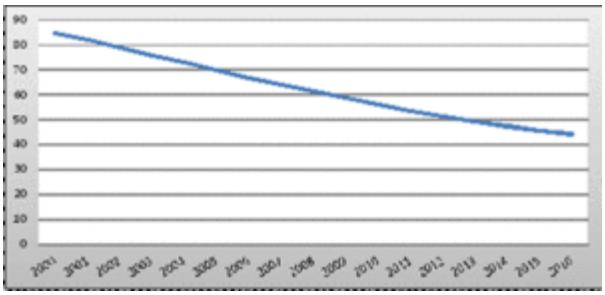
Click to view larger

Figure 1. Trends in health spending per capita (international USD) in LMICs, 2000–2015.



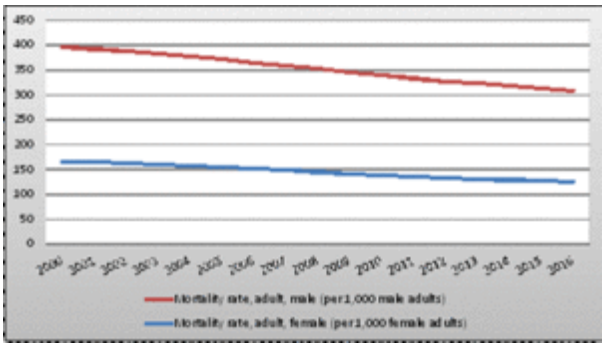
Click to view larger

Figure 2. Trends in life expectancy at birth (years) in LMICs, 2000–2016.



Click to view larger

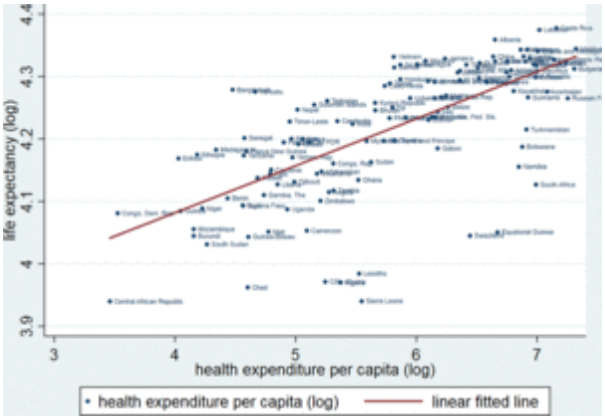
Figure 3. Trends in under-5 mortality rates (per 1,000 live births) in LMICs, 2000–2016.



Click to view larger

Figure 4. Trends in adult mortality rates (per 1,000 population) in LMICs 2000–2016.

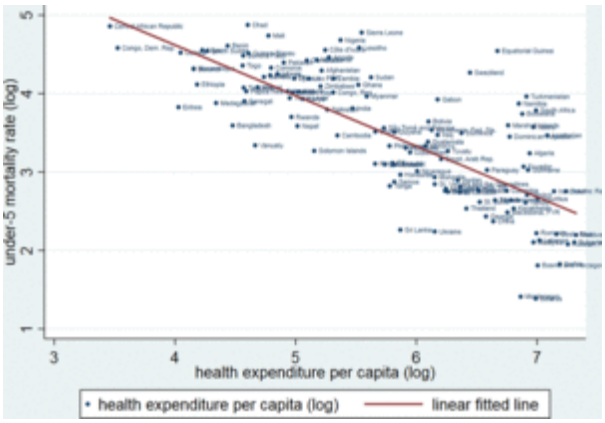
Source: World Bank World Development Indicators 2018.



Click to view larger

Figure 5. The relationship between health expenditure per capita and life expectancy in LMICs (2015).

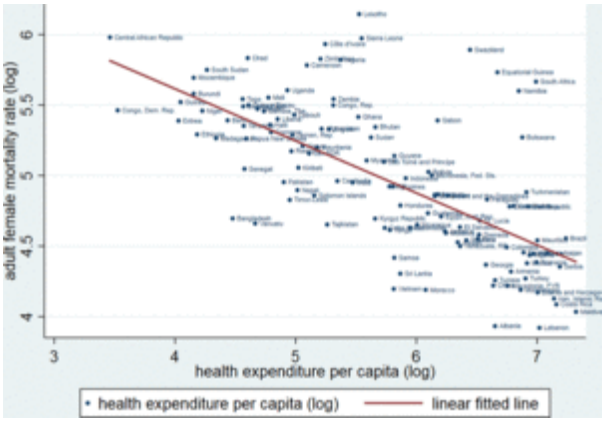
Source: World Bank World Development Indicators 2018.



Click to view larger

Figure 6. The relationship between health expenditure per capita and under-five mortality rates in LMICs (2015).

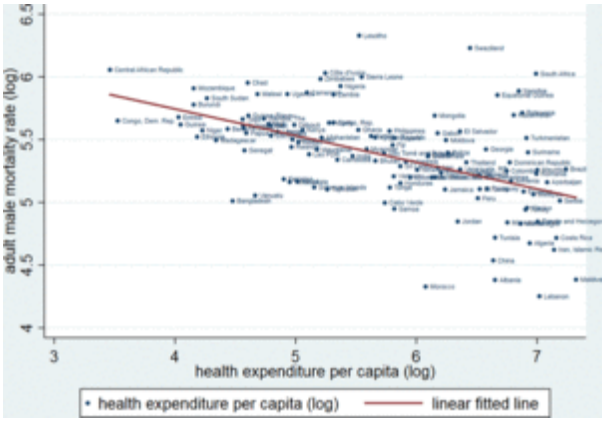
Source: World Bank World Development Indicators 2018.



Click to view larger

Figure 7. The relationship between health expenditure per capita and adult female mortality rates in LMICs (2015).

Source: World Bank World Development Indicators 2018.



Click to view larger

Figure 8. The relationship between health expenditure per capita and adult male mortality rates in LMICs (2015).

Source: World Bank World Development Indicators 2018.

