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On the Merit of Debt Relief Programs in Heavily Indebted Poor Countries

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Abstract

Although the HIPC Initiative is nearly complete, its merit is still being debated among policymakers as well as academicians. Debt relief under the Initiative was intended to help beneficiary countries achieve the Millennium Development (MDG) goals. Using four key indicators of development, this paper assesses the impact of HIPC Initiative on countries that achieved the completion point. Our results, based on dynamic panel model estimations provide supporting evidence indicating the failure of the Initiative to produce the expected outcome.

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1. Introduction

In the 1980s, most developing countries adopted the structural adjustment program (SAP) under the supervision of the Bretton Woods Institutions. Officially speaking, SAP aimed to help low-income countries stabilize their public finances through drastic budget cuts in social expenditure. A decade after its inception, the public finance results expected from this policy did not mature into their full potential. As a result of this situation, social and economic indicators of most countries worsened, leaving them with a huge debt burden (Krugman 1988). To help address the issue of debt overhang, the Bretton Woods Institutions and the majority of creditors created the Heavily Indebted Poor Countries (HIPC) initiative. This program provides faster, deeper and broader debt relief among poor countries. It also fosters poverty reduction and improves social conditions in the concerned countries. In the past few years, concerns that developing countries will achieve debt relief through HIPC have come to table. In 2011, a report by IMF and International Development Association (IDA) revealed that, while poverty reducing expenditures have increased by more than three percent on average between 2001 and 2010 and debt service payments declined, the HIPCs have made uneven and in some cases limited progress toward achieving the MDGs” (IDA and IMF, Staff Report (2011), pp 11). Similar conclusions have been drawn by such authors as Temah (2009), Arslanlp and Henri (2006), and Dessy and Vencatachellum (2007).

The HIPC initiative was launched in 1996 by the IFM and the World Bank to assist the developing countries whose ratio of debt to GDP is between 200 and 250% and to provide additional resources for social sectors. However, many developing countries did not meet that threshold. Therefore, the ratio was lower to 150% in 1999 and the initiative was referred to as enhanced HIPC. In 2005, to help accelerate progress toward the United Nations Millennium Development Goals (MDGs), the HIPC Initiative was supplemented by the Multilateral Debt Relief Initiative. The MDRI allows the relief of 100 percent of debts by three multilateral institutions; the IMF, the World Bank, and the African Development Fund (AfDF), for countries completing the HIPC Initiative process.

Finally, in 2007, the Inter-American Development Bank (IaDB) also decided to provide additional (“beyond HIPC”) debt relief to the five HIPCs in the Western Hemisphere.

Despite the significance of the issue, the literature on the subject is quite poor because of the lack of sufficient data (Depetris Chauvin and Kraay 2005 and 2007). However, some studies have been undertaken since late 1990s. The conclusions of the existing literature hinge around two lines of thought. In the first one, there is no evidence that debt relief has had a positive impact neither on economic growth nor on investment rates or public spending (Heller 1999, Sun 2004, Depetris Chauvin and Kraay 2005, Arslanlp and Henry 2006, Dessy and Vencatachellum 2007, Kaddar and Furrer 2008, Nwachukwu 2008, Freytag and Pehnelt 2009, Gunter 2011). In fact, the main reasons of the failure of HIPC initiative are that : (i) the amount of debt relief released under HIPC is trivial, (ii) the lack of functioning economic institutions, (iii) HIPC initiative intrinsically contains an element of adverse selection that penalize countries which managed well their economies and have sustainable debt burdens; (iv) no guaranty that countries will not embark on a new borrowing binge and find themselves in the same situation years later; (v) freed-up resources may be overestimated if the country was only paying a fraction of debt service before debt relief; (vi) the social outcomes are not the direct target; and (vii) the public expenditure is fungible and there is no evidence that expenditure will increase for the targeted services.

In contrast, according to the second wave of studies, there is positive evidence sustaining the relationship between debt relief and social outcomes such as education and health (Cuaresma and Vincelette 2010 and 2008, Temah 2009, Nafula 2002, Easterly 2003). The main reasons of the success are (i) spending time up to the completion point; (ii) the additional resources freed up to the social sector after the debt relief (poverty reduction expenditure); and (iii) better economic management from all undertaken structural reforms.

