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THE ASYMMETRIC IMPACT OF GROWTH FLUCTUATION ON HUMAN DEVELOPMENT

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Abstract

In this paper, we re-examine the impact of economic growth fluctuation on human development indicators. Using the per capita growth rate and human development indicators for 131 countries between 1974 and 2007, we find that growth acceleration and deceleration have significant impact on the human development indicators. We also find that the effects are asymmetric. This asymmetric effect is valid both in terms of acceleration and deceleration periods and countries which are classified according to human development. Namely, the negative impact of economic deceleration on human development outcomes is greater than the positive impact of economic acceleration for all countries. The same is true for medium and low human development countries. The positive impact of economic acceleration and negative impact of economic deceleration are greater than the impacts on very high and high development countries. Therefore, economic growth must be provided, which will reach everyone and ensure everyone's utilization of economic opportunities in order to achieve the 2023 Millennium Goals.

Keywords: Human Development, Growth Acceleration, Growth Deceleration
JEL Classification: O11, O15, O47

1. Introduction

The levels of development of countries may be measured in various ways. To be able to demonstrate development through merely one criterion is rather difficult due to discrepancies in countries' social and political structures. One of the most common criteria of the development levels is the national per capita income. Indicators related to health and education is used as other criteria. Development and growth prior to 1970 were considered to be equal to the increase in the national income. For this purpose, the criterion of per capita income was used as the basic indicator of changes in a country's development. After 1970 new approaches that aimed to describe development by means of humanistic, social, cultural, environmental and local dimensions have been used. In addition to the concepts of economic growth, poverty, unemployment, income distribution and regional inequality have begun to be considered.

In many economically developed countries, since the social problems were not being solved, the importance of the relationship between economic growth and human development became apparent. In 1990 the United Nations Development Program (UNDP) began to publish the Human Development Index, which measured the levels of socio-economic development between countries, with the Human Development Report (HDR).

The HDR is examined within three dimensions. The first dimension is a healthy and long life measured by average life expectancy. The second dimension is level of education and

knowledge measured by literacy and schooling. The third dimension is the standard of living measured by gross domestic income values which are calculated according to purchasing power parity (i.e. by the exchange rate which reflects relative price difference between countries) (UNDP, 2011).

The relationship between economic growth and human development indicators can be analyzed both in terms of longer-term trends and shorter-term fluctuations. At the aggregate level and over the long-run, there is a strong positive (though not linear) correlation between gross domestic product (GDP) per capita and human development indicators. But the direction of causality may run both ways: economic growth helps to generate the resources needed for improved human development, and improved human development enables higher potential growth (Conceicao and Kim, 2009).

Shorter-term fluctuation of growth can also affect human development. Keynes (1936) mentioned that deceleration periods are stronger but shorter than acceleration periods. Hence there is an asymmetric condition in terms of GDP. For this reason, it is supposed that while examining the relationship between economic growth and human development, the examination of economic fluctuations on human development can provide more information.

The concepts of growth acceleration and growth deceleration, specifically their measurements and underlying determinants, are a relatively new addition to the traditional economic growth literature. Hausmann *et al.* (2005) fault the empirical literature for not focusing on the most important sources of variations that underline data on economic growth. They opine that standard cross-country regressions are poor predictors of turning points of growth (Grenade and Pasha, 2012). Studies in the literature usually examine the relationship between economic growth and human development indicators. On the other hand, there are some empirical studies which investigates the relationship between economic fluctuations and human development indicators (Ranis *et al.* 2000; Bloom and Canning, 2005; Ferreira and Schady, 2008; Conceicao *et al.* 2010b; Conceicao *et al.* 2010a; Baird *et al.* 2007; Arbache and Page, 2007; Conceicao and Kim, 2009; Conceicao *et al.* 2009; Hausmann *et al.* 2005).