Unlike the classical socioeconomic determinants of health—income, education, diet, and living conditions—the causal link between health spending and health outcomes is inconclusive, with questions raised about the extent to which increased health spending really matters in improving population health (see, e.g., Filmer & Pritchett, 1999; Gottret & Schieber, 2006). At face value these reservations are justified. International comparisons show that countries with equal levels of health spending have differing levels of population health outcomes (Figures 5–8). In 2015, health spending per capita in Namibia and Turkey were approximately the same but adult female mortality rate was substantially higher in Namibia (Figure 7). Under-5 mortality rate was substantially higher in Swaziland compared to Thailand, even though both countries appeared to have similar levels of health spending per capita (Figure 6). A similar observation is seen with life expectancy in countries such as China that have lower health spending per capita compared to South Africa but a substantially higher life expectancy (Figure 5).

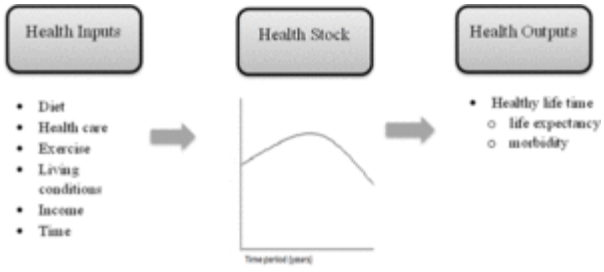
Several factors may explain these discrepancies across countries. On one hand, the measures typically used to quantify population health, such as life expectancy and mortality rates, may not fully capture all the benefits of additional investments. For example, higher health spending may produce benefits that are not only reflected in improvements to the length of life but may also result in improvements in the quality of life. On the other hand, differences in characteristics of the population and characteristics of the health systems, such as in the quality of political, governance, and administrative structures, and differences in health financing models can affect the efficiency of health spending, thus explaining some of the discrepancies observed across countries.

The question of whether increased spending on health results in improvements in population health, while being an empirical problem, has important ramifications for policymakers, particularly in LMICs faced with substantial budget constraints. Isolating the causal link between health spending and population health outcomes can provide important insights into resource allocation questions and strengthen the case for further investments in health. For example, should extra resources be allocated to the provision of healthcare or would population welfare be best maximized if resources were directed to other sectors of the economy such education and social care? Should health spending be directed toward specific types of healthcare services or programs? Furthermore, estimates of the causal effect of health spending can be useful for predicting the levels of spending required to reach a given health target (Savedoff, 2007). Finally, estimates of marginal returns to health spending are increasingly being used to define rules, or cost-effectiveness thresholds, that inform decisions on health interventions to be funded within a healthcare system (Claxton et al., 2015; Edney et al., 2018; Ochalek, Lomas, & Claxton, 2015; Vallejo-Torres et al., 2016). These thresholds are estimated using marginal returns to health spending and better reflect the opportunity costs of introducing new, more expensive health interventions into the healthcare system. Thus, their use is likely to increase efficiency in the allocation of scarce resources.

Theoretical Models of Demand for Health

Theoretical underpinnings explaining the demand for health can be distinguished on the basis of individual-level and macro-level demand for health. While this article focuses on macrolevel health spending, it begins by discussing theoretical underpinnings that explain individual-level demand for health. This provides useful insights into the determinants of health in general. The Grossman health capital model (Grossman, 1972, 1999), together with the production function model of consumer behavior, provides a basis for understanding health investment decisions at an individual level.

According to the Grossman model, health is regarded as a stock of human capital that is inherited at birth but depreciates naturally over time (Grossman, 1972, 1999). However, as with other forms of capital, health stock can be replenished through investments over the lifetime of the individual (Figure 9). The Grossman model distinguishes between the demand for health stock as a consumption commodity and the demand for healthcare as an investment commodity (or choice input). Health stock directly impacts utility because a healthy life is a direct source of satisfaction whereas healthcare is demanded because it affects consumers' health stock and healthy lifetime, not for the satisfaction provided by its consumption. Following the production function model of consumer behavior, individuals "choose" their level of health output (healthy lifetime) by investing in choice inputs (such as healthcare services, diet, exercise, and housing) that impact their health stock and healthy lifetime as a consequence (Figure 9). Thus, subject to a budget constraint, choice inputs are demanded not for the utility they produce in themselves, but for the utility derived from replenishing health stock that furnishes healthy lifetime (Figure 9). The quantity of choice inputs demanded is affected not only by the price of the inputs but by the resources available to the individual to produce health and their efficiency (or productivity). This is reflected in individual characteristics such as education, which can influence the efficiency with which they are able to combine choice inputs to produce health, or income, which can affect the quantity and quality of choice inputs demanded. Although the Grossman model has been criticized and modifications have been proposed by various authors (see Laporte, 2015; Rok, 2012; Zweifel, 2012), it provides a useful basis for understanding the determinants of health and the manner in which resources (time and money) can be allocated to the production of health.



Click to view larger

Figure 9. The demand for health at an individual level.

At a macro level, government interventions in healthcare markets and the provision of public goods and services can be justified on the basis of market failures and externalities as well as the need to maximize social welfare subject to a budget constraint. However, there is a paucity of theoretical models explaining macrolevel demand for health. Empirical studies have largely relied on the health production function approach to model the relationship between population health as an output of the healthcare system and a vector of "inputs" that go into the production of population health. Drawing on insights from the Grossman health production function, these inputs or "factors of production" include a wide range of macrolevel factors such as health expenditure (*HE*), income per capita (*G*), lifestyle choices (nutritional intake, alcohol and tobacco consumption) (*L*) and environmental factors (geographical location, climate and pollution levels) (*E*):

$$HO = f(HE, G, L, E)$$

where HO represents population health output and f is the health production function.

Typically, empirical studies have reported estimates of returns to these inputs as elasticities, implying a Cobb-Douglas production function. For example, in the case of two factors of production, this can be expressed as:

$$HO = f(HE, G) = \forall . HE^{\alpha} . G^{\beta}$$

(1)

$$0 < \alpha < 1$$

$$0 < \beta < 1$$

where ∀ represents the total factor productivity or the constant coefficient, and α and β represent output elasticities, which captures the responsiveness of the health output to changes in the quantities of HE and G, that is, the percent change in health output with a 1 percent change in *HE* and *G*, respectively.

