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Social spending and aggregate welfare in developing and transition economies

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Abstract: Notwithstanding the unprecedented attention devoted to reducing poverty and fostering human development via scaling up social sector spending, there is surprisingly little rigorous empirical work on the question of whether social spending is effective in achieving these goals. This paper examines the impact of government spending on the social sectors (health, education, and social protection) on two major indicators of aggregate welfare (the Inequality-adjusted Human Development Index and child mortality), using a panel dataset comprising 55 developing and transition countries from 1990 to 2009. We find that government social spending has a significantly positive causal effect on the Inequality-adjusted Human Development Index, while government expenditure on health has a significant negative impact on child mortality rate. These results are fairly robust to the method of estimation, the use of alternative instruments to control for the endogeneity of social spending, the set of control variables included in the regressions, and the use of alternative samples.

Keywords: Social spending, human development, aggregate welfare, child mortality, developing countries

JEL classification: C33, H51, H52, H53, I31

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1 Introduction

Economic growth has been at the heart of development objectives over the past half century. The development of the endogenous growth theory (Lucas 1988; Romer 1994) has brought to the fore the importance of social sector policy, which largely focuses on enhancing human development. Social spending and the policy strategies that facilitate the process of innovation, knowledge creation, and information are found to have profound effects on the long-run patterns of economic growth and development (Barro 1991; Rebelo 1991; Benhabib and Spiegel 1994). The advancement of human development has also been found to have strong links with poverty reduction (Ravallion and Chen 1997; Schultz 1999; Sen 1999; Squire 1993).

Continuing investments in the social sectors have been recognized by the international community. In 2000, the Millennium Development Goals (MDGs) were established, which comprise explicit targets to tackle extreme poverty and promote human development. To this end, much of the increase in development assistance has been directed toward the social sectors.[1]

There has been a fair amount of research in the economics literature that looks at the effect of social spending. The endogenous growth theory has proposed several models linking social spending with growth (Aschauer 1989; Barro 1990, 1991; Levine and Renelt 1992; Easterly and Rebelo 1993; Devarajan et al. 1996; Mittnik and Neumann 2003). The more specific question of whether there is sizable cause-effect relationship between government social spending and aggregate welfare is not irrelevant. In most developing countries, the public sector plays a leading role in providing public goods, notably education, healthcare, safe water and sanitation and social protection, which are critical for human capital formation and the overall development process. Government intervention in the social sectors is justified on the grounds of positive externalities and market failures (Baldacci et al. 2008). Yet, the question of whether government social spending is effective in fostering aggregate welfare is still a subject of widespread contention.

On the one hand, a strand of the literature finds that social spending is a weak predictor of social outcomes (Flug et al. 1998; Mingat and Tan 1998; Filmer and Pritchett 1999; Filmer et al. 2000; Dreher et al. 2008). On the other hand, a number of studies contend that social spending has a beneficial impact on welfare outcomes (Anand and Ravallion 1993; Bidani and Ravallion 1997; Gupta et al. 2002b, 2003; Mosley et al. 2004; Baldacci et al., 2008). Recent evidence suggests that social spending only yields desirable results in countries with good governance (Rodrik et al. 2004, Rajkumar and Swaroop

[1] Aid to the social sectors, namely health care, education, and the provision of safe water and sanitation facilities, increased from about 5 per cent of total aid flows in the late 1960s to around 40 per cent in 2011. In real terms, this meant an increase from an average of US$ 2 billion a year in the 1960s to US$50 billion in the 2000s, reaching US$64 billion in 2011 (OECD, 2012: Available at http://stats.oecd.org/). Despite this trend, two-thirds of overall aid is still disbursed through project aid, with less than 10 per cent channeled via government budgets.

2008). The mixed results on the effectiveness of social spending can be attributed to several factors. Previous endeavors to disentangle the effect of social spending have been bedeviled by, inter alia, the dearth of reliable data and measurement problems. Extant studies have also been hampered by fundamental methodological shortcomings, particularly with regard to endogeneity concerns. Moreover, many studies fail to control for crucial mediating factors in the relationship between social spending and welfare outcomes. However, no lesson from the existing literature is more manifest than that of the considerable sensitivity of empirical estimates to the set of control variables and the choice of estimators. Further, notwithstanding the proliferation of studies assessing the effect of social sector expenditures on health and education indicators, such analysis assumes away the distributional aspects of social spending.

This paper seeks to advance this longstanding debate by investigating the impact of government spending on the social sectors (health, education, and social protection) on two major indicators of aggregate welfare: the *Inequality-adjusted* Human Development Index (IHDI) and child mortality, in a sample of 55 developing and transition economies from 1990 to 2009. Unlike most previous studies, we adopt a wide array of estimation methods and empirical specifications to explicitly address endogeneity issues, control for the relevant covariates identified in the literature, and perform rigorous robustness checks on the main findings.

Our approach is similar to that of Gomanee et al. (2005b); however, this paper differs from Gomanee et al. (2005b) in that they primarily investigate the impact of foreign aid on aggregate welfare (proxied by the HDI and infant mortality), while accounting for 'pro-poor' public spending.[2] The HDI remains problematic as it fails to take into account distributional inequalities in its components, namely health, education, and income. There are good reasons to expect that greater inequality in these welfare dimensions would be associated with lower development achievements (Hicks 1997; Alkire and Foster 2010). For this reason, we use the *inequality-adjusted* HDI instead of the *conventional* HDI, as an indicator of aggregate welfare.

Overall, we find strong evidence of a positive causal effect of social spending on aggregate welfare. The preferred system generalized method of moments (Sys-GMM) specification indicates that a 1 per cent increase in government social spending, in per cent of GDP, leads to a 0.004 points increase in the IHDI, which is modest, albeit not negligible. The implied long-term effect of a 1 per cent increase in social spending is an increase in the IHDI of about 0.057 points. Our results are fairly robust to, inter alia, the method of estimation, the use of alternative instruments to control for the endogeneity of social spending, the set of control variables included in the regressions, and the use of alternative samples. Our findings stand in contrast to the results reported in Gomanee et al.

[2] Gomanee et al. (2005b) define 'pro-poor' public spending as comprising expenditures on health, education, and sanitation.

(2005b); Flug et al. (1998); Filmer and Pritchett (1999); Filmer et al. (2000), and Dreher et al. (2008) who argue that per capita income accounts for most of the cross-country variation in aggregate welfare, whereby social spending is a poor predictor.

The remainder of this paper is organized as follows. Section 2 provides an overview of the empirical literature on the effect of social spending on aggregage welfare. Section 3 discusses the data and presents descriptive statistics. Section 4 deals with model specification and econometric methodology. Section 5 presents the empirical results while Section 6 perform extensive robustness checks on the main findings. Finally, Section 7 concludes with reflections on policy.

2 Social spending and aggregate welfare

Studies investigating the link between social spending and aggregate welfare have produced mixed results. One strand of the literature finds evidence that health spending improves health outcomes. For instance, Anand and Ravallion (1993) and Hojman (1996) show that public spending on health has a significant impact on health status. This has been corroborated by Bidani and Ravallion (1997), who show that health expenditures have a significantly positive impact on the poor. In the same vein, Gupta et al. (2002b, 2003) find that health expenditure reduces child mortality. In particular, Gupta et al. (2003) show that the effect of health spending on health status among the poor is stronger in low-income countries than in high-income countries, suggesting diminishing marginal returns to social investment.

These results are not incontrovertible; a second strand of the literature finds a weak association between health spending and health outcomes. For example, Kim and Moody (1992), Carrin and Politi (1995), Musgrove (1996), Filmer and Pritchett (1999), and Filmer et al. (2000) find that health spending does not yield the expected improvement in health outcomes. Filmer and Pritchett (1999) find that public spending on health has a small and statistically insignificant effect on infant and child mortality, whereas a country's per capita income accounts for most of the cross-national variation in mortality rates. Similarly, Kim and Moody (1992) examine whether healthcare expenditure is a strong predictor of reductions in infant mortality. They find that health resources are not a powerful determinant of infant mortality rates and attribute most of the observed change to socioeconomic resources. Filmer et al. (2000) argue that inadequate institutional capacity and market failures are behind the tenuous link between health spending and improvements in health status.

In the area of education, evidence of a positive effect of education spending is found in Psacharopoulos (1994) and Psacharopoulos and Patrinos (2004). Harbison and Hanushek (1992) reviewed studies assessing the impact of education spending on education outcomes in developing countries. Whereas half of the studies reported a positive and statistically significant effect, the other half found no evidence of any measurable impact of education spending. This was confirmed by Hanushek (1995), Wolf (2004), and Dreher et al. (2008), who concluded that education spending had no discernible impact on indicators of education attainment. Mingat and Tan (1998) also show that bigger budget allocations in developing countries seem to contribute relatively little to differences in education outcomes vis-à-vis in industrialized countries, whereas Flug et al. (1998) indicate that income volatility, underdeveloped credit markets, and income inequality are associated with a limited educational upgrading in developing countries.

Dollar and Kraay (2001) find that many supposedly 'pro-poor' policies, such as public expenditure on education and health, do not have any significant impact on the income of the poor. The World Bank's (2004) *World Development Report* contends that the 'weak' link between social spending and indicators of social outcomes is due to the fact that little of the spending goes to the poor, although Governments allocate about a third of their budgets to these sectors.

In contrast, and after controlling for governance and incorporating nonlinear relationships, Baldacci et al. (2008) find that both education and health spending have positive and significant impact on education and health outcomes. Similarly, Baldacci et al. (2003) provide evidence that social spending is an important determinant of social outcomes, particularly in the education sector.

The literature on aid emphasizes that the welfare-poverty effect of aid is not direct, but it goes through government spending on the social sectors. Mosley et al. (2004), for instance, find that aid is associated with higher levels of pro-poor spending, which is in turn associated with lower level of poverty. Similarly, Gomanee et al. (2005b) show that aid improves welfare through higher social sector spending. Mosley and Suleiman (2007) point out that aid reduces poverty particularly when it is directed towards pro-poor sectors. In contrast, Gomanee, et al. (2005b) find no evidence to suggest that aid affects welfare through government expenditure, although they find that aid improves welfare outcomes. More recently, Alvi and Senbeta (2012) performed a similar analysis and provide stronger evidence that aid does have a significant poverty-reducing impact.

The mixed results from the literature on the effectiveness of social spending can be traced to several issues: First, existing studies have been hampered by limited data availability and measurement problems. Statistics on social spending and the relevant social outcomes are relatively scarce and truncated vis-à-vis other macroeconomic indicators.

Second, extant studies have been hampered by fundamental methodological shortcomings. In particular, several studies have not addressed appropriately endogeneity concerns and disregarded country-specific effects, which more often than not render biased empirical estimates.

Third, many previous studies fail to control for the factors that influence the effectiveness of social spending. In this regard, no lesson from the existing literature is more manifest than that of the considerable sensitivity of empirical estimates to the set of control variables and the choice of estimators. In particular, the role of governance and bureaucratic institutions in mediating the nexus between social spending, aggregate welfare, and growth is highlighted by inter alia Abed and Gupta (2002); Gupta et al. (2002b); Mauro (1998); Rajkumar and Swaroop (2008), Rodrik et al (2004), and Hausmann et al. (2005). Kaufmann et al. (1999) and Kaufmann et al. (2004) also show that governance dimensions are strong predictors of reductions in infant mortality. Furthermore, Gupta et al. (2002a) find that countries with high corruption levels also have high child mortality rates. These findings are supported by De La Croix and Delavallade (2009) who find that countries with high corruption invest more in physical capital relative to human capital.

When linking social spending to aggregate welfare, studies underline the importance of having democratic environments to exercise political freedoms and voice. Boone (1996) shows that liberal political regimes and democracies perform better in terms of welfare dimensions than highly repressive regimes. Kosack (2003) shows that aid improves quality of life in democracies but it has no effect in autocracies. Chiripanhura and Niño-Zarazúa (forthcoming) find that the drivers of success and failure in social policy in sub-Saharan Africa (SSA) are related to the existence of pre-election social stimulus linked to political business cycles.

The present study adopts a wide array of estimation methods and empirical specifications to explicitly address endogeneity issues, control for the relevant explanatory variables in the literature, and perform rigorous robustness checks on the main findings.

