# Double Digit Economic Growth vs. Social Wellbeing in Ethiopia: A Cross-Country Comparison

Dawit Senbet[8] and Tadesse Wodajo[9]

**Abstract**

Ethiopia has been reporting double digit economic growth rates over the last decade, while at the same time being ranked as one of the impoverished nations in the world. Despite the 11.0 percent average annual real GDP growth rate since 2004, the Oxford Poverty and Human Development Initiative consistently ranks Ethiopia among the bottom three nations based on Multidimensional Poverty Index (MPI). In this paper, we investigate whether the reported economic growth has enhanced the wellbeing of the ordinary people. To address this objective, we employ three strategies. First, we divide the last two and half decades into pre- and post-2004 years, based on when Ethiopia has started registering double digit growth, to enable us conduct a pre- and post-double digit growth analyses. Second, we select other three countries also ranked as the poorest countries based on MPI, and compare their performances vis-à-vis Ethiopia using selected social welfare and human development indicators drawn from the World Development Indicators. Third, we use Johansen cointegration and Granger causality tests to examine the impact of economic growth on these social wellbeing measures. Our results show that one, the significant jump in economic growth is not matched by most of the social wellbeing measures. Two, there is no or little significant difference, in terms of these measures, between Ethiopia and the other impoverished countries that reported much slower economic growth than Ethiopia. Three, based on Johansen cointegration and Granger causality tests, we find no significant impact of the reported economic growth on the selected social wellbeing measures. In other words, there is no evidence of economic growth enhancing social wellbeing in Ethiopia.

**Keywords**: real Gross Domestic Product; real GDP; real GDP per capita; economic growth; social wellbeing; Granger causality; cointegration; Ethiopia; Multidimensional Poverty Index; MPI.

**JEL Classification**: O11, O15, O47, O55

[8] Department of Economics, University of Northern Colorado, Greeley, CO
[9] The Busch School of Business and Economics, Catholic University of America, Washington, D.C.

## 1. **Introduction**

It has been more than a decade since Ethiopia started reporting double digit economic growth rates. Based on the World Bank data for the period 2004 to 2014, Ethiopia's real GDP grew by an annual average rate of 11.0 percent and its real GDP per capita registered an impressive annual average growth rate of 8.1 percent. Such growth performance is comparable to the economic growth registered by the "Four Asian Tigers," Hong Kong, South Korea, Singapore, and Taiwan, at the peak of their performance between the early 1960s and 1990s. Many, including the IMF, dispute Ethiopia's reported growth as hyped in several occasions.[10] The main objective of this study, therefore, is to investigate whether Ethiopia's reported economic growth has resulted in improving the wellbeing of the ordinary people in the country. We employ three strategies in this study.

First, taking the reported Ethiopia's "growth miracle" at face value, we investigate whether it is generating a proportional impact on the wellbeing of the ordinary people by analyzing selected social welfare and human development indicators. For the purpose of this study, we divide the period of analysis into two: the pre-2004 years (between 1992 and 2003) and post-2004 years (between 2004 and 2014, the double digit economic growth years).[11] We compare the performance of the economy during the double digit economic growth period to that of the years preceding it by focusing on a set of macroeconomic indicators (with readily available data).

Second, we conduct cross-country comparisons of the performances of Ethiopia and a sample of countries based on selected social welfare and human development indicators drawn from the World Development Indicators. Recently, the Oxford Poverty and Human Development Initiative (OPHI) has developed an international measure of acute poverty, known as the Global Multidimensional Poverty Index (MPI) (Alkire and Santos 2010). The index is based on micro level surveys of households covering about 78% of the world population.[12] MPI covers three dimensions using ten indicators: Education (years of schooling and child school attendance), Health (child mortality and nutrition), and Standard of Living (electricity, improved sanitation, improved drinking water, floor type, cooking fuel and assets ownership). Assigning equal weight across dimensions and equal weight for each indicator within dimensions, a deprivation score is constructed for each person in the household. Based on a poverty cutoff of 33.33 percent, a person is said to be multidimensionally poor (or 'MPI poor') if his or her deprivation score meets or exceeds this threshold (Alkire and Robles 2015).[13]

[10] IMF (2013) estimated a 7% economic growth for 2012/13 and projected it to be 7.5% in 2013/14 and 2014/15. This contradicts with both World Bank and Ethiopia's estimates for the same years. For example, see World Bank (2016). IMF further argues that "Historical GDP statistics are official data and are subject to significant weaknesses. Applying plausible factor productivities would suggest that the annual GDP growth rate prior to 2011/12 could be overestimated by as much as 3 percentage points."

[11] The period before 1992 is not included to avoid the unstable macroeconomic performance in Ethiopia due to the war and uncertainty of the transition period. Also, as of writing of this paper, the latest complete World Bank data available are for 2014.

[12] For more information, see http://www.ophi.org.uk/

[13] In addition, if the score is 20-33.33%, the person is considered 'Vulnerable to Poverty,' and if the score is 50% or higher, the person is identified as being in 'Severe Poverty.'

Since this measure was developed in 2010, Ethiopia has been consistently ranked alongside the three most impoverished countries, despite its reported double digit economic growth rates in this period. To be fair and objective in our comparisons, we decided to compare the performance of Ethiopia to that of the other three most impoverished countries selected based on their average rankings in the last three years (2013, 2014 and 2015). The three-year average 'MPI poor' rankings identify the following four countries as the world's poorest countries (in that order): 1. Niger, 2. Ethiopia, 3. Burkina Faso, and 4. Mali.[14] For the sake of parallel comparison, we also divided the time period of growth performance of the comparison countries based on the period of analysis constructed for Ethiopia (pre- and post-2004 years). The fact that the pre- and post-2004 economic growth rates of the other three countries are not significantly different facilitates the comparison as Ethiopia's economic growth is substantially higher during the post-2004 years.