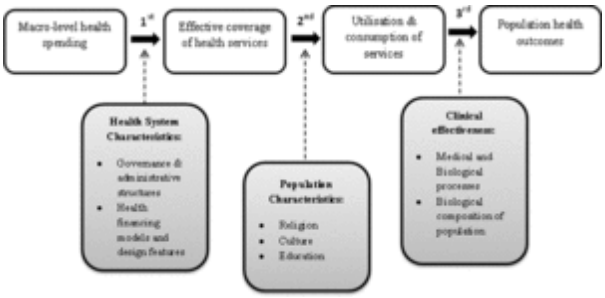
The Cobb-Douglas production function satisfies important properties of a health production function that make it attractive for use in modeling the relationship between health outputs and inputs. These properties include:

1. a positive marginal product of each input, which represents the change in the quantity of output produced by a marginal change in the quantity on the input (while holding other factors of production constant); and
2. a diminishing marginal product of each input.

Taken together, this implies that an increase in macrolevel health spending (while holding other inputs constant) is expected to result in improvements in population health output, but at a diminishing rate.

Explaining the Causal Link Between Macrolevel Health Spending and Population Health Outcomes

Intuitively, the causal pathway through which macrolevel health spending affects population health outcome is likely to be complex and indirect (Figure 10). Higher health spending could lead to an increase in the quantity and quality (i.e., effective coverage) of health services provided (Figure 10, step 1). This could in turn lead to an increase in the consumption or utilization of these service (Figure 10, step 2) and finally to better population health outcomes as a consequence (Figure 10, step 3). Therefore, the extent to which additional health spending translates to better population health outcomes depends on uninterrupted movement along this pathway and on factors that determine the rate of movement. For example, if additional resources are directed toward the provision of ineffective and inefficient services, this will lead to a breakdown of the first step. Even when additional resources are directed toward the provision of effective and cost-effective services, failure in the uptake of these services by the population will lead to a breakdown of step 2. Finally, if other services previously provided are displaced as a consequence of increased coverage (such as a shift from private to public health service consumption), total coverage and consumption levels in the population may remain unchanged with no observable change in population health outcome.



Click to view larger

Figure 10. Causal pathway between macrolevel health spending and population health outcomes.

Adapted from Filmer and Pritchett (1999).

The effectiveness of health spending is likely to be affected by both health system (supply-side factors) and population characteristics (demand-side factors) that affect the rate of transmission along this pathway (Figure 10, gray boxes). For example, weak governance or administrative structures and policies can affect the efficacy and performance of the health system and, as a result, the effectiveness of health spending (Gottret & Schieber, 2006; Rajkumar & Swaroop, 2008; Wagstaff & Claeson, 2004). Other features of the health system such as the type of healthcare financing model and its design features can also affect the efficiency of health spending. For example, out-of-pocket financing models are characterized by limited risk pooling, which results in inefficient allocation of resources. For example, the use of more expensive healthcare service (curative care and hospital services vs. less expensive preventative care and primary healthcare services) results in higher health spending but has no additional health benefits (Cylus, Papanicolas, & Smith 2017). Other health financing models that rely on prepayment mechanisms including health insurance schemes and tax-funded national health services may address some of these problems. However, variations in scheme design features such as reimbursement mechanisms, benefit design strategies, and health financing administrative structures may affect the performance of the health system (Mueller & Yuan, 2013; Chalkley, Mirelman, Siciliani, & Suhrcke, 2016) and the effectiveness of health spending as a consequence. For example fee-for-service reimbursement mechanisms may create an incentive to supply unnecessary services, resulting in cost escalations with no additional health benefits. Payment for performance schemes may increase the efficiency of spending and the quality of care, but unintended consequences of the scheme, such as the neglect of services not monitored within the scheme (Chalkley et al., 2016), may result in no net gains in population health.

On the demand side, social, economic, and demographic characteristics of the population such as religion, culture, and education may affect uptake of available interventions (Jacobs, Ir, Bigdeli, Annear, & Damme, 2012; O'Donnell, 2007). This will invariably limit the impact of additional health spending on population health outcomes.

Identifying the Causal Link Between Macrolevel Health Spending and Health Outcomes

Estimation Strategies

Identifying the causal effects of macrolevel health spending on population health outcomes presents important methodological challenges that arise mainly from the absence of an exogenous change in health spending or the absence of a classical "treatment" subpopulation exposed to changes in health spending against which outcomes of a matching subpopulation that is unexposed to similar changes can be compared. As a result, the majority of studies have relied either on single cross-sectional data pooled across different countries or time series/country panel data and exploit variations in health spending between countries and across time to identify the causal effect of health spending on population health outcomes. In the case of pooled cross-sectional data, the identification of a causal effect requires accounting for health system and population-level differences (Figure 10) between countries that may confound the effect of health spending. Country panel data or time series analysis requires disentangling temporal changes in health spending from other simultaneously occurring changes that are equally important in explaining population health outcomes, such as trends in epidemiological profile and technological advancements as well as trends in other socioeconomic and environmental determinants of population health. Single-country data analysis that explores subnational (state/province/district) cross-sectional or time series variations in health spending and health outcomes also present similar methodological challenges.

This section summarizes the approaches that have being adopted to estimate marginal returns to health spending in LMICs and the following section discusses findings that have emerged from these studies.

Multivariate Estimation Approach

Marginal returns to health spending can be estimated empirically by log transforming the Cobb-Douglas production function described in Equation 1 to obtain a linear model. For example:

$$\ln(M_{rt}) = \beta_0 + \beta_1 \ln(HE_{rt}) + \beta_2' ln(X_{rt}) + \beta_3 T_t + \epsilon_{rt}$$

(2)

where

- M_{rt} is a population-level health indicator such as mortality rates or life expectancy for region *r* (which could be countries, for multicountry analysis, or states/provinces/districts for single-country analysis) at time *t*,
- HE_{rt} is macrolevel health spending in region *r* at time *t*,
- X_{rt} is a vector of observable covariates that may be correlated with health spending but also predict population health outcomes such as economic (e.g., income, education), sociodemographic (e.g., age-gender composition), and environmental (geographical location and climate conditions) factors as well as factors that affect the efficiency of health spending (governance structures, health financing models, and design features) and uptake of health services (cultural practices and religion).
- T_t is a vector of time dummy variables,
- ϵ_{rt} is the random error term, which is assumed to be independent and identically distributed (i.i.d), and
- β_1 is the output elasticity of interest, interpreted as the percent change in population health status with a 1 percent change in health spending.