The relationship between growth fluctuations and human development indicators can be tested using causality analysis or regression analysis. In this study, we use the latter approach. The contribution of this paper is that it tries to identify the size and direction of the relation using robust estimators as well as identify the relation for countries which are classified according to human development. The paper is organized as follow. Section 2 briefly describes data. Section 3 describes methodology and regression analysis results. Section 4 concludes with the main findings from the paper.

2. Data

The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three basic dimensions of human development: life expectancy at birth, knowledge, and a decent standard of living (UNDP, 2007/2008). In this context, we use life expectancy at birth, infant mortality rate and under-5 mortality rate as health indicators, adult literacy rate and gross enrollment rate as knowledge indicators, and GDP per capita as a decent standard of living. Data on life expectancy, adult literacy rate, gross enrollment rate, and GDP per capita PPP (constant 2005 international $) are taken from Report Hybrid-HDI Data of Trend Analysis (UNDP, 2010), infant mortality rate (per 1,000 live births) and under-5 mortality rate (per 1,000 live births) are taken from World Bank-World Development Indicators.

How to determine economic fluctuations is another important issue. Arbache and Page (2007;2008), Conceicao and Kim (2009) and Conceicao *et al.* (2010b) define growth accelerations (good times) and growth deceleration (bad times) relative to a country's long-run economic performance. They define a growth acceleration as a period that satisfies the following four conditions: (i) the forward four-year moving average growth minus the backward four-year moving average growth > 0 for a given year, (ii) it exceeds the country's average growth, (iii) the forward four-year moving average GDP per capita exceeds the backward four-year moving average, and (iv) a growth acceleration episode requires at least three years in a

row satisfying conditions i-iii. The opposite of these three conditions is called decelerations. If neither of two sets of conditions applies, a period is considered as a "neutral" period.

Condition (i) identifies a kink in growth trend. If the forward average growth is higher than the backward average growth, the year is considered to be in an acceleration phase. If the sign of the difference in averages changes from positive to negative, or vice versa, it suggests a shift in the growth trend. Condition (ii) eliminates the long-term growth trend component, especially in countries with very low or very high growth rates for several of years. Condition (iii) considers the level of GDP, not the annual growth rates, to separate the growth acceleration episode from a recovery after a recession. Condition (iv) ensures the episode is not a temporary phenomenon for a few years, but a significant deviation from the underlying trend (Doytch, 2012).

Since we use four year moving averages to identify growth acceleration and deceleration episodes, the sample time period is from 1974 to 2007. Thus we have – panel data for 131 countries for 34 years[1]. Some data is unbalanced due to the unavailability of human development indicators for a few years.

3. Methodology and Regression Analysis

To find the historical relationship between human development indicators and growth fluctuations (Conceicao and Kim, 2009), we run the following regression using the panel data from 1974 to 2007:

$$HD_{i,t} = \beta_0 + \beta_1 ACC_{i,t} + \beta\, DEC_{i,t} + \varepsilon_{i,t}$$
$$i = 1, 2\ldots N \qquad t = 1, 2\ldots T$$

$HD_{i,t}$ is the level of a human development indicator for country i at time t; $ACCi,t$ is a dummy variable for episodes of growth accelerations; $DECi,t$ is a dummy variable for episodes of growth decelerations.

3.1. Pooled OLS Regression

As would be expected, the use of a pooled panel estimator leaves much variation unexplained, but the coefficients of accelerations and decelerations do capture the mean relationship between good and bad times and human development indicators (Conceicao and Kim, 2009). Therefore, the estimations were primarily made according to pooled OLS.

Firstly, the heteroscedasticity and autocorrelation tests for each model were conducted. For this purpose, White and Wooldridge tests were conducted and both heteroscedasticity and autocorrelation were found.[2] That is why a robust estimator straightened against heteroscedasticity and autocorrelation developed by Huber (1967), Eicker (1967) and White (1980) was used.