Third, although the comparative analysis is based on average values and growth rates of selected social wellbeing measures, which is descriptive analysis in nature, we employ the Johansen cointegration and Granger causality tests to determine the impact of Ethiopia's reported growth rate on the selected macroeconomic measures. The Johansen cointegration test helps determines whether there is any long-run relationships between real GDP per capita and other macroeconomic variables. The Granger causality test shows whether there is a directional movement from the real GDP per capita to the other macroeconomic indicators of social wellbeing. Based on availability of data for all countries in the comparison group, we selected the following social welfare and human development indictors for the cross-country comparative analysis: primary schooling gross enrolment ratio, depth of the food deficit, health expenditure per capita, access to improved water source, access to improved sanitation facilities, life expectancy at birth, child mortality rate, poverty head count ratio, and percent of the population with access to the Internet.[15]

Our findings from the cross-country comparisons show that Ethiopia's 8.1 percent annual average growth of real GDP per capita during the post-2004 years is approximately 3 to 9 times higher than the other countries. However, on closer inspection, Ethiopia failed to show any significant difference when it comes to the social wellbeing measures listed above. In addition, using Johansen cointegration and Granger causality tests, we do not find any evidence of the reported real GDP per capita or its growth rate impacting these social wellbeing measures in any significant way.

The study is organized as follows. Section two provides a briefly summary on the overall macroeconomic performance of Niger, Ethiopia, Burkina Faso and Mali. Section three compares and contrasts Ethiopia's pre- and post-2004 performance using the social welfare and human development indicators with that of the selected countries. Section four presents the Johansen and Granger causality tests that investigate the impact of real GDP per capita on the social

[14] See Appendix A for the details on the selection of the world's poorest countries based on the 3 year MPI rankings by the Oxford Poverty and Human Development Initiative (OPHI).

[15] The majority of these indicators are listed as Ethiopia's growth policy targets in IMF (2015), as they are within the four of the five areas identified by the county's national strategy (i.e., education, health, agriculture, access to water/sanitation, and roads).

welfare and human development indicators. Section five gives the summary and conclusion of the study.

**2. Comparison of the states of economies: Niger, Ethiopia, Burkina Faso and Mali**

This section provides a general overview of the performances of the Ethiopian economy vis-à-vis the countries selected for comparison (Niger, Burkina Faso and Mali) during the period of analysis covered by this study (1992 – 2014) using macroeconomic data obtained from the World Bank World Development Indicators (WDI). The level of performance of these economies as well as the trend over time are shown using the most commonly used macroeconomic indicators: real GDP per capita and its growth rate. Any ensuing analyses and discussions are deferred to later sections.

Based on their real GDP per capita, Niger, Ethiopia, Burkina Faso and Mali are at the bottom of the world economic echelon. All four countries' real GDP per capita were between 114 and 340 US$ in 1992, and only Burkina Faso was able to raise its per capita income to 511 US$ in 2014 (Figure 1).[16] Compared to the group, Burkina Faso and Mali attained high level of real GDP per capita during the post-2004 years. Burkina Faso's real GDP per capita seems to steadily rise during the majority of the study period: increasing from 281 US$ in 1992 to 386 US$ in 2004 and reaching 511 US$ in 2014, the highest for the group. Mali started at the top of the group (340 US$) and reached to 414 US$ in 2004 and 458 US$ in 2014.

On the other hand, Ethiopia's real GDP per capita has been at the bottom of the group for all years except for the last two years. Starting at a meager level of 114 US$ in 1992, the lowest in the group, Ethiopia's real GDP per capita grew to 149 US$ in 2004. Since then, the per capita income has been on a nearly exponential trajectory, doubling in about 10 years and reaching to 316 US$ in 2014. However, despite such rising trend, Ethiopia's real GDP per capita in 2014 is only marginally higher than that of Niger, a country whose real GDP per capita remained nearly the same during the 23-year period of analysis. Niger can be considered as a poor performer of the group only when viewed in terms of the change in the level of real GDP per capita over time. Niger's real GDP per capita exhibits a slight declining trend in pre-2004 years and a rising trend in post-2004 years, falling from 267 US$ in 1992 to 251 US$ in 2004 and rising to 293 US$ in 2014. Despite its variability, Niger's real GDP per capita has always been much higher than that of Ethiopia, except in 2013 and 2014 where Ethiopia gained a margin of 7 US$ and 23 US$, respectively, over Niger.

[16] Unless otherwise stated, all dollar values are reported in 'constant 2005 US dollars' (denoted as US$ hereafter).

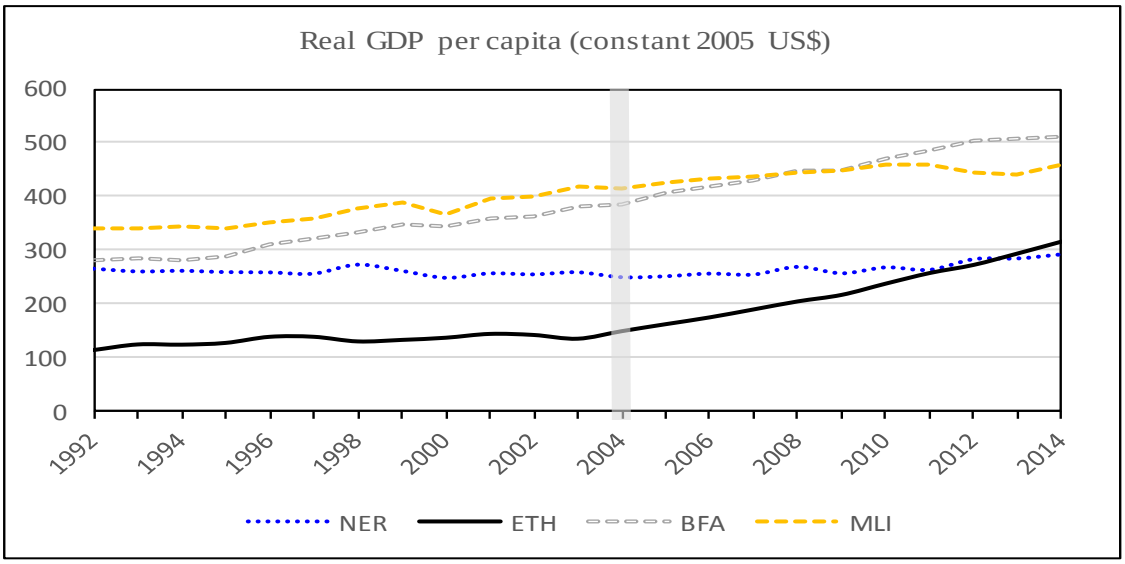


**Figure 1. Real GDP per capita of Niger, Ethiopia, Burkina Faso and Mali, 1992–2014**

Note: NER: Niger, ETH: Ethiopia, BFA: Burkina Faso and MLI: Mali
Source: Authors' calculations using data from the World Bank, WDI (1992-2014)