Admittedly, one common flaw with the bulk of existing studies is their narrow focus on individual beneficiary countries, an approach which does not allow for comparison between beneficiaries and non-beneficiary poor countries. For instance, through the use of a general equilibrium macroeconomic model, Bayraktar & Fofack (2011) analyzed the dynamic of growth in post-HIPC era in Ethiopia. They found out a stagnation of real income, a persistence of large fiscal deficits and deterioration of external debt indicators. As for Uganda, LeBlanc and al. (2009) evaluated the impact of HIPC era, nine year post completion point. They found out that the proportion of people under the national poverty line declined from 34 percent in 2000 to 31.3 percent in 2006. The life expectancy at birth was around 49 years. Other key social indicators such as the primary completion rate, the primary schooling enrollment rate and the mortality under 5, have improved since 1990s. Along the same line of thought, Somerville (2005) finds that the government of Uganda has increased the expenditure to the education sector by 2.5 percent since 2000. However, the results on health and water remain modest due to the privatization's approach of the sectors. This is also true about agricultural production and trade liberalization. For the case of Cameroon, Essama-Nssah and Bassole (2010), using a counterfactual analysis of the poverty impact of economic growth, find that poverty fell about 13 percent between 1996 and 2001. However, between 2001 and 2007, growth weakened significantly due to low productivity of sectors in the informal segment of the economy which slowed down the reduction rate from 13 percent to 1 percent. For the case of Bolivia, Lopez (2002) finds that the expenditures for poverty reduction purposes have increased substantially after the decision point in 1998 (especially for the social sectors such as education, health...). However, the achievement of the MDGs is far from being attainable due to its high costs and the lack of financing.

While the existing literature helps understand the impact of HIPC initiative on individual countries, it fails to account for cross-country differences. To the best of our knowledge, this paper is the first to take a holistic approach to study the merits of the HIPC initiatives. To do so, we use a dynamic panel data approach to make two contributions to the literature. First, building on the dynamic panel data model, we develop several specifications to analyze the impact of social policies under HIPC on key indicators regarding two defining issues of the United-Nations Millennium Development Goals (MDGs), namely education and health. Second, we evaluate the effect of full debt relief under the HIPC initiative on five key indicators of health and water for the HIPC countries in comparison to non HIPC countries and the HIPC countries with partial debt relief. Undoubtedly, this paper tries to bring new insights of the topic by using a rigorous scientific method to evaluate the impact of the HIPC initiative on the attainment of the Millennium Development Goals. The results may help policymakers to measure the gap between the actual situation to achieve the MDGs and the efforts that should be undertaken and maintained, in terms of sound reforms, in order to reach the targets of the health MDGs in poor countries. This research is timely because despite the noticeable progress in the attainment of some of the Millennium Development Goals, the health and education related goals are far from being satisfactory,

particularly in Sub-Saharan Africa, a region with the highest mortality rate and the lowest literacy rate in the world.

Our results indicate that the HIPC initiative has positive effects on HIPC countries which have received full debt relief in comparison to non HIPC and those with partial relief. More specifically, we find statistically significant evidence supporting that the HIPC initiative has increased the primary completion rate by 14 percent, the primary schooling enrollment by 23 percent and the secondary schooling enrollment by 10 percent and the life span at birth by 5 percent. Unfortunately, the HIPC initiative failed to reduce the under-five mortality rate.

The rest of the paper is organized as follows: Section 2 describes the data; section 3 presents the model; section 4 presents the empirical results; and section 5 concludes the study.