Using this approach, β_1 can be estimated using the ordinary least square estimator, by exploiting variations in health spending and population health outcomes across countries (in the case of multicountry analysis) or

subnational regions (in the case of single-country analysis) and across time.[1] Differential effect of health spending can also be estimated using this approach by either disaggregating available data into subgroups of interests (rural/urban; poor/nonpoor) and fitting Equation 2 or by including an interaction term between health spending and the subgroup indicator into Equation 2.

This model (Equation 2) assumes that the health spending is exogenous, that is, the error term ϵ_{rt} is orthogonal to health spending such that $E[HE_{rt}, \epsilon_{rt}] = 0$. However in reality, it is unlikely that this assumption will hold, resulting in endogeneity of health spending. There are potentially two sources of endogeneity. First, endogeneity can arise from unobserved heterogeneity between regions. For example, income may affect health outcomes in two ways—directly, through increasing the demand for healthcare (e.g., wealthier countries spend more on health compared to poorer countries), and indirectly, through better access to other determinants of health including better education, better living conditions (housing, water and sanitation), and better nutrition. Therefore failure to control for differences in income across national/subnational regions will result in biased estimates of β_1 due to the correlation between the omitted "income" variable and both health spending and population health outcomes. The same holds true for other time-varying factors (e.g., trends in epidemiological and disease risk factors, technological advancement, and trends in population composition) and time-invariant factors (e.g., quality of governance and administrative institutions) that simultaneously affect both health spending and population health, if these are omitted from Equation 2. Although omitted variable bias can be mitigated by controlling for a wide range of health system and population level characteristics, it is often impractical to identify and account for all potential sources of heterogeneity.

Second, endogeneity of health spending can arise from reverse causality. The parameter of interest β_1 should represent an estimate of the effect of health spending on population health outcomes. However, population health outcomes can also affect health spending. For example, health spending can be increased in response to poor population health outcomes. This simultaneous or reverse causal relationship between health spending and health outcomes can be seen as a form of omitted variable bias, where Equation 2 is misspecified due to the omission of population health outcomes from previous years (i.e., M_{rt-1}, M_{rt-2}, M_{rt-3}, etc.). Given that lagged population health outcome is likely to be correlated with both contemporaneous heath spending and health outcomes, the orthogonality assumption fails, leading to biased estimates of β_1 using the multivariate estimation approach.

Fixed Effect Approach

A fixed effect estimation approach can be used to deal with the form of endogeneity arising from unobserved heterogeneity. This approach requires panel or regional time series data to control for both time-variant and time-invariant unobserved factors that simultaneously affect the level of health spending and population health outcomes.

Consider the following linear model:

$$\ln(M_{rt}) = \delta_0 + \delta_1 \ln(HE_{rt}) + \delta_2' \ln(X_{rt}) + \rho_r + \tau_t + \varepsilon_{rt}$$

(3)

where the error term ϵ_{rt} from Equation 2 is decomposed into three components:

$$\epsilon_{rt} = \rho_r + \tau_t + \varepsilon_{rt}$$

(4)

The first term, ρ_r, represents panel fixed effects and captures unobserved time invariant regional-specific characteristics, that is, characteristics specific to each region that remain constant over time such as quality of governance structures and political institutions and health financing models that may be correlated with both health spending and health outcomes. The second term, τ_t, represents time fixed effects and captures unobserved time-varying factors that affect health spending and health outcomes uniformly in all regions, such as health technological advancements, global financial crisis or regional weather shocks, while the last term, ε_{rt} is the random i.i.d error term.

The fixed effect approach makes use of variations in health spending and population health status *within* each region and across time periods to identify the parameter of interest, δ_1, while accounting for panel and time fixed effects. The fixed effect approach has the advantage over the multivariate estimation approach of not requiring the identification and control of all potentially confounding factors. However, the fixed effect approach does not account for bias arising from reverse causality or omitted factors that vary *both* across regions *and* over time.

Instrumental Variable Approach

The instrumental variable approach can be useful for dealing with endogeneity due to unobserved heterogeneity and importantly, potential bias due to reverse causality. This requires the identification of a vector of instrumental variable(s), Z, such that Z is a source of exogenous variation in health spending but is not directly correlated with health outcomes. The performance of this approach relies on the validity or exogeneity of the instrument(s), *Z*, which satisfies the following assumptions (Wooldridge, 2012):

1. Z is uncorrelated with the error term, ε_{rt} in Equation 3,
2. Z is correlated with health spending, HE_{rt} ; i.e., Z is relevant for explaining variations in health spending.

Formally:

$$\ln(M_{rt}) = \gamma_0 + \gamma_1 \ln(HE_{rt}) + \gamma_2' \ln(X_{rt}) + \rho_r + \tau_t + \varepsilon_{rt}$$

(5)

$$\ln(HE_{rt}) = \alpha_0 + \alpha_1 \ln(Z_{rt}) + \alpha_2' \ln(X_{rt}) + \rho_r + \tau_t + \nu_{rt}$$

(6)

such that:

$$cov[Z_{rt}, {}^{\circ}HE_{rt}] \neq 0;$$

$$E[Z_{rt}, \varepsilon_{rt}] = 0$$

These assumptions imply that the effect of Z on population health outcomes is mediated only through its effect on health spending. In other words, γ_1 is estimated using only the variations in health spending mediated through Z.

Given that Z is uncorrelated with the error term, ε_{rt}, the instrumental variable approach rids health spending of the part that correlates to the error term, ε_{rt}. γ_1 can be estimated using the two-stage least square method or the two-step generalized method of moments, which is more efficient in the case of two or more instrumental variables (Cameron & Trivedi, 2005).