Each individual country's performance over the 23-year period of the study can also be analyzed in terms of its real GDP per capita growth rate. As shown in Figure 2, the real GDP per capita growth rates during the pre-2004 years fail to show any discernable pattern for all four countries, as their growth rates alternate between positive and negative values. In this period, their annual average GDP per capita growth rates were -1.0, 0.5, 2.4 and 1.3 percent for Niger, Ethiopia Burkina Faso and Mali, respectively. However, during the post-2004 years, their respective annual average real GDP per capita growth rates became 1.2, 8.1, 2.7 and 0.9 percent. While the annual average real GDP per capita growth rates of the other three countries seem to be less remarkable, Ethiopia's 8.1 percent annual average real GDP per capita growth rate (with its corresponding average annual real GDP growth of 11.0 percent) was a clear break from the pack. It should be noted that Ethiopia reported double digit real GDP growth rates (ranging from 10.3 to 13.6 percent) in nine of the 11 years of the post-2004 period. In contrast, Niger, Burkina Faso and Mali, respectively, registered annual average real GDP growth rates of 5.1, 5.9 and 4.1 percent in the same period.[17]

[17] The real GDP and real GDP per capita growth rates are computed using data from the World Bank, WDI (1992-2014).

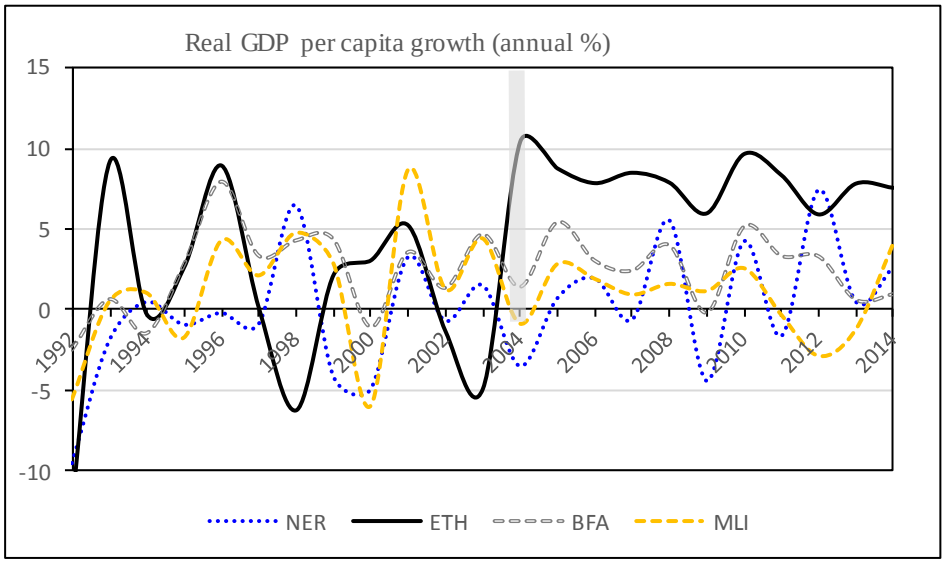


**Figure 2. Real GDP per capita growth rates of Niger, Ethiopia, Burkina Faso and Mali, 1992–2014**
Note: NER: Niger, ETH: Ethiopia, BFA: Burkina Faso and MLI: Mali
Source: Authors' calculations using data from the World Bank, WDI (1992-2014)

The next logical question one would ask is: What would the impact of Ethiopia's nearly a decade long double digit economic growth be on the wellbeing of the citizens of the country? One might also query how Ethiopia compares, in terms of selected social welfare and human development indicators, with Niger, Burkina Faso and Mali, which have registered relatively lower economic growth over the same time period. Would the economic growth rate that gave Ethiopia a clear break from the pack also result in clearly distinguishing the country in these social welfare and human development indicators? These issues are discussed in the proceeding sections.

## 3. Cross country comparisons of economic growth vs. social wellbeing measures

In this section, we investigate the impact of Ethiopia's much acclaimed real GDP growth on the wellbeing of the ordinary people in the country in contrast to the wellbeing of the people in the other poor countries. In other words, given the nearly a decade long double digit economic growth, in which the country excels, we examine whether Ethiopia also fares better in terms of the welfare of its people compared to the poorest countries in the world.

Table 1 presents a wide range of measures that capture the wellbeing of the ordinary citizens, characterized as social and human development indicators and are drawn from the World Development Indicators (WDI) database. These indicators are: primary school gross enrolment ratio, depth of the food deficit, health expenditure per capita, access to improved water source, access to improved sanitation facilities, life expectancy at birth, child mortality rate, poverty head count ratio, and percent of the population with access to the Internet.

During the post-2004 period, the gross enrollment ratio at primary schools is 59.5, 89.0, 73.4 and 78.4 percent for Niger, Ethiopia, Burkina Faso and Mali, respectively.[18] For all four countries, the percentage changes from the pre-2004 averages are 85.1, 78.9, 65.3 and 59.9, respectively. In terms of the level achieved in the post-2004 period, Ethiopia, Mali and Burkina Faso, in that order, are the best performers in gross primary enrollment.

[18] According to the World Bank, gross enrollment ratio is defined as "total enrollment in primary education, regardless of age, expressed as a percentage of the population of official primary education age." It could be more than 100% if there are over- and under-aged students enrolled due to late or early school entrance and grade repetition.

**Table 1. Comparisons of economic growth to social welfare and human development indicators: Niger, Ethiopia, Burkina Faso and Mali**