2. Data description

We collected data for 90 developing countries¹ for the period spanning 1980 to 2011 from the World Bank website. The countries are selected based on their income levels according to the World Bank classification. We chose two categories of countries: low income and low middle income. Furthermore, our model specification included the following variables:

- Primary completion rate (percentage of the relevant age group): total number of new entrants in the last grade of primary education, regardless of age, expressed as percentage of the total population of the theoretical entrance age to the last grade of primary school;
- Primary schooling enrollment rate: is the total enrollment in primary education, regardless of age, expressed as a percentage of the population of official primary education age. It can exceed 100 percent due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition;
- Life expectancy at birth: indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life;
- Under-5 mortality rate (per 1,000 live births): probability per 1,000 that a newborn baby will die before reaching age five, if subject to current age-specific mortality rate.

¹ **Central America** (Haiti, Belize, El Salvador, Guatemala, Honduras, and Nicaragua), **Central Asia** (Kyrgyz Republic, Tajikistan, and Uzbekistan), **East Asia** (Mongolia, Pakistan, and North Korea), **East Europe** (Kosovo, Albania, Georgia, Moldova, and Ukraine), **North Africa** (Morocco and Egypt), **Oceania** (Kiribati, Marshall Island, Micronesia, Tonga, Vanuatu, Samoa, Papua New Guinea, Fiji, and Solomon Islands), **South America** (Bolivia, Guyana, and Paraguay), **South Asia** (Afghanistan, Bangladesh, Cambodia, Myanmar, Nepal, Bhutan, India, Indonesia, Philippines, Sri Lanka, Timor-Leste, and Vietnam), **Sub Saharan Africa** (Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Congo, Dem. Rep., Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Sierra Leone, Somalia, Tanzania, Togo, Uganda, Zimbabwe, Cameroon, Cape Verde, Congo, Rep., Cote d'Ivoire, Djibouti, Ghana, Lesotho, Nigeria, Sao Tome and Principe, Senegal, South Sudan, Sudan, Swaziland, Zambia, Rwanda, and Nigeria), and **West Asia** (West Bank and Gaza, Iraq, Syrian Arab Republic, and Yemen).

- Government revenues (in percentage of GDP): are cash receipts from taxes, social contributions, and other revenues such as fines, fees, rent, and income from government property or sales. Grants are also considered as revenue but are excluded here.
- Tax revenues (in percentage of GDP): refers to compulsory transfers to the central government for public purposes. Certain compulsory transfers such as fines, penalties, and most social security contributions are excluded. Refunds and corrections of erroneously collected tax revenue are treated as negative revenue;
- Growth rate of gross domestic products (annual percentage change on the GDP): is the annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions of depreciation of fabricated assets or of depletion and degradation of natural resources;
- Growth rate of Gross domestic products per capita in current US\$ (annual percentage change on GDP per capita);
- Public expenditure on education as % of GDP: is the total public expenditure (current and capital) on education expressed as a percentage of the Gross Domestic Product (GDP) in a given year. Public expenditure on education includes government spending on educational institutions (both public and private), education administration, and transfers/subsidies for private entities (students/households and other private entities);
- Total health expenditure (% of GDP): is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation;
- Public health expenditure (% of total health expenditure): refers to expenditure on health care incurred by public funds. Public funds are state, regional and local Government bodies and social security schemes. Public capital formation on health includes publicly-financed investment in health facilities plus capital transfers to the private sector for hospital construction and equipment; and
- Health expenditure per capita (current US\$).
- We create a time-varying dummy variable HIPC, which equals one if the country has gotten the full debt relief; and zero otherwise.

3. Modeling Framework

We started by estimating four one-way error component models with the following dependent variables:

- Primary completion rate (PCR)
- Primary schooling enrollment (PSE)
- Life span at the birth (LE)
- Mortality rate under-5 (MRU5)

The rest of variables were considered as independent variables:

- GDP growth rate (GROWTH)