The main challenge with applying the instrumental variable approach lies with finding valid and relevant instruments. Previous multicountry analyses have used a range of instruments including foreign aid and military spending in own country (Gupta, Verhoeven, & Tiongson, 2002), military spending of neighboring countries (Anyanwu & Erhijakpor, 2009; Bokhari, Gai, & Gottret, 2007; Filmer & Pritchett, 1999), and a share of agriculture expenditure (Haile & Niño-Zarazúa, 2018). Other studies using single-country analysis have used state gross fiscal deficits as instruments Farahani, Subramanian, and Canning (2010). These studies argue that these instruments do not directly affect population health outcomes but may predict national or subnational levels of health spending. For example, military spending in a neighboring country may induce a country to increase its military budget at the expense of its health budget. But it is highly improbable that military spending in one country would directly affect the population health outcomes of another country.

Data Sources and Limitations

Population Health Indicators

Most empirical studies typically use population mortality rate (disaggregated by age and gender) or life expectancy (at birth or at other ages) as the measure of population health outcome. However, life expectancy has often been criticized for the way in which it is measured (McGuire, 2006). Unlike mortality rates, the estimation of life expectancy is based on extrapolations and not from actual data, that is, extrapolations from mortality data using hypothetical life tables. Both measures of population health status (mortality rates and life expectancy) can be obtained from online databases such as the World Bank World Development Indicators, the Institute of Health Metrics and Evaluation's (IHME) Global Health Data Exchange, and the WHO Global Health Observatory data. Single-country analyses often draw on national household surveys or national death registries as sources of population health indicators at subnational levels.

Health Spending Indicators

A number of health spending indicators have been used in previous empirical studies. The most common are total, public or private health expenditure per capita; public health expenditure as a proportion of total health spending; and health spending as a proportion of gross domestic product (GDP). Other indicators, such as the share of health spending on specific healthcare services and programs, have been used to assess marginal returns to targeted health spending. While there are no clear advantages to using one indicator over another, some authors have argued that health spending per capita suffers some limitations that may compromise the interpretation of results (McGuire, 2006). Given the high correlation between per capita health spending and wealth indicators such as GDP per capita, health spending per capita can serve as a proxy for overall national wealth status. This implies that the effect of health spending (per capita) on population health outcomes may not necessarily be mediated through the causal pathway described in Figure 10, but may be a reflection of better health outcomes mediated through other channels similar to those explaining income effect, such as access to better living conditions, diet, and education (McGuire, 2006). Similar to population health indicators, health spending indicators can be obtained from online open-access databases, particularly those required for multicountry analyses. The most common database for

health expenditure is the World Health Organization Global Health Expenditure Database (WHO GHED),[2] which also serves as a source of health expenditure data for other databases including the World Bank World Development Indicators, the WHO Global Health Observatory, and the IHME Global Health Data Exchange. Other sources of health expenditure data include the IMF Government Finance Statistics and the African Development Bank databases.

Since 2000, the WHO GHED has compiled annual estimates of health expenditure from more than 190 countries from various sources including the WHO Systems of Health Account, the Organization for Economic Co-operation and Development (OECD) Health Expenditure and Financing Dataset, and the EUROSTAT database (OECD, Eurostat, & WHO, 2011). Although compiling data from various sources allows for a more comprehensive database, variations across different data sources often results in conflicting statistics obtained using the GHED database and those obtained using in-country national databases (Ortiz-Ospina & Roser, 2018).

The major source of data for the GHED comes from the WHO Systems of Health Accounts. However, the frequency with which health accounts are produced varies significantly across LMICs. For example, since the rollout of the latest WHO Systems of Accounts framework in 2011, some countries such as Bangladesh, Costa Rica, Gabon, and Nigeria have produced four health accounts while other countries including Botswana, Egypt, India, Kazakhstan, Kenya, and South Africa have completed only one. This, in addition to incomplete data across all seven[3] categories of healthcare activities that form the core accounting framework of health accounts, (OECD, Eurostat, & WHO 2011) has led to large amounts of missing data. As a result, the WHO GHED has used imputations methods to fill in missing information (Lu et al., 2010). However, this approach has been criticized for not being standardized and for its use of implausible assumptions in the imputation process, which could result in measurement errors in health spending indicators (Lu et al., 2010). This would in turn result in attenuation bias or an underestimation of health spending elasticities.

Other issues with the GHED data pertain to inconsistencies in the sources of in-country data used for producing national health accounts and inconsistencies in the interpretation of the components of each healthcare activity, resulting in inconsistencies in what gets captured under each component across different countries (Morgan, Murakami, Ravishankar, & Njuguna, 2014; Ortiz-Ospina & Roser, 2018). These inconsistencies result in incomparable health spending data both across countries and across time within a given country, thus creating difficulties in interpreting results from multicountry studies.

Marginal Returns to Health Spending: Empirical Evidence

Although theoretical assumptions suggest that an increase in macrolevel health spending will result in better population health outcomes, evidence emerging from LMICs, and indeed from high-income countries, has been mixed (see, e.g., Gallet & Doucouliagos, 2017 for a comprehensive review). Some studies have reported effects with varying degrees of magnitude, while others have either found no effect or very limited effect to justify increased financial allocations to health (Gallet & Doucouliagos, 2017).

This section does not provide a comprehensive review of this literature, but rather presents some findings from previous studies, highlighting methodological challenges in estimating marginal returns to health spending in LMICs.

Evidence from Multicountry Studies

Earlier studies mainly adopted the multivariate estimation approach using either single or repeated cross-sections of countries to estimate marginal returns to health spending. For example, Bidani and Ravallion (1997) used a cross-section of 35 developing countries and showed that an increase in public health spending resulted in an increase in life expectancy and a decrease in mortality rates. This effect was found to be statistically significant only for the poor (Bidani & Ravallion, 1997). Similar findings were reported by Gupta, Verhoeven, and Tiongson (2003) using a pooled cross-section of developing countries. They found that an increase in public health spending improved population health outcomes (infant and under-5 mortality rates) particularly among the poor (Gupta, Verhoeven, & Tiongson, 2003). Other studies applying similar estimation strategies have also reported statistically significant (negative) effects of health spending on mortality outcomes in the wider population. For example, Rajkumar and Swaroop (2008), used a repeated cross-section of 91 countries (both developing and developed countries) and a multivariate approach and found that an increase in the share of GDP spent on health was associated with a decrease in under-5 mortality rates, especially in countries with good governance structures (Rajkumar & Swaroop 2008). By contrast, McGuire (2006), using a similar approach, failed to find a statistically significant effect of health spending on under-5 mortality.