| Selected Development Indicators | Niger | | | Ethiopia | | | Burkina Faso | | | Mali | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average 1992-2003 | Average 2004-2014 | % Change | Average 1992-2003 | Average 2004-2014 | % Change | Average 1992-2003 | Average 2004-2014 | % Change | Average 1992-2003 | Average 2004-2014 | % Change |
| GDP per capita (constant 2005 US$) | 260.7 | 267.3 | 2.6 | 132.1 | 224.7 | 70.1 | 324.3 | 455.5 | 40.4 | 368.3 | 442.7 | 20.2 |
| Real GDP per capita growth | -1.0 | 1.2 | - | 0.5 | 8.1 | - | 2.4 | 2.7 | - | 1.3 | 0.9 | - |
| Real GDP growth | 2.6 | 5.1 | - | 3.7 | 11.0 | - | 5.3 | 5.9 | - | 4.2 | 4.1 | - |
| Gross enrolment ratio, primary, both sexes (%) | 32.1 | 59.5 | 85.1 | 49.7 | 89.0 | 78.9 | 44.4 | 73.4 | 65.3 | 49.0 | 78.4 | 59.9 |
| Depth of the food deficit (kilocalories per person per day) | 192.6 | 80.5 | -58.2 | 549.8 | 304.7 | -44.6 | 170.7 | 193.5 | 13.4 | 102.8 | 41.9 | -59.2 |
| Health expenditure per capita, PPP (constant 2011 international $) | 38.4 | 50.5 | 31.7 | 18.8 | 51.6 | 174.8 | 41.6 | 83.7 | 101.1 | 63.2 | 94.4 | 49.2 |
| Improved water source (% of population with access) | 41.2 | 53.0 | 28.5 | 24.2 | 45.9 | 89.8 | 58.0 | 75.9 | 30.8 | 41.7 | 64.8 | 55.5 |
| Improved sanitation facilities (% of population with access) | 5.9 | 9.2 | 55.5 | 6.2 | 20.4 | 228.3 | 10.5 | 16.7 | 6.9 | 17.0 | 22.0 | 29.4 |
| Life expectancy at birth, total (years) | 48.9 | 57.3 | 17.3 | 50.7 | 60.1 | 18.4 | 50.3 | 56.1 | 11.6 | 48.4 | 55.3 | 14.1 |
| Mortality rate, under-5 (per 1,000) | 253.5 | 136.0 | -46.3 | 159.9 | 84.5 | -47.1 | 187.7 | 125.1 | -33.3 | 227.4 | 145.3 | -36.1 |
| Poverty headcount ratio at $3.10 a day (2011 PPP) (% of population) | 93.5 | 87.3 | -6.6 | 87.1 | 73.7 | -15.3 | 85.2 | 80.5 | -5.5 | 86.2 | 76.9 | -10.7 |
| Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population) | 38.6 | 26.1 | -32.5 | 61.6 | 34.9 | -43.3 | 69.4 | 55.3 | -20.4 | 37.4 | 16.3 | -56.3 |
| Internet users (per 100 people) | 0.1 | 0.9 | - | 0.0 | 0.9 | - | 0.1 | 2.9 | - | 0.1 | 2.1 | - |

Source: Authors' calculations using data from the World Bank, WDI (1992-2014)

The depth of food deficit, the calories required to bring someone out of malnourishment state, is very high in Ethiopia even during the post-2004 period.[19] During this period, a typical malnourished person in Ethiopia needs on average an extra 305 kilocalories of consumption per day, while the corresponding numbers are only 81, 194 and 42 kilocalories in Niger, Burkina Faso and Mali, respectively. The level of the depth of food deficit in Ethiopia during its double digit growth period is even higher than the pre-2004 levels in all the other countries. In addition, looking at the percentage change in the average depth of the food deficit over the pre- and post-2004 period, Niger and Mali did better in reducing the food deficit (-58.2 and -59.2 percent, respectively) compared to Ethiopia (-44.6 percent), which managed to reduce the level of food deficit 13.6 to 14.6 percentage points less than these countries. Burkina Faso is the poor performer of the group because depth of the food deficit increased during the post-2004 period.

Ethiopia's health expenditure per capita, access to improved water source and access to improved sanitation facilities have registered higher percentage changes in the post-2004 years vis-à-vis the pre-2004 levels (174.8, 89.8 and 228.3 percent, respectively) compared to the other countries. However, while it is encouraging to see such spectacular percentage changes, it is important to note that all of these changes are driven by a lower starting point rather than being an improvement over a threshold reflective of decent quality of life. The average values for the three indicators during the post-2004 period are $51.60 annual health expenditure per capita, 45.9 percent of the population having access to improved water source, and 20.4 percent having access to improved sanitation facilities.[20] These values are, for the most part, significantly lower than those of Burkina Faso and Mali and about the same or lower than Niger's.

The improvement in Life expectancy and child mortality rate is higher in Ethiopia than in the other three countries. In Ethiopia, life expectancy at birth rose to 60.1 years during the post-2004 period, 3 to 5 years higher than the other countries in the same period. The improvement in child mortality rate, however, is significantly higher in Ethiopia than in the other countries, the post-2004 average under-five mortality rate being nearly 85 (per 1,000) compared to Niger's 136, Burkina Faso's 125 and Mali's 145.[21]

Looking at the post-2004 averages, the percentage of the population living in poverty, as measured by $3.10 a day (2011 PPP), are still very high in all four countries (87.3, 73.7, 80.5 and 76.7 percent for Niger, Ethiopia, Burkina Faso and Mali, respectively).[22] Being able to reduce this poverty level by an average of 15.3 percent in the post- compared to pre-2004 period, Ethiopia seems to fare better than the other countries in the group. However, if we consider the extreme poverty level, as measured by $1.90 a day (2011 PPP), Ethiopia portrays a different

[19] According to the World Bank, "the depth of the food deficit indicates how many calories would be needed to lift the undernourished from their status, everything else being constant." Hence, the smaller the number, the better.

[20] The latest data (2014) for the three indicators are $72.90, 55.4% and 26.8%, respectively (World Bank, WDI (1992-2014)).

[21] According to the World Bank, "under-five mortality rate is the probability per 1,000 that a newborn baby will die before reaching age five, if subject to age-specific mortality rates of the specified year." Hence, the smaller the number, the better.

[22] The World Bank defines this poverty level as "the percentage of the population living on less than $3.10 a day at 2011 international prices." Hence, lower percentage indicates lower poverty level, because as the percentage of the people under poverty line gets larger, the percentage of people above the poverty line becomes smaller.

picture.[23] While on average 34.9 percent of Ethiopia's population live under extreme poverty earning $1.90 or less a day (2011 PPP) during the post-2004 years, relatively smaller proportion of people are exposed to such extreme poverty in Niger (26.1%) and Mali (16.3%) during the same period. Based on these two poverty measures, one may infer that, during the double digit economic growth years, on average nearly 74 percent of the people in Ethiopia are living under a $3.10 a day (2011 PPP) poverty line, and nearly half of them are exposed to extreme poverty ($1.90 a day, 2011 PPP).