- GDP per capita growth rate (GROWTHPC)
- Public spending on education (PSED)
- Public expenditure on health (PUHE)
- Total expenditure on health (HE)
- Health expenditure per capita (PRHE)
- Government Revenues (GR)
- HIPC

$$\text{Model 1: } LPCR_{it} = \delta_1 LPCR_{it-1} + X_{it}\beta_1 + \gamma_1 HIPC + u_i + \varepsilon_{it} ; \quad (1)$$

$$\text{Model 2: } LPSE_{it} = \delta_2 LPSE_{it-1} + X_{it}\beta_2 + \gamma_2 HIPC + u_i + \varepsilon_{it} ; \quad (2)$$

$$\text{Model 3: } LLE_{it} = \delta_3 LLE_{it-1} + X_{it}\beta_3 + \gamma_3 HIPC + u_i + \varepsilon_{it} ; \text{ and} \quad (3)$$

$$\text{Model 4: } LMRU5_{it} = \delta_4 LMRU5_{it-1} + X_{it}\beta_4 + \gamma_4 HIPC + u_i + \varepsilon_{it} \quad (4)$$

Where $i = 1, \dots, 90$; $t = 1, \dots, 32$;

$X_{it} = [GROWTH, GRPWHPC, GTR, GR, HE, PRHE, PUHE, PSED]$; $v_{it} = u_i + \varepsilon_{it}$ with $\mu_i \sim iid(0, \sigma_\mu^2)$, $\varepsilon_{it} \sim iid(0, \sigma_\varepsilon^2)$ and HIPC is the time-varying dummy variable, u_i is the country fixed effect, λ_t is the time fixed effect, and ε_{it} is the error terms.

Obviously, the estimation of the parameters of the models above faces Lucas Critique and the following econometric problems: (i) all lagged variables are correlated with u_i , which will make the ordinary least square (OLS) estimator biased and inconsistent even if v_{it} is not serially correlated; (ii) the fixed effect (FE) estimator will be also biased but consistent for long series ($T \rightarrow \infty$); and (iii) the random effect (RE) estimator will be also biased.

It is worth mentioning that the Lucas critique is a valid argument against our model because it is plausible that the implementation of the initiative may result systematically to a change in the structure of our econometric model; an issue that could invalidated our findings on the effects of HIPC initiative on key variables like mortality under 5 or primary completion rate. Luckily, the issue can be circumvented in two ways: The construction of a micro-founded model deep parameters, relating to preferences of a representative consumer, production technology of the firms, and policy rules (Buccioli et al. 2017). However, it appears difficult to establish a clear transmission mechanism of the HIPC initiative on micro variables. For this reason, we rely on the second solution, following Ashenfelter and Card (1985) by comparing two groups (treatment and control) for two time periods. The treatment group (36 countries that have achieved the completion point) is exposed the treatment (HIPC initiative) on the second period but not in the first period. The control group (other countries) is not exposed to the treatment during either period. The impact of the policy is measured by the difference between the average gain within the treatment and control groups.

The solution to the problem of biasedness and inconsistency of OLS estimators, in one hand, and the biasedness of both RE and FE estimators has been proposed by many authors since 1981. The first solution was proposed by Anderson and Hsiao (1981). In fact, these authors suggested a method consisting of two steps: (i) take the first difference of the model to wipe out μ_i , and then (ii) use the instrumental variables method to solve the problem of endogeneity of the lagged

variable. Finally, it is important to check the validity of the instruments by testing whether they are uncorrelated with the ε_{it-1} . We use the test of overidentification conditions proposed by Sargan (1958) and Hansen (1982).

4. The empirical results

Following Sargan (1958), we carry out two diagnostic tests to check for overidentification restrictions and serial correlation issue. The tests performed on both estimated models fail to reject the null hypothesis. Therefore, the overidentification restrictions are valid and there is no serial correlation.

The results of the estimation of models 1 - 4 are presented in Tables 1-4. We use two specifications as described above, related to the determination of the instruments. The first specification that we call DPM1 (Dynamic Panel Model 1) considers all covariate variables to the lagged variable as strictly exogenous. However, the second specification (DPM2) considers all covariate variables as predetermined.