3 Data

3.1 Social spending

The data on government spending on the social sectors (health, education, and social protection) for the period 1991-2009 are taken from the International Monetary Fund's (IMF) *Government Finance Statistics* (GFS: 2011 edition). Although the GFS database provides data dating as far back as 1972, we were able to use only data for the period 1991-2009. Data before 1990 are based on the accounting system described in the 1986 Manual on Government Finance Statistics (GFSM 1986), while the data from 1990 onwards are based on a revised accounting method outlined in GFSM 2001. The revision resulted in major changes in, *inter alia*, the definitions and classification of expenditures, and the timing at which economic events are to be recorded. For instance, in terms of the classification of expense by economic type, the definition of current and capital spending differs between GFSM 1986 and GFSM 2001. Concerning the functional classification of expense, while expenditures are classified into 14 categories in the revised GFS system, they were categorized into only 10 functional categories in GFSM 1986. Moreover, transactions and other economic flows are recorded on an accrual basis in GFSM 2001, i.e. flows are recorded at the time when a transaction occurs, regardless of the timing of cash flows. In contrast, in the GFSM 1986, transactions are recorded when cash is exchanged.[3]

The data from the GFS database are given in local currency units (LCU). To the best of our knowledge, previous studies use either the data in LCU or convert them into one monetary unit using exchange rates. However, this is likely to be misleading because exchange rates do not necessarily reflect the relative purchasing power across countries. Therefore, we transformed the data in LCU into purchasing power parity (PPP) dollars. More specifically, for the purpose of transforming LCU at time t to time t_{base}, which is set at 2005, i.e. $t_{base} = 2005$, we use data on the consumer price index (CPI) from the IMF *World Economic Outlook* (2012), and the PPP exchange rate and the official exchange rate from the World Bank's (2012) *World Development Indicators* (WDI) and *Global Development Finance* (GDF). Denoting the PPP exchange rates for the base year as PPP$_{base}$ (LCU per dollar), the currency transformation into constant dollars or PPP is carried out as follows:

$$V_t^{base} = \frac{CPI_{t_{base}}}{CPI_t \; E_{base}} V_t^{LCU} \tag{1}$$

where V_t^{LCU} is the value in LCU at time t, V_t^{base} is the value in PPP at time t, and E_{base} stands for the official exchange rate when constant US dollars are needed and PPP exchange rate when constant PPP is the value of interest. Some of the original data, in particular from the World Bank, are given in current dollars. To transform these values into PPP, the currency values were transformed first into LCU and then Equation (1) was applied to the resulting LCU value. Put in other terms, supposing G_t is the official exchange rate (LCU per dollars), the formula for transformation is:

$$V_t^{base} = \frac{CPI_{t_{base}} G_t}{CPI_t \; E_{base}} V_t^{current} \tag{2}$$

where $V_t^{current}$ is the value in current dollars at time t.

For some of the countries in our sample (see Table C in Appendix A), the government spending data are partly in cash and partly in accrual, which raises a question of comparability. Confining the analysis to include only cash data would substantially reduce the sample size, while using only accrual data would considerably shorten the time span and limit the number of countries that could be included in the sample.[4] In either case, the sample size would be too small to perform any meaningful analysis. It is difficult to convert the cash data into accrual (or vice versa) without making fairly stringent assumptions.

Seiferling (2013) suggests that merging both data and including an indicator (dummy) variable in parametric analysis to account for any systematic differences would be accept-

[3] See IMF (2001: Appendix I) for a more detailed discussion.

[4] Note that we have excluded countries with less than nine observations for government social spending over the period 1990-2009.

able for most data series from the GFS database. This suggests that cash data could be taken as a proxy for accrual data and vice versa. However, given the methodological changes introduced by GFSM 2001, mixing cash and accrual data does not seem a plausible option. Given that most of the data are in cash, a possible way to circumvent this problem is to extend the cash data using the annual growth rates for the accrual data. This is, in effect, tantamount to predicting the values of the cash data for periods for which we have only accrual data. The underlying assumption is that the year-to-year growth rates of the cash and accrual data are not systematically different from each other although the actual values might differ. This is in our view a far less restrictive assumption than the one suggested by Seiferling (2013).

Another limitation of the GFS database is that the government spending data for some of the sample countries have gaps (see Table C in Appendix A). Hence, we imputed the missing observations using health expenditure data at constant 2005 PPP from the World Development Indicators.[5] In Section 6, we test the robustness of our results by excluding the countries with data that are partly in cash and partly in accrual, and countries with data that have gaps. The results remain robust across the subsample of countries.

Finally, note that we use data on central government (CG) spending as a proxy for general government (GG) spending (central plus subnational). GFS data on social sector spending for the GG are scanty for most countries, whereas there is a more comprehensive coverage for CG accounts. Although a potential solution would be to assemble data for the GG based on data for lower government levels (central as well as state and/or local governments), the latter are missing for most countries and periods. Hence, we use CG data as a proxy measure for GG spending, although the latter would be a more satisfactory measure.[6]

3.2 Aggregate welfare

A large strand of the literature on the effectiveness of social spending relies on income- or consumption-based poverty measures, such as the World Bank's headcount index that measures the percentage of the population living on less than a US$1.25 a day, adjusted for the purchasing power parity. Although these measures are used for international comparisons, their reliability as indicators of poverty have been questioned on the grounds that they fail to capture non-income dimensions of deprivation. Income (or consumption)

[5] Data on health expenditure are widely available for these countries and are highly correlated with our social spending data. The correlation between government spending on the social sectors (health, education, and social protection) and total health expenditure for periods for which both series are available is fairly high, with correlation coefficients of 0.75 or more for 9 of the 10 countries with data gaps.

[6] Note that using CG spending as a proxy for GG spending is not uncommon in the literature. For an illustration, see Feyzioglu *et al.* (1998), Baldacci *et al.* (2003), and Acosta-Ormaechea and Morozumi (2013).

poverty is a rough approximation of deprivation in other wellbeing dimensions.

Income can, of course, be instrumental in providing the material resources needed for people to lead a decent life. However, income constitutes only the means to an intrinsic end and as such it provides a limited approximation to the multidimensional aspects of human development. Ruggeri-Laderchi, et al. (2003) show that in India, 43 per cent of children and more than half of adults who were poor, judged on the basis of health or education indicators, were counted as non-poor using monetary measures of poverty; similarly, more than half of the nutrition-poor children were not in monetary poverty. Thus, the tendency to place an overriding emphasis on income as a poverty measure may obscure the more intrinsic ends of development. This prompts the need for an indicator that better reflects income as well as non-income dimensions of human development.

In view of the limitations of conventional poverty measures and the paucity of reliable cross-country data on poverty over time, we use the IHDI and child mortality rate as indicators of aggregate welfare. The HDI, an index between 0 and 1, is built from three separate components: (1) *longevity*, measured by life expectancy at birth, (2) *educational attainment*, proxied by a weighted average of adult literacy (with a two-thirds weight) and school enrollment rates (with a one-third weight), and (3) *standard of living*, measured by income (GNI) per capita, adjusted for purchasing power parity. HDI is a widely used measure of aggregate welfare and is calculated using consistent data and methodology (UNDP 2011). Because the HDI includes GNI per capita as one of its components, we expect poverty to be inversely correlated with HDI insofar as income poverty is lower in countries with higher GNI.

Note, however, that the HDI has been criticized for not addressing distributional inequalities in education, health, and income across the population. There are good reasons to think that greater inequality in these spheres would be associated with lower development levels (Hicks 1997; Alkire and Foster 2010). In response to this criticism, the UNDP introduced a new measure, the *inequality-adjusted* HDI, which incorporates distributional aspects into the *conventional* HDI. IHDI equals HDI if there is no distributional inequality in the above-mentioned three spaces. In other words, the gap between HDI and IHDI reflects inequality in the dimensions of human development; the greater the gap, the greater the inequality. Therefore, the IHDI is our preferred measure.

Annual data on HDI for the period 1990-2009 come from the UN's *Human Development Report* (HDR). Data on the corresponding IHDI are from Huang and Quibria (2013).[7] As an additional indicator of aggregate welfare, we follow Burnside and Dollar (1998) and Gomanee et al. (2005b) and use child mortality rate, for which data is suf-

[7]UNDP (2011) calculates IHDI only for the year 2011. Following the procedure to compute HDI and IHDI outlined in UNDP (2011: Technical notes 1 and 2), Huang and Quibria (2013) calculate IHDI for almost all countries in our sample based on the HDI data from the UN's HDR and data on life expectancy at birth (years), duration of primary and secondary education (years), and GNI per capita (PPP) from WDI (2012).

ficiently available. Reddy and Pogge (2010) argue that non-income indicators of human development, such as child mortality rate, can be equally informative as income-based poverty measures.

It should be noted that unlike measures that are based on absolute poverty line, the HDI does not provide a certain threshold or cutoff point under which people can be considered to be deprived in the spaces of health, education, and income. Nonetheless, there is considerable correlation in our sample between IHDI and child mortality, on the one hand, and income poverty measures, on the other. In our data, the correlation at country level between IHDI and the US\$1.25 a day measure is -0.82; between child mortality and the US\$1.25 a day measure it is 0.84. This unveils the substantial information overlap between welfare measures and income-based poverty measures, and indicates that our analysis may have implications for the public spending-poverty nexus.

3.3 Descriptive statistics

Table B (Appendix A) presents basic summary statistics for the welfare outcomes of interest, i.e. the IHDI and child mortality, and the main explanatory variables included in our empirical model. The summary statistics show that there is considerable variation in IHDI and child mortality rate across the sample countries. For instance, HDI ranges from 0.259 to 0.813, while IHDI from 0.086 to 0.271. Similarly, child mortality rate ranges from 6.6 to 204. The countries also exhibit substantial variation in the size of government social spending, in per cent of GDP.[8]

The pairwise correlation coefficients (Table D in Appendix A) reveal that GDP per capita, social spending, trade openness, bureaucratic quality, and democracy are significantly positively correlated with IHDI, whereas IHDI is negatively correlated with terms of trade and age dependency ratio, albeit weakly so with the former. The positive correlation between IHDI and social spending may suggest that an increase in government spending on the social sectors leads to a higher level of aggregate welfare. However, this may as well reflect that countries increase social sector spending when faced with pressing demands to improve the stardard of living. In the child mortality specification, GDP per capita, health spending, the degree of urbanization, female education, access to safe water, and access to improved sanitation facilities are significantly negatively correlated with child mortality rate, whereas the latter is positively correlated with fertility rate.

[8] Among the countries in the sample, the highest and lowest IHDI correspond to Lithuania (in the year 2008) and Yemen (in 1990) respectively. The highest government social spending, in per cent of GDP, corresponds to Yemen (in 1990). The highest child mortality rate corresponds to Ethiopia (in 1990) while the lowest to Belarus (in 2009).

4 Model specification and econometric methods

4.1 Model specification

We use a panel dataset comprising 55 developing and transition economies[9] from 1990 to 2009. Given that most of the data are available on an annual basis and that the number of countries is relatively small,[10] we first focus on an annual panel spanning the period 1990-2009, which provides more degrees of freedom. The downside of using annual observations is that empirical estimates may be driven by short-term 'noise'. In addition, the variation in annual observations may be insufficient to reflect the effect of structural variables with little variation over time. It is common in the literature to use time-averaged data to smooth out potential business cycle effects and reduce measurement errors. The robustness of the results from the annual panel is tested in Section 5 using data averaged over three-year periods.[11]

We estimate two models: the first model estimates the effect of government spending on the social sectors on the IHDI after controlling for the relevant explanatory variables. The model takes the following form:[12]

$$W_{i,t} = \theta_0 W_{i,t-1} + \beta_1 Y_{i,t} + \beta_2 S_{i,t} + \beta_3 I_{i,t} + \beta_4 D_{i,t} + \gamma X + \eta_i + v_t + \varepsilon_{i,t} \tag{3}$$

where the subscripts i and t denote country and year respectively; $W_{i,t}$ stands for IHDI; $W_{i,t-1}$ for one-period lagged IHDI, θ_0 measures the persistence of $W_{i,t}$; $Y_{i,t}$ for real GDP per capita[13]; $S_{i,t}$ for government spending on the social sectors (health, education, and social protection), in per cent of GDP; β_2 is the key parameter of interest and measures the direct effect of government social spending on IHDI once we have controlled for the relevant explanatory variables; $I_{i,t}$ is a vector comprising indicators of institutional quality; $D_{i,t}$ is an indicator of the level of democratization; X is the vector of control variables that may affect $W_{i,t}$ and $S_{i,t}$; η_i denotes unobserved country-specific and time-invariant effects; v_t is a vector of time dummies capturing universal time trends; and finally, $\varepsilon_{i,t}$ is idiosyncratic error term. Table A in Appendix A provides a description of data sources and variable definitions.