The OLS estimates of the coefficients are presented in Table 1. Overall, health related indicators show a statistically significant relationship with episodes of growth accelerations and decelerations. Life expectancy is about 1.3 years higher during episodes of growth accelerations and 6.0 years lower during episodes of growth decelerations; infant mortality is reduced by 6.6 per 1000 births during episodes of growth accelerations and increases by 22.3 per 1000 births during episodes of growth decelerations; under-5 mortality is 11.7 per 1000 births lower during economic good times but 36.3 per 1000 births higher during economic bad times.

[1] See Appendix 1 for countries covered in this study.

[2] To save spaces, the results for the homoscedasticity and autocorrelation test statistics are not reported here, but available upon request.

Table 1. Pooled OLS regression of human development indicators for all countries, 1974–2007

All countries	Life Expectancy	Infant Mortality Rate[1]	Under -5-Mortality Rate[2]	Adult Literacy Rate	GER
ACC	1.249 (0.344)***	-6.600 (1.340)***	-11.670 (2.232)***	4.582 (0.802)***	3.197 (0.648)***
DEC	-6.023 (0.528)***	22.334 (2.170)***	36.290 (3.842)***	-11.054 (1.385)***	-8.602 (1.015)***
Constant	65.278 (0.202)***	48.709 (0.794)***	72.150 (1.353)***	76.246 (0.490)***	63.371 (0.382)***
Observation	4454	4317	4317	4454	4454
R-squared	0.04	0.04	0.04	0.03	0.03
Number of Country	131	130	130	131	131

Notes: Robust standard error in parentheses. * significant at 10 percent ** significant at 5 percent; *** significant at 1 percent. (1) and (2) mean unbalanced due to unavailability of human development indicators for a few years.

The relationship between education outcomes and episodes of growth accelerations or decelerations is similar to health indicators. Adult literacy rate is about 4.6 years higher during episodes of growth accelerations and 11.1 years lower during episodes of growth decelerations; gross enrollment rate is about 3.2 years higher during episodes of growth accelerations and -8.6 years lower during episodes of growth decelerations. These coefficients estimates are all statistically significant.

For sub-country groups, the results obtained from pooled OLS estimation is parallel to the results for the whole panel set. Table 2 presents the pooled regression results for very (VHHD) and high human developed (HHD) countries. Life expectancy is higher by 0.64, infant mortality rate is lower by 4.6, under–5 mortality rate is lower by 6.4, adult literacy rate is higher by 2.7 and gross enrollment rate is higher by 4.6 percentage points during acceleration episodes. During growth deceleration episodes, the indicators are worse by 3.3, 9.7, 12.2, -5.9 and -5.0 percentage points, respectively. These estimates are all statistically significant.

Table 3 presents the pooled regression results for medium human developed (MHD) and low human developed (LHD) countries. Life expectancy is higher by 2.6, infant mortality rate is lower by 10.4, under–5 mortality rate is lower by 20.2, adult literacy rate is higher by 8.3 and gross enrolment rate is higher by 5.1 percentage point during acceleration episodes. During growth deceleration episodes, the indicators are worse by -3.2, 14.9, 26.2, -4.5 and -3.6 percentage points, respectively. These estimates are all statistically significant.

Table 2. Pooled OLS regression of human development indicators for very high and high human developed countries, 1974–2007

	Life Expectancy	Infant Mortality Rate[1]	Under -5-Mortality Rate[2]	Adult Literacy Rate	GER
ACC	0.640 (0.199)**	-4.573 (0.765)***	-6.410 (0.997)***	2.651 (0.448)***	2.486 (0.507)***
DEC	-3.309 (0.314)***	9.652 (1.482)***	12.159 (2.008)***	-5.894 (1.241)***	-5.019 (0.747)***
Constant	72.219 (0.125)***	22.206 (0.522)***	27.831 (0.708)***	90.727 (0.316)***	74.491 (0.305)***
Observation	2516	2401	2401	2516	2516
R-squared	0.04	0.04	0.03	0.03	0.03
Number of country	74	73	73	74	74

Notes: Robust standard error in parentheses. * significant at 10 percent ** significant at 5 percent; *** significant at 1 percent. [(1) and (2)] mean unbalanced due to unavailability of human development indicators for a few years.