Our estimated results show that HIPC have increased the primary education completion rate by 16% for the first specification. In terms of the sign (positive), our results are in line with the findings by Nafula (2002) who found that the HIPC initiative has increased the primary completion rate by 3%. Besides, the growth rate of per capita GDP increases only the primary completion rate by 0.4% which seems very low and the past rate increases the current one by 46% and 33% respectively for the second and first specifications. Nevertheless, there is not impact of HIPC on the primary completion rate according to the second specification. Moreover, the rest of covariates do not have any impact on the primary completion point for each specification. This may be due to the fact that the total expenditure on primary education is not considered in the model as explanatory variable. In addition to the later explanation, the majority of funds from donors available to developing countries are oriented to the social sectors, especially education and health. Therefore, the available and mostly scarce internal funds are reallocated to other sectors such as defense, infrastructures, corruption... The study of LeBlanc and al. (2009) in Uganda found that its government has increased the military spending since the completion point of HIPC through its internal resources in substitution of sectors of education and health because these sectors have been funded by the foreign donors. However, the lack of statistical significance between HIPC and health related MDGs is in sharp contrast with the findings by Ondoa (2017) who concluded that the mortality rate under-five decreased by almost 24 for 1000 people owing to the HIPC initiative in 12 African countries.

The results of the model 2 show that the completion point of HIPC has increased the primary schooling enrollment rate by 8% according to the second specification. The past rate has increased the current one by 56% and 70%, respectively for the first and second specifications. However, there is a contradiction on the impact of growth rate of GDP per capita between the two specifications. In fact, the first specification suggests that the per capita growth of GDP decreases the primary schooling rate by 0.7% and the second shows there is a positive impact of 0.2%. Even though there is contradiction, the impact is very low. As in the previous, other covariates are not significant.

The results of the estimated model 3 suggest that the completion point of HIPC initiative has increased life expectancy at birth by 2%. Also, the past number of years of life expectancy

increased the current one by 88%. Besides, the growth rate of GDP per capita has very low impact on life expectancy at birth and both private and total health expenditure have a positive impact on life expectancy of birth. However, tax revenues and total public health expenditure have a negative impact on life expectancy, causing it to decrease by 0.2% and 0.1%, respectively. This corroborates the findings by LeBlanc and al. (2009) in their article pertaining to health expenditures in Uganda.

Additionally, the results of the estimated model 4 show that the HIPC initiative does not have any impact on mortality rate under-5. Surprisingly, we found that past mortality rate increases the current one by 94% to 98%. This lack of statistical significance of the estimated coefficient of the HIPC initiative can be explained using a battery of reasons when it comes to Sub-Saharan Africa. Even if the beneficiary countries of the HIPC initiative were able to improve their healthcare infrastructure within a reasonable timeframe, those countries may not have a sufficient number of trained medical doctors. Also, despite a rapid urbanization in most African countries, the ratio of urban to rural population is still very low in most places. And because of urban bias, policies as well as public investment decision may be focusing on urban areas and leaving out the vast majority of the population who live in rural areas without readily available healthcare infrastructures. This explanation is further reinforced by the negative statistically significant coefficient estimate of private expenditures on the mortality rate under-5, indicating health cares are not affordable to the majority of inhabitants of developing countries since the majority of them are poor. Other contributing factors may help explain the ineffectiveness of the HIPC initiative on mortality rate. According to the existing literature (Ondoa, 2017), one can mention the lack of access to good sanitation, drinking water, healthy foods, etc...

5. Conclusion

This paper sought to evaluate the debt relief of developing countries under the HIPC initiative for the countries which have reached the completion point (full debt relief) before 2011, in comparison to other developing countries which have not reached the completion point or were not eligible for the initiative. To do so, the paper evaluated the HIPC initiative through the achievement of MDGs goals. Therefore four key indicators were chosen which are related to education and health: the primary completion rate, the primary schooling enrollment rate, the life expectancy at birth, and the mortality under five.