As indicators for institutional quality, we follow Rajkumar and Swaroop (2008) and use the indices of bureaucratic quality and corruption from the International Country Risk Guide (ICRG). The bureaucratic quality index ranges from 1 to 4 and measures the soundness of institutions and the quality of the civil service. The corruption index,

[9] Table C (Appendix A) presents the list of countries included in the sample.

[10] Note that the number of countries drops in some of the regressions because of the limited overlap between the control variables included in the regressions.

[11] Although it is more common in the literature to use four- or five-year averaged data, this would significantly reduce the sample size. Hence, we organized the data into three-year periods.

[12] This specification draws on the work of Kosack (2003) and Gomanee et al. (2005).

[13] We use GDP per capita in the preceding period ($Y_{i,t-1}$) to address potential endogeneity problems.

ranging from 0 to 6, measures corruption within the political system, with a score of 0 pointing to very high corruption. The democracy index comes from the Polity IV project. The measures of economic policy we use in the regressions are standard in the literature: inflation rate, proxy for a country's monetary policy stance; trade openness, sum of exports and imports as a percentage of GDP; and the share of domestic credit to private sector in GDP, an indicator for the potential role of financial sector development in improving welfare. Many of the countries in our sample are vulnerable to the vagaries of the international economy and particularly to primary commodity price fluctuations. The terms of trade index controls for this effect.

The relationship between $W_{i,t}$ and $S_{i,t}$ is estimated using two functional forms: (i) linear-log specification, where $W_{i,t}$ is linear and $S_{i,t}$ is logarithmic, and (ii) log-log specification, where both variables are in log form. The linear-log specification may be preferable because it provides the absolute change in the IHDI associated with a per cent change in social spending. The log-log specification has the added convenience of smoothing the data and allowing coefficients to be interpreted as elasticities.[14]

The second model specifies child mortality as a function of government health spending and relevant covariates:

$$C_{i,t} = \alpha_0 C_{i,t-1} + \delta_1 Y_{i,t} + \delta_1 H_{i,t} + \delta_3 I_{i,t} + \delta_4 D_{i,t} + \Phi M + \eta_i + v_t + \varepsilon_{i,t} \qquad (4)$$

where $C_{i,t}$ is the child mortality rate in country i in year t; $C_{i,t-1}$ is one-period lagged $C_{i,t}$, with α_0 capturing the persistence in $C_{i,t}$; $H_{i,t}$ stands for government health spending, in per cent of GDP; M is a vector of robust explanatory variables associated with child health; and the remaining variables are as defined previously.[15] Income is one of the crucial determinants of health status (Pritchett and Summers 1996). A number of studies also show that higher levels of female education are associated with better health status of children as well as the population in general (Filmer and Pritchett 1999; Cutler et al. 2006). Following Baldacci et al. (2008), we include the share of female students in primary and secondary schools as an indicator for gender equality, which takes account of the institutional factors that may have significant bearing on child health through female education.[16] There is ample evidence that health status is affected by access to safe water and improved sanitation facilities (Mishra and Newhouse 2009; Rajkumar and Swaroop 2008); the degree of urbanization (Schultz 1993), and fertility rates (Baldacci et al. 2008; Mishra and Newhouse 2009).

[14] Moreover, when the initial IHDI is higher, specifying IHDI in logs would allow a given change in social spending to have a larger effect on IHDI.

[15] $C_{i,t}$ and $H_{i,t}$ are log-transformed, as is common in the literature. However, all regression results are fairly robust to specifying these variables in levels instead of logs.

[16] Although gender equality for the population as a whole would be a more plausible measure, such data is not available. Moreover, data limitation precluded the use of female adult literacy rate as a proxy for female education (with about 90 per cent of the data missing).

Note that the availability of data on the aforementioned variables differs considerably (see Tables B and C in Appendix A). Whereas data on the macroeconomic variables, such as GDP per capita, inflation, and trade openness, and the indicators of aggregate welfare are available for almost all countries and time periods, data on social spending and other variables are relatively limited. Hence, the sample size differs across specifications, depending on the control variables included and the instrumental variables used.

4.2 Econometric methods

As a first approximation, we estimate Equations (3) and (4) using ordinary least squares (OLS). However, this presumes, *inter alia*, that social spending is exogenously determined, which cannot reasonably be expected, given that both social spending and the outcome variables ($W_{i,t}$ and $C_{i,t}$) may be affected by the same unobserved factors and the possibility of reverse causality. For instance, governments may increase their spending on the social sectors when faced with low levels of welfare and poor health outcomes. In order to address the endogeneity problem, we first instrument for social spending in a two-stage least squares (2SLS) and fixed-effects (FE) framework.[17] The presence of country fixed-effects, η_i, in Equations (3) and (4) suggests that the preferred approach is the FE model, which allows us to mitigate heterogeneity-induced bias and control for fixed-effects-related endogeneity. However, the FE model removes a considerable portion of the variation in the right-hand-side variables, which may exacerbate measurement error.

There is evidence suggesting that Instrumental Variables (IV) methods may suffer from finite sample biases and their use is mostly justified on asymptotic grounds (Baum et al. 2007). Limited Information Maximum Likelihood estimators (LIML) and the Continuously Updating Estimator (CUE) have been shown to have better finite sample performance than IV estimators, although they provide no gain in asymptotic efficiency. In particular, LIML and CUE tend to perform better than IV methods in the presence of weak instruments (Hahn et al. 2004). In light of the different properties of alternative estimators, we investigate the robustness of the empirical results using a range of econometric methods: 2SLS, FE, LIML, Fuller's modified LIML (henceforth Fuller), and CUE.

It is evident that the inclusion of lagged dependent variables in Equations (3) and (4) would render FE estimates inconsistent because they would be correlated with the transformed errors, even if they are uncorrelated with $\varepsilon_{i,t}$. 2SLS estimations are also likely to suffer from dynamic panel bias because η_i is correlated with the lagged dependent variables. For this reason, we first disregard the lagged dependent variables and estimate

[17] Statistical tests (not shown here) indicate that the random-effects model should be rejected in favour of the fixed-effects specification (Hausman test, p-value = 0.00). Hence, we report only fixed-effects estimates.

the models using 2SLS and FE, the robustness of which will be tested using dynamic panel data estimators. Although the 2SLS estimator does not allow for country fixed-effects, η_i, we capture some of the influence of omitted spatially-correlated fixed effects, such as those emanating from geography and natural endowments, using regional dummy variables for SSA, Asia, and Latin America and the Caribbean (LAC).

Notwithstanding that finding reliable instruments is a daunting challenge, we use a purportedly robust instrumental variable that is commonplace in the literature, i.e. the lag values of public spending. Note however that the economic motivation behind the use of lagged values as instruments is somewhat questionable because it is tantamount to claiming that contemporaneous social spending affects aggregate welfare but lagged spending does not. For that reason, we use several instruments to identify the causal effect of social spending. In the 2SLS and FE specifications, we use 'external' instruments to control for endogeneity, the robustness of which we test using a number of 'internal' instruments -lags of the instrumented variables- in a dynamic panel specification framework.

Following Easterly and Rebelo (1993) and Tanzi (1992), we use the logarithm of population and the share of agriculture in GDP as external instruments. Easterly and Rebelo (1993) find that the scale of the economy (measured by its population) is an important determinant of fiscal policy in general and the level of public spending in particular. They provide evidence in favour of strong scale effects: countries with higher population have lower public spending. High population countries tend to spend less, yet there is no reason to suspect that a country can have higher or lower level of welfare simply because it has more or less people. In our sample, the log of population is highly correlated with the share of social spending in GDP (a correlation coefficient, $r = -0.52$).

Another factor that is found to influence the level of social spending is a country's economic structure, which is reflected in the share of agriculture in GDP. Tanzi (1992) argues that the more agricultural a country is, the more difficult it is to raise the tax level and thus to increase public spending.[18] This appears to be borne out by the data. Social spending and agriculture (both in per cent of GDP) are significantly negatively correlated ($r = -0.51$).

Furthermore, we use the ICRG index of ethnic tensions as an additional instrument, which has been used in earlier studies (see Dreher et al. 2008). Several studies indicate that ideological and ethnic divisions result in higher public spending by compounding the common pool problem, i.e. by inducing one section of society to neglect the tax burden falling on others (Von Hagen 2005; Alesina et al. 1999, 2003). We find a considerable correlation in our sample between social spending and the ethnic tensions index ($r =$

[18] Many studies find that it is difficult to impose heavy taxes on the agricultural sector, although the sector has often been subject to heavy implicit taxes (Ahmad and Stern 1991; Tanzi 1992). The reason is that agricultural activity is small scale and spatially spread, which is more so in developing countries (Tanzi 1992).

0.39). Whether the instruments discussed above are valid and strong is an empirical question that we test in Section 6.[19]

As a robustness check, we organize the data into three-year periods and estimate Equations (3) and (4) using dynamic panel data estimators.[20] The presence of lagged dependent variables and country fixed-effects, η_i, poses a challenge that necessitates the use of more sophisticated econometric methods. The Arellano and Bond (1991) first-differenced GMM (Dif-GMM) estimators circumvent the endogeneity problem by removing η_i using first-differencing or orthogonal deviations and then deploying suitably lagged values of the independent and dependent variables as instruments. Nonetheless, the Dif-GMM estimator suffers from large finite-sample biases and poor precision when the time series are persistent. In such cases, the lagged levels of the series are weakly correlated with the lagged first differences, thereby making the instruments for the first-differenced equations 'weak'. Building on Arellano and Bover (1995), the system GMM estimator (Sys-GMM) developed by Blundell and Bond (1998), works around the weak instrument problem. Sys-GMM solves a system of level and difference equations. Lagged differences of the endogenous variables are used as instruments in the level equations, while lagged levels of the endogenous variables are used as instruments in the first differenced equations.[21] Sys-GMM significantly improves the accuracy of estimates by exploiting additional moment conditions that are informative even for persistent data. Hence, we opt for the Sys-GMM estimator given that it addresses some of the finite-sample biases and imprecision inherent in the Dif-GMM.

However, the additional moment conditions of the Sys-GMM estimator do not come without a cost, and some restrictions on the initial conditions are required, which are not empirically testable and may be less innocuous. In particular, the instruments for the level equations are valid as long as they are orthogonal to the fixed effects. In addition, it has recently come to light that Sys-GMM may equally suffer from the weak instrument problem, particularly when the time series is large and substantial unobserved heterogeneity exists (Hayakawa 2006; Bun and Windmeijer 2010). In order to mitigate this problem and thereby check for the sensitivity of the results, we complement the internally generated set of instruments with the external instruments discussed earlier.

Another potential deficiency of the Sys-GMM (and the Dif-GMM) estimator is that the number of internal instruments grows quadratically as the number of time periods increases. Roodman (2009b) cautions that instrument proliferation can over-fit endogenous variables, biasing coefficient estimates and weakening the Hansen test of the instruments'

[19] An instrument is valid and strong if it affects the dependent variable only through the instrumented variable and is sufficiently correlated with the latter respectively.

[20] In the annual panel, the number of time series observations, T, is relatively 'large' compared to the number of countries, N. However, the GMM estimators are particularly designed for the panel data setting with fixed T and large N. As T increases they may even lose consistency (Anderson et al. 2010).

[21] See Roodman (2009a) and Blundell and Bond (1998) for a more detailed exposition of the Sys-GMM estimator.

joint validity. Therefore, we reduce the instrument count by 'collapsing' instruments and take period averages that considerably reduce the sample size.[22] All these caveats should be borne in mind when interpreting the Sys-GMM results and the alternative specifications presented in the following section.