Finally, on average nearly one person out 100 people is observed to have access to the Internet in Niger and Ethiopia during the post-2004 years. But in Burkina Faso and Mali on average 2 or 3 of every 100 people have access to the Internet.[24] Therefore, despite its double digit economic growth, the overall penetration of the Internet in Ethiopia is not only extremely low but also substantially lower than Burkina Faso and Mali.

To sum, Figure 3 shows the trend of the social welfare and human development indicators selected from Table 1 over the entire period of study (1992 – 2014).[25] Compared to the three poorest countries used for comparison, Ethiopia has done better in a few areas (e.g., gross primary enrollment and mortality rate under-5) while her performance is about the same in some areas (e.g., life expectancy at birth and access to improved sanitation facilities) and worse in other areas (e.g., health expenditure per capita and depth of the food deficit). However, even in the social wellbeing measures Ethiopia seems to perform better we fail to observe a jump as distinctive and similar to the one observed in its double digit economic growth in the post-2004 years. Figure 3 reveals that the double digit growth episode is not reflected in almost all of the social wellbeing measures under consideration since the measures seem to follow the same smooth trend during the 23-year period.

Based on what have been displayed in Table 1 and Figure 3, one observes some improvement in Ethiopia over time in some of the social welfare measures, examples include: gross primary enrollment (increased), life expectancy at birth (increased) and child mortality rate (decreased). However, such improvement is not unique to Ethiopia alone as it is observed in the other three countries selected for comparison as well. The main point at issue here is then: whether or not the much acclaimed economic growth rates reported in post-2004 years, which gave Ethiopia a clear break from the pack, have also resulted in clearly distinguishing the country in the selected social welfare and human development measures.

Given Ethiopia's near exponential growth rate of real GDP per capita averaging at 8.1 percent (with corresponding average real GDP growth rate of 11.0 percent) since 2004, it would not be unrealistic if one expects at least some of the social wellbeing measures to show a similar pattern

[23] As a measure of extreme poverty, the World Bank defines this poverty level "as the percentage of the population living on less than $1.90 a day at 2011 international prices." Again, lower percentage indicates lower poverty level.

[24] According to the World Bank, WDI (1992-2014), as of 2014, the number of Internet users per 100 people is nearly 2 in Niger, 3 in Ethiopia, 9 in Burkina Faso and 7in Mali.

[25] Figure 3 does not include the time trends for four of the social welfare and human development indicators: for poverty headcount ratios at $1.90 and $3.10 a day, data are not available for majority of the years in the period of analysis; improved water source displays similar information as improved sanitation facilities; and no discernable trend is observed in all countries for Internet users per 100 people.

compared to the other countries in the group. Nevertheless, none of the social wellbeing measures seem to exhibit a pattern that distinctively distinguishes Ethiopia from her peers (i.e., Niger, Burkina Faso and Mali). Rather, as discussed above, with the exception of a couple of measures, Ethiopia either fares with or performs worse than the other countries in the group in most of the social wellbeing measures under consideration.

Particularly, it is important to note that Ethiopia's 8.1 percent average annual real GDP per capita growth for post-2004 years is about 7, 3 and 9 times higher than that of Niger, Burkina Faso and Mali in the same period, respectively (Table 1).[26] Even in the two measures Ethiopia seems to excel, namely, gross primary enrollment and mortality rate under-5, the country's achievement is only marginally higher than that of the comparison group countries (see Figure 3.3.1 and Figure 3.3.6). Accordingly, the annual average gross enrollment ratio in Ethiopia (89.0%) in post-2004 years is about 1.5, 1.2 and 1.1 times higher than that of Niger, Burkina Faso and Mali in the same years, respectively. At an average mortality rate of 84.5 per 1000 children under 5 years of age in post-2004 years, the 'reduction in mortality rate' in Ethiopia is about 1.6, 1.5 and 1.7 times higher than that of Niger, Burkina Faso and Mali in the same years, respectively.

[26] In percentage terms these translate into 575%, 200% and 800%, respectively.