The paper finds that the HIPC initiative has contributed positively to the improvement of the three of the five chosen indicators of health and education. The strongest impact is on the primary completion rate (16%). Other indicators also have been improved. In fact, the primary enrollment rate has been improved by 7 percent in 11 years which is not sufficient to reach the target of the MDGs by 2015. Besides, the life expectancy at birth has improved by 2 percent during the period studied, which is also insufficient to achieve the target of the universal basic education by 2015. However, the initiative has not had any impact on a very important indicator on health, the mortality rate under five. This shows that all the reforms undertaken under the initiative have mitigated impact on the indicators under investigation. These results are closed to the previous independent evaluation of the IDA and the IMF (2011, 2006) as mentioned above. Nevertheless, the achievement of the MDGs need more reforms which should help the beneficiary countries to maintain the momentum on their implementation. For instance, a more targeted approach can be used by first identifying the outcome and then use a result-based approach to achieve the desired target. At the country level, a more inclusive policy targeted towards rural population should be encouraged.

It is worth mentioning that data availability has proven to be a limitation of this study. Thus, proxy variables were used in order to circumvent the issue.

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Appendix

Table 1 Estimation of the model 1 (Dependent Variable: Log of Primary Completion Rate)

VARIABLES	(1) DPM1	(2) DPM2
L.lpcr	0.334*** (0.086)	0.463*** (0.018)
HIPC	0.094 (0.108)	0.158*** (0.017)
lgrowthpc	0.007 (0.009)	0.004** (0.002)
lgr	-0.028 (0.066)	-0.015 (0.039)
lgr	-0.068 (0.071)	0.031 (0.039)
lpsed	0.103 (0.109)	0.011 (0.007)
Constant	2.917*** (0.434)	2.168*** (0.090)
Observations	2,700	2,700
Number of countrycode	90	90
Adj. R-squared	.	.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Test of overidentification conditions for DPM1

```
. estat sargan;
```

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

```
chi2(1669) = 50.46856
```

```
Prob > chi2 = 1.0000
```

Test of serial correlation for DPM1

```
. estat abond;
```

Arellano-Bond test for zero autocorrelation in first-differenced errors

```
+-----+-----+-----+-----+-----+
```

```
|Order | z      Prob > z|
```

```
|-----+-----|
```

```
| 1 | -3.8824 0.0001 |
```

```
| 2 | -.33223 0.7397 |
```

```
+-----+-----+-----+-----+-----+
```

H0: no autocorrelation

Test of overidentification conditions for DPM2

```
. estat sargan;
```

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

```
chi2(464) = 52.16555
```

```
Prob > chi2 = 1.0000
```

Test of serial correlation for DPM2

. estat abond;

Arellano-Bond test for zero autocorrelation in first-differenced errors

```

+-----+
|Order |  z      Prob > z|
|-----+-----|
|  1  |-4.7855  0.0000 |
|  2  | .05416  0.9568 |
+-----+

```

H0: no autocorrelation

Table 2 Estimation of the model 2 (Dependent Variable: Log of Primary School Enrolment)

VARIABLES	(1) DPDM2	(2) DPDM2
L.lpse	0.556*** (0.078)	0.699*** (0.019)
HIPC	0.031 (0.035)	0.077*** (0.012)
lgrowthpc	-0.007* (0.004)	0.002* (0.001)
lgr	-0.117 (0.074)	-0.008 (0.019)
lgr	-0.006 (0.049)	0.010 (0.021)
lpsed	-0.033 (0.040)	0.005 (0.007)
Constant	2.417*** (0.418)	1.331*** (0.088)
Observations	2,700	2,700
Number of countrycode	90	90
Adj. R-squared	.	.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Test of overidentification conditions for DPM1

```
. estat sargan;
```

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

```
chi2(1679) = 42.02846
```

```
Prob > chi2 = 1.0000
```

Test of serial correlation for DPM1

```
. estat abond;
```

Arellano-Bond test for zero autocorrelation in first-differenced errors

```
+-----+
|Order | z      Prob > z|
|-----+-----|
|  1  |-2.5377  0.0112 |
|  2  | 1.7017  0.0888 |
+-----+

```

H0: no autocorrelation

Test of overidentification conditions for DPM2

```
. estat sargan;
```

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

```
chi2(464) = 55.0931
```

```
Prob > chi2 = 1.0000
```

Test of serial correlation for DPM2

. estat abond;

Arellano-Bond test for zero autocorrelation in first-differenced errors

```

+-----+
|Order |  z      Prob > z|
|-----+-----|
|  1  |-2.5149  0.0119 |
|  2  | 1.6528  0.0984 |
+-----+