5 Results[23]

Section 5.1 presents the results on the impact of government social spending on the IHDI, while Section 5.2 discusses the results on the nexus between government health spending and child mortality. Note that all regressions include time dummies and all t-statistics (reported in parentheses) are robust to arbitrary heteroskedasticity and autocorrelation. Besides, all 2SLS, LIML, Fuller, and CUE regressions include regional dummies for SSA, Asia, and LAC. Further, all Sys-GMM results are based on the two-step estimator, which allows for Windmeijer's (2005) finite sample correction.

5.1 Social spending and IHDI

The OLS, 2SLS, and FE regression results are reported in Table 1. Consider first the benchmark OLS estimation results in column 1. Most of the coefficients are statistically significant and have the expected sign. Social spending is positively associated with IHDI; however, this does not say anything about causality. In order to deal with the potential endogeneity of social spending, we next estimate Equation (3) using 2SLS and employing the log of population and the ethnic tensions index as instruments. Because potential multicollinearity problems may render the parameter estimates unstable, we first include few covariates (column 2) and then include additional institutional and macroeconomic indicators (column 3).

The Hansen test of over-identifying restrictions indicates that the validity of the instruments cannot be rejected. Under-identification tests (not reported) find that the null hypothesis of zero correlation between the instruments and social spending is strongly rejected (p-value: 0.00). The Kleibergen-Paap Wald F test of weak identification (which, like the standard F-statistic, tests for the strength of the partial correlation between the included endogenous variable and the excluded instruments but makes finite-sample corrections) comfortably exceeds conventional critical values. Further, the Stock-Wright LM S statistic, which is robust in the presence of weak instruments, confirms the existence of significant correlation between the excluded instruments and the dependent variable. These suggest that the instruments are sufficiently correlated with social spending but not significantly correlated with IHDI once the relevant explanatory variables are controlled

[22] Roodman (2009b) demonstrates that, in some common cases, collapsing instruments is superior to simply restricting the lag ranges.

[23] The 2SLS, LIML, Fuller-LIML, and CUE estimation results are obtained using the Stata (version 12) command *ivreg2* (Baum et al. 2007), the FE estimates using *xtivreg2* (Schaffer 2010), and the Sys-GMM results using the *xtabond2* routine (Roodman 2005).

Table 1: IHDI equation (2SLS and FE regressions)

Dependent variable	IHDI				
Regression	(1)	(2)	(3)	(4)	(5)
Method	OLS	2SLS	2SLS	FE	FE
Social spending	0.009	0.01	0.014	0.009	0.012
(% GDP) (*ln*)	(10.07)***	(3.67)***	(6.02)***	(2.32)**	(2.54)**
GDP per capita	0.029	0.034	0.026	0.018	0.017
(*ln*) ($t-1$)	(24.44)***	(15.02)***	(13.65)***	(4.97)***	(6.10)***
Openness	0.004	0.004	0.001	0.003	0.003
(*ln*)	(3.07)***	(1.72)*	(0.43)	(1.95)*	(1.99)**
Terms of trade	−0.011	−0.006	−0.012	−0.004	−0.005
(*ln*)	(4.94)***	(1.81)*	(3.76)***	(2.70)***	(2.73)***
Inflation	−0.002		−0.002		0.0002
	(2.22)**		(1.47)		(0.61)
Bureau. quality	0.001		0.003		0.002
	(1.50)		(1.70)*		(2.78)***
Democracy	0.001		0.001		−0.0002
	(4.12)***		(2.66)***		(1.34)
Age dependency	−0.035		−0.033		−0.016
(*ln*)	(6.92)***		(4.29)***		(1.91)*
Number of countries	51	51	51	40	38
Observations	504	529	504	442	417
R-squared	0.92	0.90	0.91	0.90	0.90
Kleibergen-Paap F st.		33.60	42.17	13.18	9.82
Stock-Wright LM st.		9.09	18.80	4.64	6.13
(p-value)		0.01	0.00	0.098	0.05
Hansen test[a]		0.22	0.77	0.68	0.69

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Notes: Columns 2 and 3 instrument for social spending using log population and the ethnic tensions index; columns 4 and 5 use the ethnic tensions index and central government (CG) budget deficit (% of GDP), as instruments. Resource allocation to the social sectors is likely to be influenced by the fiscal stance of the CG (proxied by budget deficit). The assumption that budget deficit affects IHDI only via social expenditure should be supported by empirical tests, which we provide in this table.

Source: Authors' analysis based on data described in Appendix A.

for, which confirms the validity of our specifications.[24]

The estimated coefficient on social spending is positive and significant. It indicates that a 1 per cent increase in government spending on the social sectors, in per cent of GDP, increases IHDI by 0.014 points (column 3). Similarly, a 1 per cent increase in lagged per capita income is associated with an increase in IHDI in the order of 0.026 points, which is consistent with previous studies finding that higher levels of income are associated with improved welfare (or lower poverty) (Gomanee et al. 2005b; Gomanee et al. 2005a; Mosley et al. 2004; Alvi and Senbeta 2012). Our estimates also show that IHDI is higher in countries with stronger democratic institutions and better bureaucratic

[24]As an additional crude way of checking whether the instruments pass the exclusion restriction, we simply included them in the second stage regression and found that they are consistently insignificant.

Table 2: IHDI equation (Sys-GMM regressions)

Dependent variable	IHDI		
	(1)	(2)	(3)
Lagged IHDI	0.96	0.93	0.93
	(30.75)***	(35.83)***	(18.86)***
Social spending	0.003	0.004	0.005
(% GDP) (*ln*)	(2.03)**	(2.33)**	(1.88)*
GDP per capita	0.002	0.002	0.002
(*ln*)	(1.83)*	(2.63)***	(1.84)*
Openness	0.001	0.005	0.005
(*ln*)	(0.38)	(2.14)**	(2.14)**
Terms of trade	−0.005	−0.005	−0.005
(*ln*)	(1.58)	(1.77)*	(1.79)*
Inflation		−0.001	−0.0003
		(1.18)	(0.27)
Bureaucratic quality		0.001	0.001
		(0.63)	(0.48)
Democracy		0.00004	−0.000
		(0.30)	(0.01)
Number of countries	43	42	42
Observations	182	175	175
Number of instruments	30	33	30
Hansen test[a]	0.60	0.68	0.53
Diff-in-Hansen test[a]	0.66	0.94	0.86
Autocorr. (second order)[a]	0.01	0.03	0.03
Autocorr. (third order)[a]	0.48	0.80	0.56

[a] *p*-values Significance level: *10%; **5%; ***1%

Notes: All regressions except column 3 use both internal (third and longer lags of IHDI, social spending, GDP per capita, and openness) as well as external (log population, agriculture (% of GDP), and the ethnic tensions index) instruments; column 3 uses only the aforementioned internal instruments.

Source: Authors' analysis based on data described in Appendix A.

quality. Moreover, a decline in the terms of trade and age dependency ratio are linked with an increase in IHDI.

Note, however, that the 2SLS regressions do not allow for country fixed-effects, which may have a significant bearing on the empirical results. Columns 4 and 5 of Table 1 are the FE counterparts of columns 2 and 3 respectively. The Hansen test cannot be rejected at conventional levels of significance, suggesting that there are no signs that the instruments are endogenous. Moreover, the Stock-Wright S statistic rejects (at the 5 per cent level) its null hypothesis, indicating that the endogenous regressors are relevant. However, the Kleibergen-Paap F-statistic in column 5 is slightly below the rule of thumb threshold of 10 proposed by Staiger and Stock (1997). The FE results reveal that increasing social spending by 1 per cent would increase IHDI by 0.012 points, which is consistent with the 2SLS estimate. Other policy- and institutions-related variables also affect IHDI.

IHDI is positively associated with trade openness and bureaucratic quality, whereas it is negatively correlated with the terms of trade. The FE estimates are by and large similar to the 2SLS estimates, which may suggest the regional dummies in the 2SLS regressions capture most of the country-specific effects.

We now turn to the Sys-GMM results, which are reported in columns 1 through 3 of Table 2.[25] Identification is based on a set of 'internal' as well as 'external' instruments.[26] The validity of the instruments and moment conditions was tested using the Hansen test of over-identifying restrictions and the Arellano-Bond test for autocorrelation.[27] The test results show that the null of no second-order autocorrelation is rejected, which precludes the use of second lags of the endogenous variables as instruments. Hence, we restricted the instrument set to lags 3 and longer of the variables. Table 2 shows that all specifications pass the Hansen test, suggesting that the instrument set is valid. The test for the null of no third-order autocorrelation cannot be rejected either.[28] Further, we performed a difference-in-Hansen test for the exogeneity of the subset of additional instruments in the Sys-GMM and found that the specifications cannot be rejected.

The Sys-GMM estimates show a substantial degree of inertia in aggregate welfare. The lag of the IHDI is highly significant and has considerable explanatory power, rendering some of the covariates included in the regression insignificant. The coefficient on social spending is positive and significant at the 1 per cent level. The estimates imply that a 1 per cent increase in social spending, in per cent of GDP, increases the IHDI by 0.004 points, which is somewhat lower than those indicated by the 2SLS and FE regressions. Given the inclusion of the lagged dependent variable, it is also possible to calculate the long-run effect of social spending on the IHDI. The estimates in the preferred GMM specification (column 2 of Table 2), and coefficients of 0.004 for social spending and 0.93 for lagged social spending suggest that the long-run effect of a 1 per cent increase in social spending is to increase the IHDI by about 0.057 points. The coefficient on GDP per capita suggests that a 1 per cent increase in per capita income would increase IHDI by 0.002 points.

Modelling the persistence of IHDI and accounting for the endogeneity of per capita income appear to have resulted in a smaller coefficient on the latter, albeit still highly significant. Turning to the coefficients on the other explanatory variables, trade openness and the terms of trade are positively and negatively associated with the IHDI respectively,

[25] To preserve degrees of freedom, the Sys-GMM regressions exclude age dependency ratio from the regressions. The results when this variable is included can be provided upon request from the authors.

[26] For more details, see the notes at the bottom of Table 2.

[27] We opt for the instrument set in collapsed form for a couple of interrelated reasons. First, the number of instruments is sizably lower when the instruments are collapsed than when the lag ranges are limited. Second, in some common cases, collapsing instruments is superior to restricting lag ranges (Roodman, 2009b).

[28] Note that we report only the test results for the nulls of no second- and third-order serial correlations. The null of no autocorrelation of higher orders is not rejected either.

Table 3: Child mortality equation (2SLS and FE regressions)

Dependent variable: ln(child mortality rate)					
Regression	(1)	(2)	(3)	(4)	(5)
Method	OLS	2SLS	2SLS	FE	FE
Health spending	−0.136	−0.156	−0.181	−0.076	−0.087
(% GDP) (ln)	(9.73)***	(4.77)***	(5.45)***	(2.19)**	(2.56)**
GDP per capita	−0.241	−0.68	−0.215	−0.35	−0.19
(ln)	(5.63)***	(22.79)***	(3.10)***	(4.81)***	(2.87)***
Female education	0.003		0.005		−0.011
(ln)	(0.36)		(0.50)		(1.78)*
Access to sanitation	−0.012		−0.012		−0.002
	(9.53)***		(6.25)***		(0.57)
Access to safe water	0.005		0.004		−0.004
	(3.09)***		(1.95)*		(1.29)
Degree of urbanization	−0.0005		−0.001		−0.009
	(0.37)		(0.65)		(1.88)*
Fertility rate	0.204		0.224		−0.027
($t-1$)	(8.46)***		(5.64)***		(0.74)
Bureaucratic quality	−0.024		−0.024		−0.025
	(1.27)		(0.89)		(1.27)
Democracy	−0.009		−0.005		0.007
	(2.60)***		(0.89)		(2.60)***
Number of countries	55	55	55	55	44
Observations	537	819	533	643	425
R-squared	0.86	0.78	0.86	0.85	0.91
Kleibergen-Paap F st.		134.36	73.92	21.49	20.1
Stock-Wright LM st.		18.69	19.99	5.89	7.73
(p-value)		0.00	0.00	0.05	0.02
Hansen test (p-value)		0.82	0.85	0.51	0.97

Significance level: *10%; **5%; ***1%

Notes: The 2SLS regressions use log population and agriculture (% GDP) as instruments for health spending; the FE regressions use the second lag of health spending and the military spending of neighbouring countries (% of CG expenditure). Although one may suspect lagged spending to be endogenous, empirical tests do not reject the validity of the instruments.