Although some of these studies suggest a protective effect of health spending on population health outcomes, they suffer from one important limitation—health spending is assumed to be exogenous. While these studies control for important confounding sociodemographic and economic factors, the multivariate estimation approach often fails to account for all unobserved heterogeneity and reverse causality, thus resulting in biased estimates of the effect of health spending on population health outcomes. At best, these findings can be interpreted as an estimate of the association between health spending and population health outcomes, and not as causal effects.

Other studies applying more complex methods in an attempt to account for unobserved heterogeneity and reverse causality have also reported mixed findings. For example, Filmer and Pritchett (1999) used a pooled cross-section of approximately 100 countries (both developed and developing countries) and an instrumental variable approach and found that an increase in health spending does not result in statistically significant improvements in under-5 mortality rates (Filmer & Pritchett, 1999). Rather, variations in mortality were largely explained by variations in socioeconomic factors such as country GDP per capita, female education, ethnicity, religion, and income inequality (Filmer & Pritchett, 1999). Conversely, Gupta, Verhoeven, and Tiongson (2002), using a similar estimation approach (i.e., the instrumental variable approach) and a pooled cross-section of countries, found a statistically significant negative effect of health spending on under-5 mortality (Gupta, Verhoeven, & Tiongson, 2002).

Recent studies have reported more consistent findings. For example, in sub-Saharan Africa, Anyanwu and Erhijakpor (2009) used a panel of repeated cross-sections of 47 African countries between 1999 and 2004 and an instrumental variable approach. They found that higher health spending per capita resulted in a decrease in infant and under-5 mortality rates. Similar findings have been reported by Novignon, Olakojo, and Nonvignon (2012) in sub-Saharan Africa. Using a panel of 44 sub-Saharan African countries and a fixed-effect estimation approach, they found that higher public health spending results in an increase in life expectancy and a decrease in both crude death rates and infant mortality rates. Other studies across a wider range of LMICs using instrumental variable approaches have also reported a statistical significant effect of health spending on population health outcomes including child and adult mortality rates (Bokhari et al., 2007; Haile & Niño-Zarazúa, 2018; Moreno-Serra & Smith, 2015). However, the validity of some of these findings has been called into question due to the sensitivity of the results to alternative model specifications and data manipulations (Nakamura et al., 2016).

The use of multicountry data comes with some costs. For example, it is likely that data on health spending and health status indicators compiled in available databases are defined, classified, and measured differently across countries, resulting in incomparable data across countries and difficulties in interpreting results from these studies (McGuire 2006). Single-country data analyses that explore subnational variations in health spending and health outcomes can circumvent some of these challenges.

Evidence From Single-Country Studies

Single-country studies explore variations in health spending and health outcomes at subnational levels (district-, province-, or state-level) to identify the causal effect of health spending. In LMICs, these studies are less common in comparison to multicountry data analysis, perhaps due to the paucity of data at subnational levels. Evidence from single-country studies has also being mixed. In one of the first studies using subnational level analysis, the World Bank, using a panel of 14 Indian states over a 20-year time period (1980–1999) and different model specifications, found that health spending has no significant effect on infant mortality after accounting for time invariant state-level fixed effects and time trends (World Bank, 2004). Bhalotra (2007) also reports similar findings in India. Using microdata from the National Family Health Survey (NFHS) of India to construct a time series of infant mortality rates from 1961 to 1999, Bhalotra (2007) found no effect of health spending on infant mortality for the entire population after controlling for state and time fixed effects as well as for lagged health spending. However, when the sample was restricted to rural populations, a significant effect of lagged health spending was observed, suggesting a delayed effect of health spending on population health outcomes in rural areas (Bhalotra, 2007). In another study using a single cross-section of the NFHS of India and an instrumental variable approach, Farahani et al. (2010) found a statistically significant (negative) effect of health spending on the probability of death. However, contrary to Bhalotra (2007), they found no differential effect of health spending by socioeconomic status including rural-urban locations (Farahani et al., 2010).

Concluding Remarks

At a macro level, the impact of health spending on health outcome is likely to be indirect, mediated through a complex pathway that may in turn be affected by a range of counteracting factors that determine the extent to which additional health spending translates to better health outcomes. These factors further confound estimates of marginal returns to health spending because they are themselves direct predictors of population health outcomes. Thus, methodological challenges of disentangling the effect of health spending from external confounding factors, and the relative extent to which existing studies have been able to achieve this, may, at least in part, explain conflicting findings across studies.

Most studies rely on multicountry data to identify the causal effect of health spending. Although in recent years an attempt has been made to address the biggest challenge to identifying causal effects of health spending by explicitly accounting for endogeneity due to reverse causality as well as time-varying and -invariant unobservable heterogeneity, the availability of good quality data remains a challenge in many LMICs. Measurement errors due to incomplete and incomparable data may result in biased estimates of marginal returns to health spending. Although the instrumental variable approach can deal with this form of bias,[4] the availability of valid instruments pose a challenge to the application of this approach.

These limitations can to a large extent be mitigated by single-country data, which are likely to be more comparable across subnational regions within the same country. Furthermore, single-country data analysis can exploit contextual nuances that are important in explaining the link between macrolevel health spending and population health outcomes. For example, single-country data can facilitate modeling the decision-making process that produces the observed data by explicitly making use of in-country resource allocation and budgetary formulas that define the size of health budgets and health spending at subnational levels (Claxton et al., 2015; Gravelle & Backhouse, 1987). This approach can be useful in identifying valid and relevant instruments and has been applied by a few studies within high-income countries (see, e.g., Claxton et al. 2015; Marton, Sung, & Honore, 2015) and more recently in an LMIC, South Africa (Edoka, Stacey, & Hofman, 2017). However, the high data demand of this approach and unavailability of data on both health spending indicators and variables that define budgetary allocations at subnational levels may explain the dearth of studies applying this approach in LMICs.

Further Reading

Anyanwu, J. C., & Erhijakpor, A. E. O. (2009). Health expenditures and health outcomes in Africa. *African Development Review*, *21*, 400–433.