```

H0: no autocorrelation

Table 3 Estimation of the model 3 (Dependent Variable: Log of Life Span at Birth)

VARIABLES	(1) DPDM1	(2) DPDM2
L.lle	0.889*** (0.026)	0.881*** (0.004)
HIPC	-0.000 (0.002)	0.016*** (0.001)
lgrowthpc	0.000** (0.000)	0.000** (0.000)
lgr	0.001 (0.002)	0.001 (0.001)
lgr	-0.002 (0.002)	-0.002* (0.001)
lhe	0.004 (0.003)	0.008*** (0.001)
lpuhe	-0.002** (0.001)	-0.001*** (0.000)
lprhe	0.001 (0.002)	0.006*** (0.001)
Constant	0.457*** (0.107)	0.475*** (0.018)
Observations	2,700	2,700
Number of countrycode	90	90
Adj. R-squared	.	.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Test of overidentification conditions for DPM1

```
. estat sargan;
```

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

cannot calculate Sargan test with dropped variables

```
chi2(1467) = .
```

```
Prob > chi2 = .
```

Test of serial correlation for DPM1

```
. estat abond;
```

cannot calculate AR tests with dropped variables

Arellano-Bond test for zero autocorrelation in first-differenced errors

cannot calculate test with dropped variables

```
+-----+
```

```
|Order | z      Prob > z|
```

```
|-----+-----|
```

```
|  1  |      .      . |
```

```
|  2  |      .      . |
```

```
+-----+
```

H0: no autocorrelation

Test of overidentification conditions for DPM2

```
. estat sargan;
```

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

```
chi2(322) = 68.45158
```

```
Prob > chi2 = 1.0000
```

Test of serial correlation for DPM2

. estat abond;

Arellano-Bond test for zero autocorrelation in first-differenced errors

```
+-----+
|Order |  z      Prob > z|
|-----+-----|
|  1  |-1.4504  0.1469 |
|  2  | 1.8874  0.0591 |
+-----+
H0: no autocorrelation
```

Order	z	Prob > z
1	-1.4504	0.1469
2	1.8874	0.0591

Table 4 Estimation of the model 4 (Dependent Variable: Log of Mortality under 5)

VARIABLES	(1) DPDM1	(2) DPDM2
L.lmru5	0.978*** (0.035)	0.941*** (0.005)
HIPC	-0.001 (0.008)	-0.000 (0.001)
lgrowthpc	-0.000 (0.001)	0.000 (0.000)
lgr	-0.003 (0.009)	-0.001 (0.001)
lgrtr	0.004 (0.005)	0.003* (0.002)
lhe	0.028 (0.025)	-0.007*** (0.002)
lpuhe	-0.014 (0.012)	0.000 (0.001)
lprhe	-0.011 (0.011)	-0.004*** (0.001)
Constant	0.022 (0.136)	0.206*** (0.022)
Observations	2,700	2,700
Number of countrycode	90	90
Adj. R-squared	.	.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Test of overidentification conditions for DPM1

. estat sargan;

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid

chi2(1517) = 44.85977

Prob > chi2 = 1.0000

Test of serial correlation for DPM1

. estat abond;

Arellano-Bond test for zero autocorrelation in first-differenced errors

```
+-----+
|Order | z      Prob > z|
|-----+-----|
|  1  |-2.6971  0.0070 |
|  2  |-.06329  0.9495 |
+-----+
H0: no autocorrelation
```

Test of overidentification conditions for DPM2

. estat sargan;

Sargan test of overidentifying restrictions

H0: overidentifying restrictions are valid
chi2(464) = 49.88047
Prob > chi2 = 1.0000

Test of serial correlation for DPM2

. estat abond;

Arellano-Bond test for zero autocorrelation in first-differenced errors

```
+-----+
|Order | z      Prob > z|
|-----+-----|
|  1  |-2.6541  0.0080 |
|  2  |.02515  0.9799 |
+-----+
H0: no autocorrelation
```