Source: Authors' analysis based on data described in Appendix A.

although the latter is significant only at the 10 per cent level. To check the robustness of the results to alterations in the instrument set, we rerun the regression in column 2 using only internal instruments. Column 3 unveils that the coefficient on social spending remains unaffected, although its significance slightly declined.

To summarize, the results strongly indicate that social spending has a positive and significant impact on aggregate welfare, measured by the IHDI. The impact size from the Sys-GMM equations is modest, albeit not negligible. Given that there are no previous studies on the effect of social spending on IHDI, it is difficult to place these results in context. Gomanee et al. (2005b) is, to the best of our knowledge, the only study that is relatively comparable to ours. The finding that social spending has a significantly positive impact on aggregate welfare is at variance with Gomanee et al. (2005b), who report an insignificant impact of social spending on HDI. Based on endogeneity concerns, we believe that our results are plausible and stronger.

5.2 Health spending and child mortality

We now turn to the results for child mortality, which are reported in Tables 3 and 4.[29] Column 1 of Table 3 shows the baseline OLS estimates. Most of the coefficients are statistically significant and have the expected sign. The 2SLS results, which are based on regressions that instrument for health spending using the log of population and the share of agriculture in GDP, are shown in columns 2 and 3. The models pass the specification tests and the explanatory variables account for a considerable portion of the variation in child mortality rates. The estimated coefficients in column 3 reveal that health spending and per capita income are important factors explaining the cross-country differentials in child mortality rates. A 1 per cent increase in health spending, in per cent of GDP, reduces child mortality rate by around 0.18 per cent. The coefficient on per capita income is consistent with the robust finding in the literature that income explains a good portion of the variation in child mortality rates across countries and over time (Pritchett and Summers 1996; Filmer and Pritchett 1999; Baldacci et al. 2008; Rajkumar and Swaroop 2008).

Among the other variables, access to improved sanitation is negatively associated with child mortality rate. What is more, access to safe water is positively associated with child mortality, which appears counterintuitive, albeit significant only at the 10 per cent level. However, closer scrutiny reveals the presence of a strong collinearity between access to safe water and access to improved sanitation. Both variables are negatively associated with child mortality rate when they enter the regressions individually, which suggests that multicollinearity problems are biasing the coefficients on these variables. However, the coefficient on health spending remained stable regardless of whether these variables are allowed to enter the regressions individually or jointly. The positive coefficient on lagged fertility suggests that a decline in fertility rates has a positive impact on child survival rates, which is consistent with Baldacci et al. (2008) and other studies examining the fertility-child mortality nexus during demographic transitions (Galor andWeil 2000; Greenwood and Seshadri 2002, and Rosenzweig and Schultz 1983). Note that the magnitude of the coefficients in columns 2 and 3 show that the parameter estimates for some of the variables are relatively unstable, perhaps mainly due to the presence of multicollinearity problems.[30] It should also be pointed out that unaccounted-for country-specific effects may be biasing the 2SLS results. Therefore, the 2SLS results should be interpreted cautiously. We thus turn to the FE results in columns 4 and 5.[31]

[29] The sample size in the child mortality regressions is slightly larger than that in the IHDI regressions because data on child mortality rate are available for all countries in the sample.

[30] Note, however, that the sample sizes in columns 2 and 3 differ.

[31] The instruments employed in the 2SLS regressions turned out to be weak in the FE specifications and

Table 4: Child mortality equation (Sys-GMM regressions)

Dependent variable	ln(Child mortality)		
	(1)	(2)	(3)
Lagged child mortality (ln)	0.93 (34.69)***	0.93 (14.92)***	0.95 (12.00)***
Initial child mortality (ln)			
Health spending (% GDP) (ln)	−0.052 (1.96)**	−0.06 (3.15)***	−0.065 (2.42)**
GDP per capita (ln)	−0.025 (3.04)***	−0.028 (2.52)**	−0.054 (1.52)
Female education (ln)		−0.002 (0.51)	−0.006 (0.91)
Access to sanitation		−0.001 (0.11)	−0.0004 (0.17)
Access to safe water		0.001 (0.35)	0.001 (0.46)
Degree of urbanization		−0.0001 (0.20)	0.0001 (0.10)
Fertility rate ($t-1$)		0.015 (0.84)	0.0001 (0.00)
Bureaucratic quality		0.003 (0.18)	0.009 (0.31)
Democracy		0.002 (0.82)	0.001 (0.20)
Number of countries	51	44	44
Observations	242	193	195
Number of instruments	26	33	31
Hansen test[a]	0.51	0.29	0.24
Difference-in-Hansen test[a]	0.27	0.15	0.20
Autocorrelation (second order)[a]	0.21	0.82	0.77
Autocorrelation (third order)[a]	0.21	0.13	0.15

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Notes: All except column (3) use internal (second and longer lags of child mortality, health spending, and GDP per capita) and external (log population and agriculture (% GDP)) instruments; column 3 uses only the aforementioned internal instruments.

Source: Authors' analysis based on data described in Appendix A.

The specification tests indicate that the FE models are by and large well specified. Consistent with the 2SLS results, health spending and per capita income are statistically significant and have the expected sign. The coefficients indicate that a 1 per cent increase in health spending results in a decline in child mortality rate of about 0.09 per cent. The same increase in per capita income is associated with an approximately 0.19 per cent reduction in child mortality rate, *ceteris paribus*. Turning to the other explanatory variables, female education and the degree of urbanization are inversely related to child mortality rates, which are in concordance with our expectations. The negative coefficient on female education suggests that mother's schooling reduces the incidence of child mortality, which is consistent with, among many others, Filmer and Pritchett (1999), Rajkumar and Swaroop (2008), and Baldacci et al. (2008). The negative coefficient on the degree of urbanization is in line with Schultz (1993), who finds that child mortality rates are higher for rural, low-income, and agricultural households.

Given that the 2SLS and FE results are not based on dynamic specification and that they may be driven by short-term fluctuations, we test their robustness using dynamic panel data estimators and the period-averaged data. Columns 1 to 3 of Table 4 report the Sys-GMM results. Column 2 uses both internal and external instruments, while column 3 employs only internal instruments.[32] In all specifications, the null hypotheses that the instruments are valid and that there is no serial correlation of order two and higher are not rejected at conventional critical values.

The Sys-GMM estimates for health spending and per capita income are qualitatively similar to those from the 2SLS and FE regressions. The coefficient on the lagged dependent variable indicates that child mortality rate is highly persistent and has considerable explanatory power, rendering most of the other covariates insignificant. Column 2 shows that health spending and per capita income have significant negative impact on child mortality rate. The estimates imply that increasing health spending, in per cent of GDP, and per capita income by 1 per cent would reduce child mortality rate by approximately 0.06 per cent and 0.03 per cent respectively. Given the inclusion of the lagged dependent variable, it is also possible to calculate the long-run effect of health spending on child mortality. The estimates in the preferred GMM specification in column 2 of Table 4–the coefficients of 0.06 for health spending and 0.93 for lagged health spending–suggest that the long-term effect of a 1 per cent increase in health spending, as a percentage of GDP, lowers the child mortality rates by about 0.86 per cent. Column 3 shows that these results are fairly robust to using only internal instruments, although income per capita loses its

thus we follow Filmer and Pritchett (1999) and Bokhari et al. (2007) and use the military expenditures, in per cent of total CG expenditures, of neighbouring countries as an additional instrument for health spending. Government health spending is a function of own military budget and the latter is supposedly a function of the military budget of neighbouring countries. Hence, in the reduced form, health spending is a function of neighboring countries' military spending while it is highly unlikely that the latter is correlated with IHDI.

[32]For more details, see the notes at the bottom of Table 4.

significance. All in all, the Sys-GMM results support the proposition that government health spending and income per capita are important contributing factors in reducing the incidence of child mortality in developing and transition economies.

6 Robustness checks

In this section, we run several robustness checks to test the validity of our results. Sections 6.1 and 6.2 rerun equations (3) and (4) using alternative samples and estimators respectively. In Section 6.3, social spending is measured in per capita terms instead of in per cent of GDP, while in Section 6.4 aggregate welfare is proxied with HDI instead of IHDI. Section 6.4 employs alternative specifications, Section 6.5 expands the set of control variables, whereas Section 6.6 looks at the effects of the different components of social spending. Finally, Section 6.7 tests whether the efficacy of social spending hinges on democratic governance. Tables 5-19 (Appendix B) report the results.

6.1 Alternative samples

Five of the countries in our dataset (Argentina, Chile, Latvia, Lithuania, and Uruguay) are upper middle income and transition economies (UMICs) with high IHDI and very low child mortality rates, and their inclusion may imply a downward bias for the effectiveness of social spending. Hence, to ensure that these countries are not skewing the results, we rerun equations (3) and (4) using a restricted sample that excludes them. As shown in columns 1 through 3 of Tables 5 and 6, the previous result that government social (and health) spending has significant positive impact on IHDI (and negative impact on child mortality in the case of health spending) remains intact when these supposedly 'outlying' countries are omitted.

Moreover, we test the sensitivity of our results by only including middle income countries (MICs), which constitute about two-thirds of the sample. Columns 4 through 6 of Tables 5 and 6 report the IHDI and child mortality regression results for the MICs subsample. We find no considerable difference in the effect of social spending when the sample is restricted to this set of countries.

As discussed in Section 3, for some of the sample countries, the social spending data were reported partly in cash and partly in accrual. In order to extend the cash-based data, we use the growth rates of the accrual data. To ensure that these countries are not systematically influencing the results, we reestimate the baseline models by confining the analysis to include only the countries for which we have complete cash data. In addition, as we inputted missing observations of government spending for countries with data gaps, we check for the sensitivity of the results by excluding these countries from the estimates. The results in Columns 4 to 6 of Tables 7 and 8 confirm the robustness of our results. Furthermore, we follow Seiferling (2013) and include a dummy variable to account for any systematic differences between the cash and accrual data. The estimates show no discernible difference between the two estimates.[33] In sum, the results for the full sample as well as for the subsamples hold, although splitting the sample considerably reduces the sample size at the cost of having 'weak' instruments in some regressions, and in some others, relatively small p-values of the Hansen test. Therefore, caution should be taken when interpreting the regression results for the subsamples of developing countries.

6.2 Alternative estimators

To check whether the results hold across different estimators, we rerun equations (3) and (4) using alternative estimation methods. More specifically, we compute LIML, Fuller-LIML, and CUE estimators (see Section 4.2). Columns 5-7 of Tables 9 and 10 show that the results are robust and consistent irrespectively to the use of different estimators.

6.3 Redefining social spending and aggregate welfare

In the analysis presented above, social spending is defined relative to a country's GDP, which provides a reasonable measure of government social spending relative to a country's available resources. Per capita social spending is an alternative measure, which is more appropriate in assessing the efficacy of social sector spending with respect to the MDGs. As a robustness check, we rerun equations (3) and (4) using social spending per capita instead of social spending as per centage of GDP. Columns 1 to 4 of Tables 9 and 10 show the results for IHDI and child mortality respectively. We find that the 2SLS, FE, and Sys-GMM results are broadly consistent with our previous results.

So far, our focus has been on the nexus between social spending and the *inequality-adjusted* HDI. Table 11 (columns 1 through 4) shows the results when IHDI is replaced with the *conventional* HDI in the 2SLS, FE, and Sys-GMM specifications. Using HDI leads to qualitatively similar results, although social spending has now a larger impact. This seems to suggest that the prevailing inequalities in the various dimensions of the HDI limits the ability of governments to promote human development through increased spending in the social sectors. However, the issue of inequality is not a trivial one and requires further analysis, which is beyond the scope of this paper.