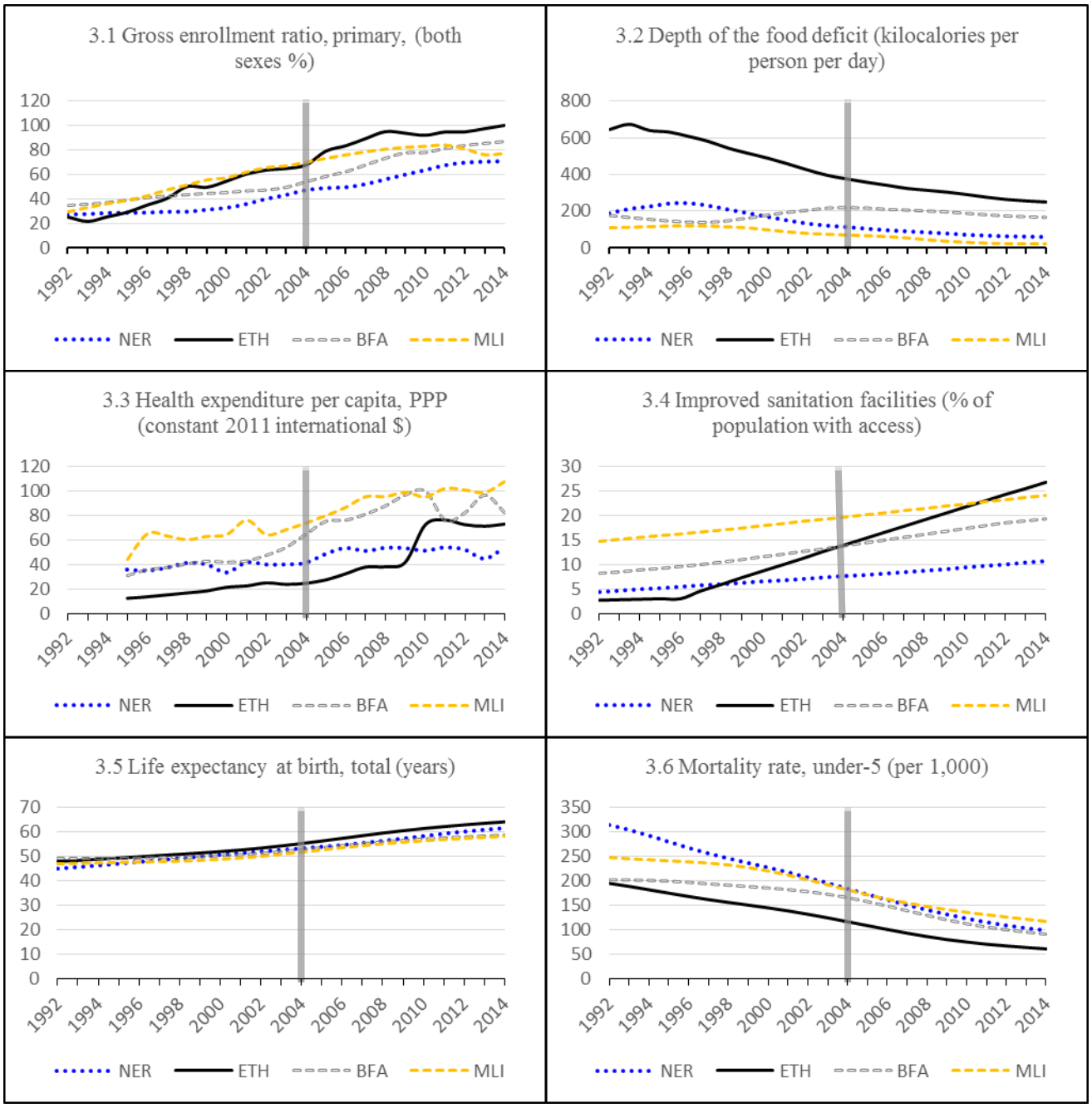


**Figure 3. Trends of selected social welfare and human development indicators, 1992-2014**

## 4. Empirical results

### 4.1. Background

The Granger causality test (Granger 1988) examines whether the lagged values of a time-series variable helps predict another variable. Suppose that we have two time series variables, $\{Y_t\}$ and $\{X_t\}$, and that the forecast of their future values are based on their past information (i.e., on their lagged vales). Then, Granger causality is defined as follows (Lin 2008):

$X_t$ does not Granger cause $Y_t$ if for all $m > 0$,

$$F(Y_{t+m}|\psi_t) = F(Y_{t+m}|\psi_t - X_t)$$

Where $F(\cdot|\cdot)$ denotes the conditional distribution and $(\psi_t - X_t)$ is all the information in the universe except the information contained in the time series variable $\{X_t\}$. In other words, $X_t$ is said not to Granger cause $Y_t$ if it does not add any value (or information) in predicting $Y_t$. Granger causality tests the absence of causality, which means, if we fail to reject the null hypothesis (or "accept" the null hypothesis), then there is no Granger causality in the direction specified.

Specifically, the casual relationship between $Y_t$ and $X_t$ is examined through the Granger causality test as:

$$Y_t = \alpha_1 + \sum_{i=1}^{n_1} \beta_{1i} Y_{t-i} + \sum_{j=1}^{m_1} \theta_{1j} X_{t-j} + \varepsilon_t$$

$$X_t = \alpha_2 + \sum_{i=1}^{n_2} \beta_{2i} Y_{t-i} + \sum_{j=1}^{m_2} \theta_{2j} X_{t-j} + \omega_t$$

Where $n_1, m_1, n_2$ and $m_2$ are all integers and $\varepsilon_t$ and $\omega_t$ are random errors in both models. We test the null hypothesis of $\theta_{1j} = 0$, for all $j$ to determine if $X$ Granger causes $Y$. Similarly, we test the null hypothesis of $\beta_{2i} = 0$, for all $i$ to test if $Y$ Granger causes $X$. In all cases, the lag length is determined by Akaike Information Criteria (AIC).

In order to make an appropriate Granger causality test, the first task is to determine if the variables are stationary, or to determine the order of integration if the variables are found to be non-stationarity.[27] If two or more variables have an order of integration I(1) or higher, then we test for cointegration to determine whether the variables have long-term relationships (i.e., if their linear combinations turn out to be stationary or not). Typically, this is done using the Johansen cointegration test (Johansen 1991). If the variables are cointegrated, then we conduct the Granger causality test on the levels of the variables (without differencing) to capture the long-term causality, if there is one. However, if the variables are not cointegrated, then the Granger causality test should be conducted to determine the existence of a short-run relationship, if any (i.e., the test is conducted on the first difference, second difference, or growth rate of the variables, whichever makes them I(0)).

[27] A stationary time series is defined as the time series data with statistical properties such as mean, variance and autocorrelation constant over time. The order of integration could be thought of as the number of times a variable needs to be differenced to achieve stationarity. Therefore, if a variable is I(1), it means that the variable becomes stationary after the first difference. If it is I(2), it should be differenced twice before it becomes stationary. If it is I(0), then the variable is said to be stationary at level.

### 4.2. Cointegration and Granger causality tests

We begin by examining the stationarity of the variables of interest. We include all the variables reposted in Table 1 except those lacking continuous time series data for the entire period of analysis under consideration. The results of the ADF tests are reported in Table 2.

**Table 2. Unit root test (Augmented Dickey–Fuller, ADF test)**

| Variable | Level | | First Difference | | Result |
|---|---|---|---|---|---|
| | ADF statistic (with constant) | ADF statistic (with constant & trend) | ADF statistic (with constant) | ADF statistic (with constant & trend) | |
| Real GDP per capita | 4.55 [0] | 0.98 [0] | -0.38 [0] | -3.95* [0] | I(1) |
| Gross enrolment ratio, primary, both sexes (%) | -0.82 [0] | -1.19 [0] | -4.46** [0] | -4.78** [0] | I(1) |
| Depth of the food deficit (kilocalories per person per day) | -5.49** [4] | -3.28* [4] | - | - | I(0) |
| Health expenditure per capita, PPP (constant 2011 international $) | -0.10 [0] | -1.87 [0] | -3.61** [0] | -3.56* [0] | I(1) |
| Improved water source (% of population with access) | -0.76 [0] | -2.77 [0] | -4.07** [0] | -3.89** [0] | I(1) |
| Improved sanitation facilities (% of population with access) | -0.33 [0] | -2.84 [1] | -3.44* [2] | -2.33 [0] | I(1) |
| Life expectancy at birth, total (years) | -2.80* [3] | -4.79** [3] | - | - | I(0) |
| Mortality rate, under-5 (per 1,000) | -2.75* [1] | -5.09** [1] | - | - | I(0) |

Notes: Numbers in the brackets denote the lag length.
** Significant at 1 percent, * Significant at 5 percent

As reported in Table 2, real GDP per capita, gross enrolment ratio, health expenditure per capita, improved water source and improved sanitation facilities are all non-stationary. On the other hand, depth of the food deficit, life expectancy and under-5 mortality rate are stationary at level. All the non-stationary variables become stationary after the first difference except the real GDP per capita. To attain stationarity, GDP per capita should be differenced twice, implying an exponential behavior of the variable.[28] To conserve a degree-of-freedom, we take the logarithm of real GDP per capita and then difference it once to achieve stationarity. This also facilitates a better interpretation as the first difference of a logarithm produces a growth rate. Therefore, for the short-run Granger causality test (for variables not cointegrated), we use growth rate for GDP per capita and first differences for the rest of the variables.[29]

[28] Figure 1 shows the nearly exponential trajectory of Ethiopia's GDP per capita.
[29] We also run the same test using twice differenced real GDP per capita, nonetheless, the qualitative conclusions (findings) remain the same.