Find this resource:

Bhalotra, S. (2007). Spending to save? State health expenditure and infant mortality in India. *Health Economics*, *16*, 911–928.

Find this resource:

Bokhari, F. A. S., Gai, Y., & Gottret, P. (2007). Government health expenditures and health outcomes. *Health Economics*, *16*, 257–273.

Find this resource:

Farahani, M., Subramanian, S. V., & Canning, D. (2010). Effects of state-level public spending on health on the mortality probability in India. *Health Economics*, *19*, 1361–1376.

Find this resource:

Filmer, D., & Pritchett, L. (1999). The impact of public spending on health: Does money matter? *Social Science & Medicine*, *49*, 1309–1323.

Find this resource:

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

Find this resource:

Gupta, S., Verhoeven, M., & Tiongson, E. R. (2002). The effectiveness of government spending on education and health care in developing and transition economies. *European Journal of Political Economy*, *18*, 717–737.

Find this resource:

Gupta, S., Verhoeven, M., & Tiongson, E. R. (2003). Public spending on health care and the poor. *Health Economics*, *12*, 685–696.

Find this resource:

Haile, F., & Niño-Zarazúa, M. (2018). does social spending improve welfare in low-income and middle-income countries? *Journal of International Development*, *30*, 367–398.

Find this resource:

Novignon, J., Olakojo, S. A., & Nonvignon, J. (2012). The effects of public and private health care expenditure on health status in sub-Saharan Africa: New evidence from panel data analysis. *Health Economics Review*, *2*, 22.

Find this resource:

Rajkumar, A. S., & Swaroop, V. (2008). Public spending and outcomes: Does governance matter? *Journal of Development Economics*, *86*, 96–111.

Find this resource:

References

Anyanwu, J. C., & Erhijakpor, A. E. O. (2009). Health expenditures and health outcomes in Africa. *African Development Review*, *21*, 400–433.

Find this resource:

Bhalotra, S. (2007). Spending to save? State health expenditure and infant mortality in India. *Health Economics*, *16*, 911–928.

Find this resource:

Bidani, B., & Ravallion, M. (1997). Decomposing social indicators using distributional data. *Journal of Econometrics*, *77*, 125–139.

Find this resource:

Bishai, D., & Cardona, C. (2017). Aggregate health spending. *Lancet*, *390*, 647.

Find this resource:

Bokhari, F. A. S., Gai, Y., & Gottret, P. (2007). Government health expenditures and health outcomes. *Health Economics*, *16*, 257–273.

Find this resource:

Cameron, A., & Trivedi, P. (2005). *Microeconometrics: Methods and Applications*. (New York: Cambridge University Press).

Find this resource:

Chalkley, M., Mirelman, A., Siciliani, L., & Suhrcke, M. (2016). *Paying for performance for health care in low- and middle-income countries: An economic perspective* (CHE Research Paper No. 140) York, U.K.: University of York Centre for Health Economics.

Find this resource:

Claxton, K., Martin, S., Soares, M., Rice, N., Spackman, E., Hinde, S., . . . Sculpher, M. (2015). Methods for the estimation of the NICE cost effectiveness threshold. *Health Technology Assessment*, 19.

Find this resource:

Cylus, J., Papanicolas, I., & Smith, P. C. (2017). *How to make sense of health system efficiency comparisons?* (Policy Brief 27). Copenhagen, Denmark: European Observatory on Health Systems and Policies.

Find this resource:

Dieleman, J. L., Haakenstad, A., Micah, A., Moses, M., Abbafati, C., Acharya, P., . . . Christopher J. L. Murray. (2018). Spending on health and HIV/AIDS: Domestic health spending and development assistance in 188 countries, 1995–2015. *Lancet*, *391*, 1799–1829.

Find this resource:

Edney, L. C., Afzali, H. H. A., Cheng, T. C., & Karnon, J. (2018). Estimating the reference incremental cost-effectiveness ratio for the Australian health system. *PharmacoEconomics*, *36*, 239–252.

Find this resource:

Edoka, I., Stacey, N., & Hofman, K. (2017). Estimating marginal returns to healthcare spending in South Africa: An instrumental variable approach. International Health Economics Association Biennial World Congress, Boston.

Find this resource:

Escobar, M.-L., Griffin, C. C., & Shaw, R. P. (2010). The impact of health insurance in low- and middle-income countries. Washington, DC: The Brookings Institution.

Find this resource:

Farahani, M., Subramanian, S. V., & Canning, D. (2010). Effects of state-level public spending on health on the mortality probability in India. *Health Economics*, *19*, 1361–1376.

Find this resource:

Filmer, D., & Pritchett, L. (1999). The impact of public spending on health: Does money matter? *Social Science & Medicine*, *49*, 1309–1323.

Find this resource:

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

Find this resource:

Gottret, P., & Schieber, G. (2006). Health financing revisited: A practitioner’s guide. Washington DC: The International Bank for Reconstruction and Development/The World Bank.

Find this resource:

Gravelle, H. S. E., & Backhouse, M. E. (1987). International cross-section analysis of the determination of mortality. *Social Science & Medicine*, *25*, 427–441.

Find this resource:

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy*, *80*, 223–255.

Find this resource:

Grossman, M. (1999). *The human capital model of the demand for health*. Cambridge, MA: National Bureau of Economic Research.