6.4 Alternative specifications

An alternative way to assess the effectiveness of social spending is to investigate its impact on the rates of change in IHDI and child mortality instead of looking at the variation in these variables. The rates of change in aggregate welfare capture the longer-term effects of social spending, and better reflect a country's progress towards sustainable development. Thus, we run the Sys-GMM estimators using the growth rates of IHDI and child mortal-

[33] Results not reported but available on request.

ity as dependent variables.[34] The results are presented in columns 4 and 5 of Table 19. Consistent with our previous result, social spending has a significantly positive impact on IHDI growth. The coefficient on the initial level of IHDI is negative and significant, suggesting a convergence effect: countries with low achievements in human development experience higher increases in IHDI as a result of an additional unit of government expenditure in the social sectors, *ceteris paribus*. The results for child mortality are also in line with our previous findings.

Columns 1 to 3 of Table 19 present the results when IHDI is expressed in logarithms. The estimated coefficients show that the main results are robust, irrespectively to whether the outcome variables are expressed in logarithmic or lineal scales.

6.5 Additional control variables

To ensure that omitted variables are not biasing the results, we expand the set of control variables to include in the IHDI model (equation 3), the following additional controls: aid flows, in per cent of GNI[35]; Gini coefficient, measuring income inequality; the share of domestic credit to private sector in GDP; and corruption index. In the child mortality model (equation 4), the set of additional control variables include: aid in per cent of GNI, the percentage of population aged under 5, the prevalence of undernutrition, ethnolinguistic fractionalization, and the percentage of the population that is Muslim.[36]

Tables 12 to 15 present the results when these controls are included to the baseline regressions. Overall, the 2SLS, FE, and Sys-GMM results remain unaffected.[37] Only some of the additional controls are significant at conventional levels. The finding that aid has an insignificant effect on IHDI does not come as much of a surprise. Most of the countries in the sample are middle-income and receive far less official development assistance than low-income countries.

Turning to the child mortality regressions, the inclusion of additional controls leaves the main results broadly unaffected.[38] Aid (lagged one-period) has a desirable significant negative effect on child mortality rate in the FE specification.[39] Moreover, the positive coefficients on ethnolinguistic fractionalization and 'predominantly muslim' are consistent

[34] We focus on the GMM specifications, which use the three-year averaged data, because of the limited variation in the annual data.

[35] We include aid lagged one-period to minimize endogeneity problems.

[36] We allow these variables to enter the regressions individually because of the limited overlap between them, which would have led to a considerable loss of degrees of freedom.

[37] Including the Gini coefficient reduces the sample size substantially, which may explain the decline in the significance of social spending in some of the regressions and the decline in instrument strength in some others.

[38] In the FE regression that includes aid, the instruments in our baseline regression are unreliable and thus we use lagged health spending and military spending, in per cent of central government expenditure, as instruments.

[39] In contrast, aid has a positive and significant (at the 10 per cent level) coefficient in the 2SLS regression. However, the FE result seems plausible given that the 2SLS regression does not control for country fixed-effects.

with, inter alia, Filmer and Pritchett (1999) and Rajkumar and Swaroop (2008), who show that child mortality rates are higher in countries with a predominantly Muslim population, and with higher ethnolinguistic diversity. Note, however, that some of these results should be interpreted with caution as the instruments appear 'weak' in some of the regressions.

6.6 Disaggregating social spending

So far, we have focused on the effectiveness of government social spending, which aggregates expenditures on health, education, and social protection. In this subsection, we investigate the potential differential effects of the different components of social spending on aggregate welfare. Table 18 reports the Sys-GMM results. We find that health spending has a significantly positive impact on IHDI, whereas the coefficients on education and social protection expenditures appear insignificant at conventional levels. This result is robust to changes in the set of instruments. Our findings support the evidence reported in Hanushek (1995), Mingat and Tan (1998), and Wolf (2004) that the correlation between education spending and welfare outcomes is weak. These results should be taken with caution though, especially when considering the small sample at our disposal, and the number of instruments that becomes large when social spending is disaggregated.

6.7 Social spending, aggregate welfare and democracy

We now consider the possibility that the efficacy of social spending might be influenced by democratic governance. A strand of the literature contends that governments are more inclined to allocate public funds to the social sectors when democratic institutions provide an institutionalized check on their actions (Svensson 1999). Boone (1996) , for instance, argues that liberal democracies perform better in human development achievements than repressive regimes. The underlying proposition here implies that with more political freedoms and better channels to expressed voice, redistributive struggles between political and socioeconomic groups may lead to more effective allocation of resources. Thus, other things being equal, it would be plausible to expect that social spending is more effective in countries with stronger democratic institutions. This however, may entirely depend on who wins and who loses from redistributive social policy reforms (Gelbach and Pritchett 1995).

We explore this question by including interaction terms to the specifications derived in equations (3) and (4). More specifically, Tables 16 and 17 present the interaction terms $spending \times democracy$ and $health\ spending \times democracy$, which are included in the baseline IHDI and child mortality regressions, respectively.[40] Our approach is similar to that of Burnside and Dollar (2000), who employ interaction terms to answer the question of whether aid has a stronger impact on growth in countries with better policies.

[40] In line with most previous studies, we treat democracy as an exogenous variable.

In the IHDI model, the interaction term enters the 2SLS and Sys-GMM regressions with insignificant statistical power, whereas it becomes negative and significant in the FE specification. In all specifications, social spending has a significantly positive effect on the IHDI. In the child mortality model, health spending has a consistently negative effect on child mortality rate, while the corresponding interaction term is significant in some of the regressions. To ensure that these results are not artifact of the Polity democracy index, we rerun the regressions using the ICRG index on democratic accountability, which measures how responsive a government is to its people. We find similar results to the ones reported in Tables 16 and 17.[41] Overall, the results show that there is no strong evidence to suggest that democratic institutions are *sine qua non* for the effective allocation of social spending to improve aggregate welfare.

Our findings support previous studies that point out that government spending on the social sectors can improve the stardard of living even in countries with less-advanced democratic institutions (Ames 1987; Alesina and Rodrik 1994). Note, however, that a more thorough examination is necessary on this matter before attempting to arrive to any far-reaching conclusion.

7 Conclusions

There has been a widespread attention to the promotion of human development through public interventions and actions, and yet the preponderant evidence of a sizable cause-effect relationship between government social spending and aggregate welfare remains inconclusive. Against this backdrop, we investigated the impact of government spending on the social sectors (health, education, and social protection) on two indicators of aggregate welfare: the *Inequality-adjusted* Human Development Index (IHDI) and child mortality rates.

Our study provides strong evidence to support the proposition that social spending is a strong predictor of improved aggregate welfare. The preferred System GMM specification indicates that a 1 per cent increase in social spending, in per cent of GDP, increases IHDI by 0.004 points, which is modest, albeit not negligible. The implied long-run effect of a 1 per cent increase in social spending is an increase in the IHDI of about 0.057 points.

The results are fairly robust to the method of estimation, the use of alternative instruments to control for the endogeneity of social spending, the set of control variables included in the estimations, and the use of alternative samples.

Our findings stand in contrast with the results reported in Flug et al. (1998); Filmer and Pritchett (1999); Filmer et al. (2000); and Dreher et al. (2008) who argue that per capita income accounts for most of the cross-country variation in aggregate welfare, with public spending being a poor predictor.

We also find evidence that health spending is more effective in fostering human devel-

[41] Not reported but available on request.

opment than education or social protection spending. It is unclear whether this is due to data limitations or the intrinsic nature, in terms of scope and scale, of the components of government expenditure. This is a question that demands further attention in future research.

Finally, we found no evidence to suggest that the efficacy of social spending relies on democratic governance. Our results are in line with those of Ames (1987) and Alesina and Rodrik (1994) who point out that even autocratic regimes eventually need to respond to the demands of socioeconomic groups to avoid social unrest, the disruption of markets and eventually being overthrown. The recent developments in Northern Africa may be illustrative in that respect. So whereas democratic freedoms and the opportunity for people to control their leaders are valid aspirations, there seems to be no apparent reason why social sector policy could not improve aggregate welfare even in contexts of less-advanced democratic institutions.

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Appendix A

Table A Data description and source

Variable	Description and source
GDP per capita	Gross Domestic Product (GDP) per capita, PPP (constant 2005 international dollar). Source: World Development Indicators (WDI)
Child mortality rate	The number of new born babies out of 1000 that die before reaching the age of 5, if subject to current age-specific mortality rates. Source: WDI
Social spending	Central government (CG) spending (current and capital) on health, education, and social protection. Source: GFS database (2011 edition)
Openness	Sum of exports and imports of goods and services (% GDP). Source: WDI
Terms of trade	The ratio of export price to import price index. Source: WDI
Inflation	Log of one plus the inflation rate. Source: WDI
Age dependency ratio	The ratio of dependents (people younger than 15 or older than 64) to working age population (those aged 15-64). Source: WDI
Bureaucratic quality	Assesses how much strength and expertise bureaucrats have to govern without drastic alterations in policy or interruptions in government services. Scale is from 0 to 4. Source: ICRG.
Corruption	Index measuring corruption in government, based on the subjective evaluations of experts. Scale is from 0 to 6. Source: ICRG
Democracy index	Comprises two components: democracy (Dc) and autocracy (Ac), ranging from 0 to 10, where 10 corresponds to full democracy and full autocracy respectively. The index is computed by subtracting Ac from Dc and is thus measured on a -10 to 10 scale. Source: Marshall et al. (2013).
Aid	Net Official Development Assistance (% GNI). Source: WDI
Gini	Gini coefficient. Source: UNU-WIDER (2013)
Finance	Domestic credit to private sector (% GDP). Source: WDI
Female education	Share of female students in primary and secondary schools. Source: WDI
Degree of urban ization	Percentage of population living in areas defined as urban by each country. Source: WDI
Sanitation	Access to improved sanitation facilities (% population) Source: WDI
Safe water	Access to improved drinking water source (% population) Source: WDI
Fertility rate	Number of births per woman. Source: WDI
Democratic acc ountability	This index ranges from 1 to 6 and measures how responsive government is to its people. Source: ICRG
Population	Total population. Source: WDI
Under-5 population	Percentage of population aged under 5. UN Population Division (2013).
Muslim	Percentage of population that is Muslim. Source: La Porta et al. (1999)
Undernutrition	Prevalence of undernourishment (% population). Source: WDI
Ethnolinguistic fractionalization	The probability that two randomly selected individuals from a popula tion do not belong to the same ethnolinguistic group. Source: Alesina et al. (2003)
Ethnic tensions	The degree of tension within a country stemming from differences in race, nationality, or language: the higher the tension, the lower the rating. Scale is from 1 to 6. Source: ICRG
Agriculture	Agriculture, value added (% GDP). Source: WDI
Military spending	Military expenditures (% total CG spending) Source: WDI
Budget deficit	CG budget deficit (% GDP). Source WDI (2013) and GFS (2011)

Table B. Summary statistics

Variable	Obs.	Mean	Std. dev.	Min	Max
Panel A: IHDI specification					
GDP per capita (2005 PPP)	1017	5360.51	3923.98	433.76	21190.58
Social spending (% of GDP)	785	9.29	6.20	0.14	46.01
HDI	982	0.595	0.133	0.259	0.813
IHDI	962	0.199	0.044	0.086	0.271
Terms of trade	846	104.8	24.3	50.93	251.85
Openness	1007	76.04	39.95	0.31	223.06
Gini coefficient	512	42.43	9.08	20.5	65.77
Inflation	952	28.93	190.75	-17.63	4734.92
Age dependency ratio	1020	67.14	17.83	38.95	120.82
Bureaucratic quality	840	1.89	0.75	0	3.5
Democracy	972	3.95	5.58	-9	10
Panel B: Child mortality specification					
GDP per capita (2005 PPP)	1097	5382.322	3874.504	433.76	21190.58
Health spending (% of GDP)	830	1.88	1.78	0.03	20.82
Child mortality rate	1100	51.49	41.98	6.6	204
Degree of urbanization	1100	49.39	21.82	6.27	92.35
Female education	931	49.4	21.82	30.49	53.97
Fertility rate	1094	47.79	3.17	1.09	8.67
Access to sanitation	1059	68.04	26.39	2.3	100
Access to safe water	1078	83.15	17.43	13.6	100

Source: Authors

Table C. Countries with data partly in cash and partly in accrual, and data gaps

Country	Years available		Data gaps	Country	Years available		Data gaps
	Cash	Accrual			Cash	Accrual	
Algeria	2000-2005	2006-09	None	Indonesia	1990-2004	None	2000
Argentina	1990-2001	2002-04	None	Lebanon	1993-99	2000-09	None
Bolivia	1990-2001	2002-07	None	Lithuania	1999-2000	2001-09	None
Chile	1990-2002	2003-09	None	Madagascar	1990-97	2001-09	1998-2001
Costa Rica	1990-2007	None	1992-93; 2004	Malaysia	1990-2009	None	1996-2001
Domincan Republic	1990-2003	None	2001	Mongolia	1992-2002	None	1999
El Salvador	1990-2001	2002-09	None	Morocco	1990-99	None	1996
Ethiopia	1990-2005	None	2000	Romania	1990-2001	2002-07	None
Fiji	1990-1996; 2004-2006	None	1997-2003	Thailand	1990-2004	2005-09	None
				Zambia	1990-2007	None	2000

Panel B. List of countries included in the sample

Algeria, Argentina, Bangladesh, Belarus, Bhutan, Bolivia, Bulgaria, Burundi, Chile, Columbia, Costa Rica, Dominican Republic, Egypt, El Salvador, Ethiopia, Fiji, Georgia, Guatemala, India, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Latvia, Lebanon, Lithuania, Madagascar, Malaysia, Maldives, Mauritius, Mexico, Moldova, Mongolia, Morocco, Myanmar, Nepal, Pakistan, Panama, Papua New Guinea, Philippines, Romania, Russian Federation, Seychelles, Sri Lanka, Thailand, Tunisia, Turkey, Uganda, Ukraine, Uruguay, Yemen, Zambia.