Table 3. Pooled OLS regression of human development indicators for medium and low human developed countries, 1974–2007

	Life Expectancy	Infant Mortality Rate[1]	Under -5-Mortality Rate[2]	Adult Literacy Rate	GER
ACC	2.618 (0.456)***	-10.397 (1.804)***	-20.182 (3.289)***	8.289 (1.292)***	5.120 (0.934)***
DEC	-3.165 (0.539)***	14.859 (2.209)***	26.164 (4.230)***	-4.572 (1.735)***	-3.593 (1.280)***
Constant	55.471 (0.253)***	84.443 (1.011)***	131.789 (1.923)***	55.780 (0.760)***	47.656 (0.544)***
Observation	1938	1916	1916	1938	1938
R-squared	0.04	0.05	0.05	0.03	0.02
Number of country	57	57	57	57	57

Notes: Robust standard error in parentheses. * significant at 10 percent ** significant at 5 percent; *** significant at 1 percent. [(1) and (2)] mean unbalanced due to unavailability of human development indicators for a few years.

In summary, this asymmetric effect is valid both in terms of acceleration and deceleration periods and countries which are classified according to human development. In terms of acceleration and deceleration periods, the negative impact of deceleration on human development outcomes is greater than the positive impact of economic accelerations for all

countries. In the same way, for medium and low human development countries, the positive impact of economic acceleration is greater than the impact for very high and high development countries. And, for medium and low human development countries, the negative impact of economic decelerations is greater than the impact for very high and high development countries.

3.2. Fixed Effect Regression

To check the robustness of our panel regression results, we run fixed effect regression. We use fixed effect because in this case the sample that makes up the cross-sectional units is not obtained by some random sampling procedure. For example, any panel which is made up of time series observations over a group of countries that are brought together, either through membership in an organization like the OECD or geographical designation, such as the Middle East countries, should be investigated by using a fixed effects model (Erlat, 2011).

Since in panel data models the omission of individual and/or time effects can lead to biased estimates, the significance of such effects should be tested. The significance of individual and time effect may be tested jointly or separately by using the Fisher F tests. The five models used in pooled OLS were tested and the existence of both time and individual effects has been seen. But in the data set, since N>T, the model with only individual effects was preferred.

The hypotheses of fixed effects model: Independent variables and unit effects are not correlated with error terms; there is no multilinear connection between the independent variables; and the hypotheses of homoscedasticity and autouncorrelatedness and sometimes cross sectional correlation can be confronted. These three problems hinder the efficiency (Tatoglu, 2012). In addition, spatial and other forms of cross-sectional correlation are likely to be an important complicating factor in many empirical studies. Standard techniques which fail to take into account this spatial dependence will lead to inconsistent standard error estimates (Driscoll and Kraay, 1997).

Therefore, initially, the Modified Wald test for heteroskedasticity determination (Greene, 2000), the Bhargava, Franzini and Narendranathan's Durbin-Watson test for autocorrelation, and for cross sectional correlation, the Pesaran (2004) test were conducted.[3] As a result, it was found that the three problems mentioned above existed in the five models.

As already known, Parks-Kmenta, Beck-Katz and Driscoll-Kraay estimators provide resistant estimators in the case of heteroskedasticity, autocorrelation and cross sectional correlation. Driscoll-Kraay is a powerful estimator even in the case of N>T (Tatoglu, 2012, p.277). Therefore, estimations were made by means of fixed effects regression with Driscoll-Kraay standard errors. In addition, this robust estimator is suitable for use with both balanced and unbalanced panels (Hoechle, 2007, p.286).

The fixed effect regressions for all countries yield results in Table 4 Health (life expectancy, infant mortality rate, and under–5 mortality rate) and education related indicators (adult literacy rate and gross enrolment rate) are significantly related with episodes of growth accelerations and decelerations. The results are consistent with what we find in the pooled panel regressions. We can't find asymmetric impact on human development outcomes in fixed effect regressions.