Find this resource:

Gupta, S., Verhoeven, M., & Tiongson, E. R. (2002). The effectiveness of government spending on education and health care in developing and transition economies. *European Journal of Political Economy*, *18*, 717–737.
Find this resource:

Gupta, S., Verhoeven, M., & Tiongson, E. R. (2003). Public spending on health care and the poor. *Health Economics*, *12*, 685–696.
Find this resource:

Haile, F., & Niño-Zarazúa, M. (2018). Does social spending improve welfare in low-income and middle-income countries? *Journal of International Development*, *30*, 367–398.
Find this resource:

IMF. (2017). *Debt relief under the Heavily Indebted Poor Countries (HIPC) initiative*. Washington, DC: International Monetary Fund.
Find this resource:

Jacobs, B., Ir, P., Bigdeli, M., Annear, P. L., & Damme, W. V. (2012). Addressing access barriers to health services: an analytical framework for selecting appropriate interventions in low-income Asian countries. *Health Policy and Planning*, *27*, 288–300.
Find this resource:

Jakovljevic, M., & Getzen, T. E. (2016). Growth of global health spending share in low and middle income countries. *Frontiers in Pharmacology*, *7*.
Find this resource:

Laporte, A. (2015). Should the Grossman model of investment in health capital retain its iconic status? (Working Paper). Toronto, ON: Canadian Centre for Health Economics.
Find this resource:

Lu, C, Schneider, M. T., Gubbins, P., Leach-Kemon, K., Jamison, D., & Murray, C. J. L. (2010). Public financing of health in developing countries: a cross-national systematic analysis. *Lancet*, *375*, 1375–1387.
Find this resource:

Marton, J., Sung, J., & Honore, P. (2015). **Does more public health spending buy better health?** *Health Services Research and Managerial Epidemiology*, *2*.
Find this resource:

McGuire, J. W. (2006). Basic health care provision and under-5 mortality: A cross-national study of developing countries. *World Development*, *34*, 405–425.
Find this resource:

Moreno-Serra, R., & Smith, P. C. (2015). Broader health coverage is good for the nation's health: evidence from country level panel data. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *178*, 101–124.
Find this resource:

Morgan, D., Murakami, Y., Ravishankar, N., & Njuguna, D. (2014). *Strengthening resource tracking and monitoring health expenditure*. Paris, France: OECD.
Find this resource:

Mueller, M., & Yuan, X. (2013). *Guidelines to improve estimates of expenditure on health administration and health insurance*. Paris, France: OECD, Directorate for Employment, Labour and Social Affairs.

Find this resource:

Nakamura, R., Lomas, J., Claxton, K., Farasat, Bokhari, A. S., Moreno Serra, R., & Suhrcke, M. (2016). *Assessing the impact of health care expenditures on mortality using cross-country data* (CHE Research Paper 128). York, U.K.: University of York Centre for Health Economics.

Find this resource:

Novignon, J., Olakojo, S. A., & Nonvignon, J. (2012). The effects of public and private health care expenditure on health status in sub-Saharan Africa: New evidence from panel data analysis. *Health Economics Review*, *2*(1), 22.

Find this resource:

O'Donnell, O. (2007). Access to health care in developing countries: breaking down demand side barriers. *Cadernos de Saúde Pública*, *23*(12), 2820–2834.

Find this resource:

Ochalek, Jessica, Lomas, J., & Claxton, K. (2015). *Cost per DALY averted thresholds for low- and middle-income countries: Evidence from cross country data* (CHE Research Paper 122). York, U.K.: University of York Centre for Health Economics.

Find this resource:

OECD, Eurostat, & WHO. (2011). *A system of health accounts*. Paris, France: OECD.

Find this resource:

Ortiz-Ospina, E., & Roser, M. (2018. ***Financing healthcare***. Oxford, U.K.: Our World in Data.

Find this resource:

Rajkumar, A. S., & Swaroop, V. (2008). Public spending and outcomes: Does governance matter? *Journal of Development Economics*, *86*, 96–111.

Find this resource:

Ravishankar, N., Gubbins, P., Cooley, R. J., Leach-Kemon, K., Michaud, C. M., Jamison, D. T., & Murray, C. J. L. (2009). Financing of global health: Tracking development assistance for health from 1990 to 2007. *Lancet*, *373*, 2113–2124.

Find this resource:

Rok, H. (2012). Theoretical shortcomings of the Grossman model. *Economics, Organisation and Informatics in Healthcare Bulletin*, *28*, 63–75.

Find this resource:

Savedoff, W. D. (2007). what should a country spend on health care? *Health Affairs*, *26*, 962–970.

Find this resource:

Savedoff, W. D., Bitrán, R., de Ferranti, D., Fan, V. Y., Holly, A., Moreno-Serra, R., . . . Xu, K. (2012). Transitions in health financing and policies for universal health coverage: Final report of the Transitions in Health Financing Project. Washington, DC: Results for Development Institute.

Find this resource:

Vallejo-Torres, L., García-Lorenzo, B., Iván Castilla, Valcárcel-Nazco, C., García-Pérez, L., Linertová, R., Polentinos-Castro, E., & Serrano-Aguilar, P. (2016). On the estimation of the cost-effectiveness threshold: Why, what, how? *Value in Health*, *19*, 558–566.

Find this resource:

Wagstaff, A., & Claeson, M. (2004). *The millennium development goals for health: Rising to the challenges*. Washington, DC: International Bank for Reconstruction and Development.

Find this resource:

WHO. (2010). *The World Health Report: Health systems financing; The path to universal coverage*. Geneva, Switzerland: World Health Organization.

Find this resource:

WHO. (2017). *Global Report: New Perspectives on global health spending for universal health coverage*. Geneva, Switzerland: World Health Organization.

Find this resource:

Wooldridge, J. M. (2012). *Introductory econometrics: A modern approach* (5th ed). Mason, OH: South-Western Cengage Learning.

Find this resource:

World Bank. (2004). *Attaining the millennium development goals in India: How likely and what will it take to reduce infant mortality, child malnutrition, gender disparities and hunger-poverty and to increase school enrollment and completion?* Washington, DC: World Bank.

Find this resource:

Zweifel, P. (2012). The Grossman model after 40 years. *European Journal of Health Economics*, *13*, 677–682.

Find this resource:

Notes:

(1.) In the case of a single cross-sectional data, the estimation of β_1 will rely only on variations between regions, in which case the subscript, *t*, and term, $\beta_3 T_t$, drops off from Equation 1.

(2.) Information on the WHO GHED can be found online.

(3.) These include health promotion and prevention; diagnosis, treatment, cure, and rehabilitation of illness; caring for persons affected by chronic illness; caring for persons with health-related impairment and disability; palliative care; providing community health programs; governance and administration of the health system.

(4.) Provided that in addition to the instrumental variable assumption highlighted in the subsection on "Instrumental Variable Approach," the measurement error in the instrumental variable is uncorrelated with measurement error in health spending.

Ijeoma Peace Edoka

School of Public Health, University of the Witswatersrand