The Johansen cointegration tests between real GDP per capita and the other non-stationary variables are reported in Table 3. For robustness check, we show both the Trace and Maximal Eigenvalue tests. A significant level of 5 percent or better is chosen to reject the null hypotheses. For all tests, we choose the lag length using the Akaike Information Criterion (AIC) on the respective pair-wise vector autoregressive (VAR) models before the Johansen test.

**Table 3. Johansen cointegration tests between real GDP per capita and variables of I(1)**

| Real GDP per capita AND Gross enrolment ratio, primary, both sexes (%) | | | | | | |
|---|---|---|---|---|---|---|
| Null Hypothesis ($H_0$) | Trace Test | p-value | Result | Maximal Eigenvalue Test | p-value | Result |
| $r \leq 0$ | 11.292 | 0.194 | Not Reject $H_0$ | 11.216 | 0.144 | Not Reject $H_0$ |
| $r \leq 1$ | 0.076 | 0.782 | Not Reject $H_0$ | 0.076 | 0.782 | Not Reject $H_0$ |
| Real GDP per capita AND Health expenditure per capita, PPP (constant 2011 international $) | | | | | | |
| $r \leq 0$ | 0.473 | 0.076 | Not Reject $H_0$ | 10.898 | 0.159 | Not Reject $H_0$ |
| $r \leq 1$ | 0.180 | 0.067 | Not Reject $H_0$ | 3.356 | 0.067 | Not Reject $H_0$ |
| Real GDP per capita AND Improved water source (% of population with access) | | | | | | |
| $r \leq 0$ | 0.448 | 0.119 | Not Reject $H_0$ | 12.460 | 0.095 | Not Reject $H_0$ |
| $r \leq 1$ | 0.021 | 0.508 | Not Reject $H_0$ | 0.439 | 0.508 | Not Reject $H_0$ |
| Real GDP per capita AND Improved sanitation facilities (% of population with access) | | | | | | |
| $r \leq 0$ | 17.05 | 0.029* | Reject $H_0$ | 17.052 | 0.018* | Reject $H_0$ |
| $r \leq 1$ | 0.001 | 0.978 | Not Reject $H_0$ | 0.001 | 0.978 | Not Reject $H_0$ |

Notes: r is the number of cointegrating vectors.
* Significance at 5 percent

As the results show, there is no cointegration between real GDP per capita and the following variables: gross primary enrolment ratio, health expenditure per capita, or improved water source. That means, there is no long run relationship between real GDP per capita and one of these variables, for the given data under the time frame of consideration. However, we observe at least one cointegrating vector between real GDP per capita and improved sanitation facilities.

The above results determine the type of Granger causality test we should conduct. Granger causality test requires using the same order of integration for both variables under investigation. If one of the two variables are stationary (or I(0)), then the other variable should also be I(0). If both variables are I(1) and cointegrated, then the Granger causality test is conducted on level. For the case at hand, since there is no long-run relationship between real GDP per capita and the first three variables, we run Granger causality test on real GDP per capita growth (I(0)) on the first difference of gross enrolment ratio, health expenditure per capita and improved water source (which are all I(0), as shown in Table 2).

Table 4 presents the null hypothesis of Granger causality test with the corresponding F-statistic and p-value. Again, we use a significance level of 5 percent or better for hypothesis testing. We test the Granger causality in both directions. Not rejecting the null hypothesis (or "accepting" the null) is evidence for lack of Granger causality in a given direction. Accordingly, we find no evidence of short-run Granger causality between real GDP per capita growth and depth of the

food deficit, life expectancy at birth and under-5 mortality rate. We also find no evidence of long-run (cointegration) and short-run Granger causality between real GDP per capita growth and gross enrolment ratio, health expenditure per capita and improved water source. On the other hand, we observe a long-run relationship (cointegration) between real GDP per capita growth and improved sanitation facilities. The Granger causality test shows that the direction of the relationship goes from improved sanitation facilities to real GDP per capita growth rather than the other way around.

In summary, the Johansen cointegration test determines if there is a long-run equilibrium between two variables, while the Granger causality test determines if the information set of one variable helps predict the other variable, even though they do not have a strict cause-effect relationship in the traditional sense. We set out to investigate if there is a relationship (long-run or short-run) between Ethiopia's near exponential real GDP per capita growth and a set of variables that impact the life of ordinary citizens. Our findings show that we cannot find a significant Granger causality from the reported real GDP per capita to gross enrolment ratio of primary schooling, depth of the food deficit, health expenditure per capita, improved water source, improved sanitation facilities, life expectancy at birth, and child (under-5) mortality rate.