Table 5 presents the fixed effect regression (Driscoll-Kraay Standard Error) of Human Development Indicators for VHH and HHD countries. For this group, infant mortality rate is lower by 4.0, under–5 mortality rate is lower by 5.6, and adult literacy rate is higher by 1.4 percentage point during acceleration episodes. Life expectancy is lower by 1.2 and gross enrolment rate is worse by 2.7 percentage points during deceleration episodes. There is no statistically significant improved in the life expectancy and gross enrollment rate when economic growth accelerates. In addition, there is no statistically significant deterioration in the adult literacy rate, infant mortality rate and under-5 mortality rate when economic growth decelerates.

[3] To save spaces, the results for the homoscedasticity, autocorrelation and cross sectional correlation test statistics are not reported here but available upon request.

Table 4. Fixed effect regression (Driscoll-Kraay standard error) of human development indicators for all countries, 1974–2007

	Life Expectancy	Adult Literacy Rate	GER	Infant Mortality Rate[1]	Under -5- Mortality Rate[2]
ACC	1.125 (0.411)***	2.701 (1.020)***	1.902 (0.973)**	-6.462 (2.004)***	-10.576 (3.151)***
DEC	-1.003 (0.580)*	-3.497 (1.622)**	-2.235 (1.364)*	5.052 (2.873)*	7.990 (4.668)*
Constant	64.804 (0.760)***	75.991 (1.727)***	63.078 (2.006)***	50.445 (3.614)***	74.754 (5.581)***
Observation	4454	4454	4454	4317	4317
Within R-squared	0.03	0.05	0.02	0.06	0.06
Number of country	131	131	131	130	130

Notes: Driscoll/Kraay standard error in parentheses. * significant at 10 percent ** significant at 5 percent; *** significant at 1 percent. [(1) and (2)] means unbalanced due to unavailability of human development indicators for a few years.

Table 5. Fixed effect regression (Driscoll-Kraay standard error) of human development indicators for very high human and high human developed countries, 1974–2007

	Life Expectancy	Infant Mortality Rate[1]	Under -5- Mortality Rate[2]	Adult Literacy Rate	GER
ACC	0.519 (0.369)	-4.043 (1.576)**	-5.629 (2.205)**	1.434 (0.636)**	1.463 (1.312)
DEC	-1.214 (0.627)*	3.750 (3.750)	4.792 (3.267)	-2.323 (1.475)	-2.650 (1.596)*
Constant	72.095 (0.787)***	22.521 (2.961)***	28.191 (3.633)***	90.794 (1.071)***	74.896 (2.249)***
Observation	2516	2401	2401	2516	2516
Within R-squared	0.02	0.04	0.04	0.03	0.02
Number of country	74	73	73	74	74

Notes: Driscoll/Kraay standard error in parentheses. * significant at 10 percent ** significant at 5 percent; *** significant at 1 percent. [(1) and (2)] means unbalanced due to unavailability of human development indicators for a few years.

Table 6 presents the fixed effect regression (Driscoll-Kraay Standard Error) of human development indicators for MHD and LHD countries. For this group, all health and education indicators improve during acceleration episodes. No indicators are statistically significant during growth deceleration episodes.

Table 6. Fixed effect regression (Driscoll-Kraay standard error) of human development indicators for medium and low human developed countries, 1974–2007

	Life Expectancy	Infant Mortality Rate[1]	Under -5-Mortality Rate[2]	Adult Literacy Rate	GER
ACC	2.197 (0.577)***	-10.789 (3.053)***	-18.701 (5.052)***	4.857 (1.733)***	3.006 (1.194)**
DEC	-0.545 (0.567)	4.535 (3.210)	8.026 (5.660)	-3.646 (1.688)**	-1.682 (1.116)
Constant	55.230 (0.751)***	85.921 (4.786)***	133.812 (8.055)***	56.564 (2.589)***	47.958 (1.666)***
Observation	1938	1916	1916	1938	1938
Within R-squared	0.06	0.08	0.08	0.08	0.03
Number of country	57	57	57	57	57

Notes: Driscoll/Kraay standard error in parentheses. * significant at 10 percent ** significant at 5 percent; *** significant at 1 percent. (1) and (2) means unbalanced due to unavailability of human development indicators for a few years.