Source: IMF (2011) Government Finance Statistics

Table D. Simple correlations (selected variables)

Panel A: IHDI equation								
	GDP*pc*	SS	IHDI	ToT	Trade	Inflation	BQ	Democ.
GDP*pc*	1							
SS	0.38	1						
IHDI	0.82	0.45	1					
ToT	−0.03	0.02	−0.07	1				
Trade	0.24	0.32	0.38	−0.09	1			
Inflation	−0.06	−0.06	−0.05	0.09	−0.21	1		
BQ	0.33	−0.12	0.24	−0.12	0.17	−0.18	1	
Democracy	0.35	0.23	0.40	−0.16	0.21	0.04	0.17	1

Panel B: Child mortality (CM) equation								
	GDP*pc*	HS	CM	Urban.	Educ.	Fertility	Sanit.	Water
GDP*pc*	1							
HS	0.19	1						
CM	−0.69	−0.23	1					
Urbanization	0.69	0.09	−0.69	1				
Education	0.36	0.20	−0.57	0.46	1			
Fertility	−0.61	−0.10	0.85	−0.61	−0.51	1		
Sanitation	0.65	0.15	−0.81	0.70	0.51	−0.71	1	
Water	0.60	0.14	−0.78	0.66	0.39	−0.70	0.83	1

Notes: GDP*pc* stands for GDP per capita; SS for social spending; ToT for terms of trade; BQ for bureaucratic quality; HS for health spending; and Education for female education.
Source: Authors

Appendix B

Table 5: IHDI equation (alternative samples)

Dependent variable: IHDI						
Sample countries	Excluding UMICs countries			Only MICs countries		
Regression	(1)	(2)	(3)	(4)	(5)	(6)
Method	2SLS	FE	Sys-GMM	2SLS	FE	Sys-GMM
Social spending (% GDP) (*ln*)	0.009 (3.41)***	0.014 (2.70)***	0.004 (2.46)**	0.008 (1.94)*	0.024 (2.54)**	0.003 (3.34)***
Lagged IHDI			0.95 (30.89)***			0.96 (24.98)***
GDP per capita (*ln*)	0.026 (12.23)***	0.018 (5.50)***	0.002 (2.25)**	0.038 (9.14)***	0.02 (2.89)***	0.002 (1.93)*
Number of countries	47	34	38	25	19	33
Observations	461	374	160	246	201	141
R-squared	0.91	0.89		0.90	0.79	
Number of instruments	2	2	33	2	2	33
Kleibergen-Paap F st.	35.24	6.98		13.72	2.8	
Stock-Wright LM st.	8.23	7.37		2.90	10.00	
(p-value)	0.016	0.025		0.23	0.007	
Hansen test[a]	0.58	0.59	0.70	0.56	0.60	0.30
Diff-in-Hansen test[a]			0.98			0.76
Autocor. (2^{nd} order)[a]			0.02			0.03
Autocor. (3^{rd} order)[a]			0.86			0.62

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 6: Child mortality equation (alternative samples)

Dependent variable: ln(child mortality rate)						
Sample countries	Excluding UMICs countries			Only MICs countries		
Regression method	(1) 2SLS	(2) FE	(3) Sys-GMM	(4) 2SLS	(5) FE	(6) Sys-GMM
Health spending (% GDP) (ln)	−0.19 (5.17)***	−0.09 (2.66)***	−0.056 (3.64)***	−0.168 (4.51)***	−0.074 (2.11)**	−0.078 (4.06)***
Lagged child mor. (ln)			0.90 (15.60)***			0.91 (16.57)***
GDP per capita (ln)	−0.198 (2.49)**	−0.157 (2.03)**	−0.026 (2.14)**	−0.251 (3.18)***	0.123 (1.56)	−0.029 (2.74)***
Number of countries	50	39	39	26	21	33
Observations	478	374	172	259	208	145
R-squared	0.84	0.91		0.89	0.92	
Number of instruments	2	2	33	2	2	33
Kleibergen-Paap F st.	65.41	21.11		69.00	11.71	
Stock-Wright LM st.	16.97	8.30		14.17	6.84	
(p-value)	0.00	0.016		0.003	0.03	
Hansen test[a]	0.64	0.82	0.37	0.94	0.17	0.28
Diff-in-Hansen test[a]			0.12			0.06
Autocorr. (2^{nd} order)[a]			0.85			0.20
Autocorr. (3^{rd} order)[a]			0.14			0.27

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 7: IHDI equation (alternative samples)

Dependent variable: IHDI						
Sample countries	Only cash data[b]			No data gaps[c]		
Regression method	(1) 2SLS	(2) FE	(3) Sys-GMM	(4) 2SLS	(5) FE	(6) Sys-GMM
Social spending (% GDP) (*ln*)	0.012 (5.83)***	0.015 (2.47)**	0.003 (2.02)**	0.014 (3.72)***	0.01 (2.67)***	0.003 (2.09)**
Lagged IHDI			0.96 (34.73)***			0.94 (32.93)***
GDP per capita (*ln*) $(t-1)$	0.025 (12.19)***	0.018 (4.42)***	0.002 (2.23)**	0.026 (10.60)***	0.021 (6.83)***	0.002 (2.10)**
Number of countries	40	29	35	39	28	33
Observations	386	329	144	378	316	141
R-squared	0.94	0.87		0.89	0.91	
Number of instruments	2	2	33	2	2	33
Kleibergen-Paap F st.	27.46	7.4		24.32	12.69	
Stock-Wright LM st.	16.22	6.58		9.93	6.27	
(p-value)	0.00	0.037		0.007	0.043	
Hansen test (p-value)	0.35	0.58	0.52	0.93	0.78	0.35
Diff-in-Hansen test[a]			0.48			0.48
Autocorr. (2^{nd} order)[a]			0.01			0.02
Autocorr. (3^{rd} order)[a]			0.94			0.38

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Notes: [b]Countries for which we have complete cash-based data on public spending; [c]Countries with no data gap.

Source: Authors

Table 8: Child mortality equation (alternative samples)

Dependent variable: ln(child mortality rate)						
Sample countries	Only cash data[b]			No data gaps[c]		
Regression method	(1) 2SLS	(2) FE	(3) Sys-GMM	(4) 2SLS	(5) FE	(6) Sys-GMM
Health spending (% GDP) (ln)	−0.196 (4.39)***	−0.138 (3.14)***	−0.059 (3.18)***	−0.235 (7.08)***	−0.064 (1.82)*	−0.06 (3.64)***
Lagged child mor. (ln)			0.94 (13.08)***			0.93 (12.90)***
GDP per capita (ln)	−0.341 (4.27)***	−0.258 (3.17)***	−0.03 (2.24)**	−0.097 (1.44)	−0.292 (4.97)***	−0.026 (2.32)**
Number of countries	43	34	36	43	33	35
Observations	398	322	155	415	329	154
R-squared	0.85	0.90		0.84	0.92	
Number of instruments	2	2	33	2	2	33
Kleibergen-Paap F st.	73.58	14.65		86.59	15.26	
Stock-Wright LM st.	13.22	9.86		28.70	3.65	
(p-value)	0.001	0.007		0.00	0.16	
Hansen test[a]	0.51	0.90	0.28	0.23	0.72	0.17
Diff-in-Hansen test[a]			0.14			0.18
Autocorr. (2^{nd} order)[a]			0.75			0.66
Autocorr. (3^{rd} order)[a]			0.22			0.25

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Notes: [b]Countries with complete cash-based data. [c]Countries with no data gap.

Source: Authors

Table 9: IHDI equation (alternative estimators)

Dependent variable: IHDI							
Regression method	(1) 2SLS	(2) FE	(3) GMM	(4) GMM	(5) CUE	(6) LIML	(7) Fuller
Lagged IHDI			0.86 (19.57)***	0.85 (17.38)***			
Social spending per capita (ln)	0.014 (6.12)***	0.014 (2.54)**	0.004 (2.91)***	0.004 (3.18)***			
Social spending (% GDP) (ln)					0.014 (6.10)***	0.014 (6.01)***	0.014 (6.03)***
GDP per capita (ln)	0.012 (3.43)***	0.005 (0.95)	0.002 (3.27)***	0.002 (1.71)*	0.027 (13.91)***	0.012 (13.65)***	0.027 (13.68)***
Number of countries	52	38	42	42	52	52	52
Observations	504	417	175	175	504	504	504
R-squared	0.91	0.89			0.91	0.91	0.91
Number of instruments	2	2	33	30	2	2	2
Kleibergen-Paap F st.	42.98	6.91			42.17	42.17	42.17
Stock-Wright LM st.	18.80	6.13			18.80	18.80	18.80
(p-value)	0.00	0.047			0.00	0.00	0.00
Hansen test[a]	0.74	0.69	0.73	0.51	0.77	0.77	0.77
Diff-in-Hansen test[a]			0.74	0.61			
Autocor. (2^{nd} order)[a]			0.02	0.02			
Autocor. (3^{rd} order)[a]			0.86	0.86			

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 10: Child mortality equation (alternative estimators)

Dependent variable: ln(child mortality rate)							
Regression method	(1) 2SLS	(2) FE	(3) GMM	(4) GMM	(5) CUE	(6) LIML	(7) Fuller
Lagged child mor.			0.86 (13.96)***	0.93 (8.98)***			
Health spending per capita (ln)	−0.181 (5.45)***	−0.095 (2.72)***	−0.052 (3.42)***	−0.059 (2.30)**			
Health spending (% GDP) (ln)					−0.18 (5.51)***	−0.181 (5.45)***	−0.181 (5.46)***
GDP per capita	−0.034 (0.38)	−0.092 (1.18)	−0.02 (1.76)*	−0.034 (0.98)	−0.219 (3.29)***	−0.215 (3.10)***	−0.216 (3.11)***
Number of countries	55	44	44	44	55	55	55
Observations	533	425	193	195	533	533	533
R-squared	0.86	0.91			0.86	0.86	0.86
Number of instrum.	2	2	33	31	2	2	2
Kleibergen-Paap F	73.92	20.02			73.92	73.92	73.92
Stock-Wright LM	19.99	8.74			19.99	19.99	19.99
(p-value)	0.00	0.01			0.00	0.00	0.00
Hansen test[a]	0.85	0.91	0.36	0.47	0.85	0.85	0.85
Diff-in-Hansen test[a]			0.25	0.28			
Autoco. (2^{nd} order)[a]			0.94	0.59			
Autoco. (3^{rd} order)[a]			0.10	0.19			

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 11: HDI equation

Dependent variable: HDI				
Regression method	(1) 2SLS	(2) FE	(3) Sys-GMM	(4) Sys-GMM
Lagged HDI			0.93 (35.55)***	0.93 (18.75)***
Social spending (% GDP) (*ln*)	0.033 (3.66)***	0.023 (2.31)**	0.013 (2.32)**	0.015 (1.87)*
GDP per capita (*ln*)	0.083 (13.08)***	0.055 (6.11)***	0.007 (2.62)***	0.007 (1.84)*
Number of countries	52	39	42	42
Observations	518	431	175	175
R-squared	0.93	0.91		
Number of instruments	2	2	33	30
Kleibergen-Paap F stat.	18.64	13.50		
Stock-Wright LM stat.	7.25	5.77		
(p-value)	0.027	0.056		
Hansen test[a]	0.84	0.48	0.68	0.53
Diff-in-Hansen test[a]			0.93	0.86
Autocorr. (2^{nd} order)[a]			0.79	0.56
Autocorr. (3^{rd} order)[a]			0.13	0.31

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Notes: Column 3 uses internal as well as external instruments, while column 4 employs only internal instruments.