**Table 4. Granger causality test results**

| Null Hypothesis | F-Stat. | p-value‡ | Result |
|---|---|---|---|
| Real GDP per capita growth DOES NOT Granger cause Gross enrolment ratio, primary, both sexes† | 0.454 | 0.508 | Accepted |
| Gross enrolment ratio, primary, both sexes† DOES NOT Granger cause Real GDP per capita growth | 1.108 | 0.306 | Accepted |
| Real GDP per capita growth DOES NOT Granger cause Depth of the food deficit | 1.193 | 0.329 | Accepted |
| Depth of the food deficit DOES NOT Granger cause Real GDP per capita growth | 3.585 | 0.052 | Accepted |
| Real GDP per capita growth DOES NOT Granger cause Health expenditure per capita† | 0.149 | 0.705 | Accepted |
| Health expenditure per capita† DOES NOT Granger cause Real GDP per capita growth | 0.044 | 0.837 | Accepted |
| Real GDP per capita growth DOES NOT Granger cause Improved water source† | 3.492 | 0.078 | Accepted |
| Improved water source† DOES NOT Granger cause Real GDP per capita growth | 1.313 | 0.267 | Accepted |
| Real GDP per capita DOES NOT Granger cause Improved sanitation facilities† | 1.956 | 0.178 | Accepted |
| Improved sanitation facilities† DOES NOT Granger cause Real GDP per capita | 3.794 | 0.037* | Rejected |
| Real GDP per capita growth DOES NOT Granger cause Life expectancy at birth | 1.470 | 0.269 | Accepted |
| Life expectancy at birth DOES NOT Granger cause Real GDP per capita growth | 2.280 | 0.128 | Accepted |
| Real GDP per capita growth DOES NOT Granger cause Mortality rate, under-5 | 1.885 | 0.182 | Accepted |
| Mortality rate, under-5 DOES NOT Granger cause Real GDP per capita growth | 1.683 | 0.219 | Accepted |

Notes: † The variables are non-stationary at level and stationary at first difference. Therefore, the first differences are used here.
‡ MacKinnon, Haug & Michelis (1999) p-values.
* Significant at 5 percent.

## 5. Conclusion

Ethiopia has been reporting a major economic expansion since 2004. The country has been reporting economic growth rates that amount to an economic explosion, registering an impressive 11.0 percent annual average real GDP and 8.1 percent annual average real GDP per capita growth rates over the last decade. Given the nearly a decade long double digit real GDP growth rates, one might wonder how these growth rates would impact on certain key social wellbeing measures.

In this paper, we investigated whether the reported decade long double digit growth rates have also generated a parallel shift in some selected social wellbeing measures. Focusing on measures that capture the quality of life of the ordinary people, the following social welfare and human development indicators are selected for this study: gross enrolment ratio of primary schooling, depth of the food deficit, health expenditure per capita, access to improved water source, access to improved sanitation facilities, life expectancy at birth, child mortality rate, poverty head count ratio at the World Bank's poverty lines of $3.10 and $1.90 a day, and proportion of people with

access to the Internet. We employed descriptive comparative analyses and econometric estimations (Johansen cointegration and Granger causality tests). We analyzed Ethiopia's pre- and post-2004 economic performances vis-à-vis the above selected variables to investigate whether or not they mirror the level and trend of the reported real GDP and real GDP per capita growth rates, individually or as a group.

In addition, for cross-country comparisons, we selected three countries ranked as the poorest countries in the world (along with Ethiopia) by the Oxford Poverty and Human Development Initiative (OPHI): Niger, Burkina Faso and Mali. These countries are used to make performance comparisons with Ethiopia using Ethiopia's before and after double digit growth years as reference. The basic question we attempted to answer is: How do these countries, with economic growth rates that are 575, 200 and 800 percent, respectively, lower than Ethiopia, fare in terms of the selected social welfare and human development indicators?

Our findings show that first, in the majority of the cases, the selected social welfare and human development measures hardly mirror the reported high real GDP or real GDP per capita growth rates, particularly in terms of the size of changes over time. Second, despite her several times higher GDP per capita growth rates compared to countries in the comparison group, Ethiopia's achievement is only marginally higher than that of her peers in two of the selected measures and nearly the same or worse than them in the rest of the measures.

Third, either real GDP or real GDP per capita (or its growth rate) is not cointegrated (i.e., has no long-run relationship) with all of the social welfare and human development measures, except with access to improved sanitation facilities. Fourth, we did not find any evidence of Granger causality (i.e., directional causality) between real GDP per capita and gross primary enrolment ratio, depth of the food deficit, health expenditure per capita, access to improved water source, life expectancy and child (under-5) mortality rate. The only significant Granger causality found was in the direction from access to improved sanitation facilities to real GDP per capita. Even in this case, the lack of Granger causality in the reverse direction fails to fully justify whether or not the observed Granger causality could just be a statistical noise.

In conclusion, if Ethiopia has indeed achieved double digit economic growth rates in nearly all the post-2004 years, we could not find any significant evidence confirming the impact of these growth rates on measures that show improvements in the quality of life of the ordinary people. Such unprecedented divergence between the reported economic growth rates and the social wellbeing measures may warrant an in-depth study of the sources of economic growth in Ethiopia.

**Appendix A. Selection of countries for comparison based on MPI rankings**

| Country | 2015 MPI Ranking | 2014 MPI Ranking | 2013 MPI Ranking | 3-Year Average | Ranking Based on the 3-Year Average |
|---|---|---|---|---|---|
| Niger | 2 | 1 | 1 | 1.3 | 1 |
| Ethiopia | 3 | 2 | 2 | 2.3 | 2 |
| Burkina Faso | 5 | 4 | 5 | 4.7 | 3 |
| Mali | 9 | 3 | 3 | 5 | 4 |
| Somalia | 6 | 5 | 8 | 6.3 | 5 |
| Burundi | 8 | 9 | 4 | 7 | 6 |
| Guinea | 12 | 6 | 7 | 8.3 | 7 |
| Liberia | 14 | 7 | 6 | 9 | 8 |
| Sierra Leone | 7 | 15 | 10 | 10.7 | 9 |
| DR Congo | 13 | 13 | 12 | 12.7 | 10 |
| Mozambique | 16 | 14 | 9 | 13 | 11 |
| Uganda | 15 | 16 | 14 | 15 | 12 |
| Chad | 4 | 22 | 21 | 15.7 | 13 |
| Timor-Leste | 18 | 17 | 16 | 17 | 14 |
| Rwanda | 17 | 21 | 15 | 17.7 | 15 |
| Madagascar | 19 | 18 | 17 | 18 | 16 |
| South Sudan | 1 | na | na | na | na |
| Central African Republic | 10 | 11 | na | na | na |
| Guinea-Bissau | 11 | 8 | na | na | na |
| Afghanistan | 20 | 19 | na | na | na |

Source: Authors' calculations using 2013-2015 MPI reports

Notes: The numbers in the table indicate the ranking of each country based on its MPI in the respective years, where the lower the number the poorer the country. Column 4 gives the 3-year average rankings based on which the countries are sorted from low to high as shown in the last column. The bottom four poorest countries of the world are (in that order): Niger, Ethiopia, Burkina Faso and Mali.

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