4. Conclusion

This paper has examined the impact of growth fluctuation on human development indicators. Using the per capita growth rate and human development indicators for 131 countries between 1974 and 2007, we find that growth acceleration and deceleration have significant impact on the human development indicators. We also find that the effects are asymmetric. Statistically significant results were found contradicting theory and former empirical studies. This asymmetric effect is valid both in terms of acceleration and deceleration periods and countries which are classified according to human development. In terms of acceleration and deceleration periods, the negative impact of deceleration on human development outcomes is greater than the positive impact of economic accelerations for all countries. Similarly, for medium and low human development countries, the positive impact of economic acceleration is greater than the impact for very high and high development countries. And, for medium and low human development countries, the negative impact of economic decelerations is greater than the negative impact for very high and high development countries.

In summary, economic fluctuations are likely to affect human development. Results from aggregate analysis using country level data show that growth accelerations could be a boon to human development. However, growth decelerations are generally associated with an erosion of human development. Especially, the evidence suggests that children are vulnerable to the destructive effects of growth fluctuations. Therefore, in order to achieve 2023 Millennium Goals, more decisive and stable steps must be taken, especially for MHD and LHD countries, so that

economic growth reaches everyone and ensures everyone's utilization of economic opportunities.

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Appendix 1. Countries Covered in This Study

VHHDC	**HHDC**	**MHDC**	**LHDC**
Norway	Lithuania	Fiji	KENYA
Australia	Chile	Dominican Republic	Bangladesh
New Zealand	Argentina	China	Ghana
United States	Kuwait	El Salvador	Cameroon
Ireland	Latvia	Bolivia	Benin
Netherlands	Romania	Paraguay	Madagascar
Canada	Croatia	Philippines	Nepal
Sweden	Uruguay	Botswana	Togo
Japan	Libyan Arab Jamahiriya	Moldova (Republic of)	Lesotho
Korea (Republic of)	Panama	Mongolia	Nigeria
Switzerland	Saudi Arabia	Egypt	Uganda
France	Mexico	Uzbekistan	Senegal
Israel	Malaysia	Guyana	Djibouti
Finland	Bulgaria	Honduras	Côte d'Ivoire
Iceland	Trinidad and Tobago	Indonesia	Zambia
Belgium	Belarus	Kyrgyzstan	Rwanda
Denmark	Costarica	Tajikistan	Malawi
Spain	Peru	Viet Nam	Sudan
Hong Kong, China (SAR)	Albania	Morocco	Afghanistan
Greece	Russian Federation	Nicaragua	Ethiopia
Italy	Kazakhstan	Guatemala	Central African Republic
Luxembourg	Azerbaijan	India	Mali
Austria	Ukraine	Swaziland	Burkina Faso
United Kingdom	Iran (Islamic Republic of)	Lao People's Dem. Rep.	Liberia
Czech Republic	Mauritius	Cambodia	Chad
Slovenia	Brazil	Pakistan	Mozambique
Slovakia	Georgia	Congo Rep.	Burundi
United Arab Emirates	Venezuela (Bolivarian Rep. of)	-	Niger
Malta	Armenia	-	Congo (Dem. Rep of the)
Estonia	Ecuador	-	Zimbabwe
Cyprus	Colombia	-	-
Hungary	Jamaica	-	-
Brunei Darussalam	Tunisia	-	-
Qatar	Jordan	-	-
Bahrain	Turkey	-	-
Portugal	Algeria	-	-
Poland	Tonga	-	-
37	37	27	30