Source: Authors

Table 12: IHDI equation (Additional explanatory variables)

Dependent variable: IHDI								
Method	2SLS				FE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Social spending (% GDP) (*ln*)	0.014 (6.31)***	0.013 (4.81)***	0.013 (5.82)***	0.013 (5.07)***	0.015 (2.68)***	0.012 (3.49)***	0.012 (2.65)***	0.013 (2.69)***
GDP per capita (*ln*) ($t-1$)	0.024 (9.33)***	0.029 (18.31)***	0.027 (14.57)***	0.027 (14.13)***	0.022 (6.97)***	0.016 (5.75)***	0.024 (6.65)***	0.017 (5.85)***
Aid (% GNI) ($t-1$)	0.000 (0.02)				0.0001 (0.97)			
Gini (*ln*)		−0.007 (1.28)				0.006 (2.34)**		
Finance			−0.004 (3.12)***				−0.003 (3.59)***	
Corruption				0.003 (2.35)**				0.001 (1.36)
Number of countries	52	52	52	52	33	31	38	38
Observations	451	279	503	504	364	239	417	417
R-squared	0.90	0.93	0.92	0.92	0.89	0.92	0.90	0.90
Kleibergen-Paap F	49.64	18.97	45.69	35.79	7.38	11.44	9.77	9.40
Stock-Wright LM	19.70	21.12	17.63	15.78	7.68	9.78	6.57	6.81
(p-value)	0.00	0.00	0.00	0.00	0.02	0.008	0.04	0.03
Hansen test[a]	0.95	0.10	0.96	0.66	0.33	0.57	0.59	0.64

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 13: IHDI equation (Additional controls)

Dependent variable: IHDI				
Method	System GMM regressions			
	(1)	(2)	(3)	(4)
Lagged IHDI	0.94 (36.83)***	0.96 (34.49)***	0.95 (30.80)***	0.92 (37.43)***
Social spending (% GDP) (*ln*)	0.003 (1.82)*	0.002 (1.73)*	0.004 (2.66)***	0.004 (2.14)**
GDP per capita (*ln*)	0.002 (1.60)	0.011 (1.61)	0.002 (2.68)***	0.002 (2.35)**
Aid (% GNI) ($t-1$)	−0.0001 (0.32)			
Gini (*ln*)		−0.002 (0.86)		
Finance			−0.002 (2.35)**	
Corruption				0.0003 (0.40)
Number of countries	37	40	42	42
Observations	153	144	175	175
Number of instruments	34	34	34	34
Hansen test (p-value)	0.30	0.56	0.53	0.57
Diff-in-Hansen test[a]	0.87	0.69	0.60	0.84
Autocorr. (second-order)[a]	0.02	0.03	0.03	0.03
Autocorr. (third-order)[a]	0.65	0.86	0.86	0.74

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 14: Child mortality equation (additional controls)

Dependent variable: *ln*(child mortality rate)								
Method	2SLS					FE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Health Spending (% GDP) (*ln*)	−0.17 (5.17)***	−0.139 (3.63)***	−0.139 (3.63)***	−0.184 (5.64)***	−0.171 (4.75)***	−0.103 (2.70)***	−0.055 (2.17)**	−0.048 (2.31)**
GDP per capita (*ln*)	−0.217 (2.54)**	−0.213 (2.52)**	−0.213 (2.52)**	−0.217 (3.06)***	−0.239 (3.44)***	−0.198 (2.92)***	−0.192 (2.25)**	−0.186 (2.63)***
Under-5 pop.	0.096 (3.65)***					−0.005 (0.33)		
Aid (% GNI) ($t-1$)		0.11 (1.91)*					−0.005 (2.75)***	
Undernutrition (*ln*)			0.13 (2.33)**					−0.026 (0.54)
Fractionalization				0.174 (1.75)*				
Predom. muslim					0.004 (4.23)***			
Number of countries	55	55	55	55	55	43	34	42
Observations	522	435	434	532	466	414	302	367
R-squared	0.87	0.86	0.87	0.86	0.89	0.90	0.92	0.92
Kleibergen-Paap F	19.93	35.89	36.38	79.89	79.95	17.69	46.81	56.46
Stock-Wright LM	15.62	13.48	10.2	21.71	16.38	8.53	3.97	6.05
(p-value)	0.00	0.00	0.006	0.00	0.001	0.01	0.14	0.049
Hansen test[a]	0.21	0.15	0.23	0.95	0.23	0.85	0.90	0.42

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 15: Child mortality equation (additional controls)

Dependent variable: ln(Child mortality) [Sys-GMM regressions]					
Regressions	(1)	(2)	(3)	(4)	(5)
Lagged child mor. (ln)	0.95 (14.81)***	0.87 (15.62)***	0.92 (15.06)***	0.92 (15.00)***	0.94 (13.02)***
Health spending (% GDP) (ln)	−0.05 (2.97)***	−0.063 (2.12)**	−0.068 (3.24)***	−0.061 (3.24)***	−0.059 (3.13)***
GDP per capita (ln)	−0.025 (2.30)**	−0.021 (1.16)	−0.024 (1.85)*	−0.029 (2.63)***	−0.029 (2.59)***
Under-5 population	−0.01 (0.81)				
Aid (% GNI) ($t-1$)		0.001 (0.71)			
Undernutrition (ln)			−0.003 (0.16)		
Fractionalization				0.032 (0.64)	
Predominantly muslim					0.0002 (0.55)
Number of countries	43	38	42	43	44
Observations	188	163	173	192	193
Number of instruments	34	34	34	34	34
Hansen test (p-values)	0.29	0.50	0.60	0.35	0.22
Diff-in-Hansen test[a]	0.07	0.22	0.12	0.27	0.10
Autocor. (2^{nd} order)[a]	0.89	0.35	0.45	0.90	0.77
Autocor. (3^{rd} order)[a]	0.14	0.07	0.08	0.11	0.14

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 16: IHDI equation (spending and democracy)

Dependent variable: IHDI				
Regression method	(1) OLS	(2) 2SLS	(3) FE	(4) Sys-GMM
Lagged IHDI				0.93 (40.44)***
Social spending (% GDP) (*ln*)	0.009 (9.83)***	0.015 (4.91)***	0.011 (2.46)**	0.004 (1.91)*
Democracy	0.0003 (1.95)*	0.001 (1.86)*	0.0002 (1.22)	0.0002 (0.46)
Social spending×democracy (% GDP)	0.0001 (2.11)**	−0.0001 (0.60)	−0.0003 (2.74)***	−0.0001 (0.49)
Number of countries	51	51	38	42
Observations	504	504	417	175
R-squared	0.92	0.91	0.91	
Number of instruments		2	2	34
Kleibergen-Paap F statistic		19.88	10.64	
Stock-Wright LM statistic		12.97	5.89	
(p-value)		0.00	0.05	
Hansen test (p-value)		0.78	0.49	0.70
Diff-in-Hansen test[a]				0.88
Autocor. (2^{nd} order)[a]				0.50
Autocor. (3^{rd} order)[a]				0.12

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 17: Child mortality equation (spending and democracy)

Dependent variable: *ln*(Child mortality rate)				
Regression method	(1) OLS	(2) 2SLS	(3) FE	(4) Sys. GMM
Lagged child mor. (*ln*)				0.93 (13.69)***
Health spending (% GDP) (*ln*)	−0.148 (9.80)***	−0.20 (5.18)***	−0.104 (2.87)***	−0.058 (2.60)***
Democracy	−0.008 (2.27)**	−0.004 (0.14)	0.009 (3.07)***	0.002 (0.83)
Health spending×democracy (% GDP)	0.004 (1.96)**	0.007 (1.93)*	0.006 (2.42)**	0.001 (0.39)
Number of countries	55	55	44	44
Observations	537	533	425	193
R-squared	0.86	0.86	0.91	
Number of instruments		2	2	34
Kleibergen-Paap F statistic		42.43	18.54	
Stock-Wright LM statistic		12.49	8.63	
(p-value)		0.00	0.01	
Hansen test (p-value)		0.25	0.66	0.24
Diff-in-Hansen test[a]				0.15
Autocorr. (2^{nd} order)[a]				0.90
Autocorr. (3^{rd} order)[a]				0.12

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors

Table 18: IHDI equation (disaggregating social spending)

Sys-GMM regressions (dependent variable: IHDI)			
	(1)	(2)	(3)
Lagged IHDI	0.99 (41.77)***	0.97 (31.82)***	0.93 (21.03)***
Health spending (% GDP) (*ln*)	0.003 (3.37)***	0.004 (2.11)**	0.004 (2.18)**
Education spending (% GDP) (*ln*)	0.001 (0.40)	−0.002 (1.22)	−0.003 (1.27)
Social protection spending (% GDP) (*ln*)	−0.001 (1.43)	−0.0002 (0.22)	−0.0003 (0.24)
GDP per capita (*ln*)	0.002 (3.91)***	0.002 (1.84)*	0.004 (3.16)***
Number of countries	41	40	40
Observations	184	162	162
Number of instruments	39	49	46
Hansen test (p-value)	0.50	0.88	0.81
Difference-in-Hansen test[a]	0.95	1.00	0.92
Autocorrelation (second-order)[a]	0.40	0.30	0.89
Autocorrelation (third-order)[a]	0.06	0.75	0.11

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Notes: Column 1 includes only the variables shown here; Columns 2 & 3 include all variables in Table 2; Columns 1 & 2 add second and longer lags of health, education, and social protection spending to the instrument set in Table 2 (column 2); column 3 uses only the aforementioned internal instruments.

Source: Authors

Table 19: IHDI and Child mortality equations (alternative specifications)

Dependent variable	*ln*(IHDI)			Δln(IHDI)	Δln(CM)
Regression method	(1) 2SLS	(2) FE	(3) Sys-GMM	(4) Sys-GMM	(5) Sys-GMM
Initial IHDI/CM (*ln*)				−0.094 (3.77)***	−0.11 (2.25)***
Lagged IHDI			0.91 (38.53)***		
Social spending (% GDP) (*ln*)	0.064 (5.10)***	0.068 (2.34)**	0.02 (2.35)**	0.021 (2.63)***	
Health spending (% GDP) (*ln*)					−0.058 (2.81)***
GDP per capita (*ln*)	0.135 (12.93)***	0.074 (3.90)***	0.011 (2.23)**	0.012 (2.76)***	−0.022 (1.67)*
Number of countries	51	38	42	39	44
Observations	504	417	175	166	193
Number of instruments	2	2	33	33	33
R-squared	0.91	0.85			
Kleibergen-Paap F st.	42.17	9.82			
Stock-Wright LM st.	13.95	5.22			
(p-value)	0.00	0.07			
Hansen test (p-value)	0.63	0.99	0.26	0.30	0.21
Diff-in-Hansen test[a]			0.40	0.56	0.16
Autocor. (2^{nd} order)[a]			0.03	0.02	0.93
Autocor. (3^{rd} order)[a]			0.99	0.98	0.15

[a]Denotes p-value. Significance level: *10%; **5%; ***1%

Source: Authors