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A Quality of Growth Index for Developing Countries: A Proposal

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Abstract This paper proposes a new quality of growth index for developing countries. The index encompasses both the intrinsic nature and social dimensions of growth, and is computed for over 90 countries for the period 1990–2011. The approach is premised on the fact that not all growth is created equal in terms of social outcomes, and that it does matter how one reaches from one level of income to another for various theoretical and empirical reasons. The paper finds that the quality of growth has been improving in the vast majority of developing countries over the past two decades, although the rate of convergence is relatively slow. At the same time, there are considerable cross-country variations across income levels and regions. Finally, empirical investigations point to the fact that main factors of the quality of growth are political stability, public pro-poor spending, macroeconomic stability, financial development, institutional quality and external factors such as FDI.

Keywords Quality of growth · Social indicators · Poverty

JEL Classification O40 · O55 · I10 · I20 · I32

1 Introduction

Recent history has shown that high growth on its own does not necessarily lead to good social outcomes. It matters if growth is inclusive or not. Thus, inclusiveness is an essential ingredient of any successful growth strategy. The concept has yet to be rigorously documented, as it is used to convey several aspects of growth. Numerous papers have proposed different definitions. For instance, the Commission on Growth and Development (2008) notes that inclusiveness of growth is associated with equity, equality of opportunity, and

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protection in market and employment transitions. In a similar vein, Ianchovichina and Lundstrom Gable (2012) define inclusive growth as rapid, broad-based across sectors and sustained growth that is inclusive of a large part of a country's labor force. According to this definition, to be inclusive a growth path needs to be strong, pro-poor and redistributive, and further geared toward improving productive employment. Recently, Anand et al. (2013) refer to both the pace and distribution of economic growth to define inclusive growth, on the ground that for growth to be sustainable and effective in reducing poverty, it needs to be inclusive.

This paper argues that all these aspects of inclusive growth have a common denominator, dubbed the "quality of growth". A necessary condition to achieve all these different approaches of inclusive growth is "good quality growth". Good quality growth is seen as high, durable, and socially-friendly growth. There is a consensus that high growth over the long run is necessary to achieve lasting improvements in social outcomes, but it is increasingly evident that high growth alone may not be sufficient in many cases. For instance, over the past few decades, many developing countries experienced strong growth episodes in the context of relative macroeconomic stability, sound policies, and strengthening institutions. However, relatively few posted significant declines in poverty, inequality and unemployment (see Dollar and Kraay 2002; Dollar et al. 2013). It is therefore relevant for policy makers and academic professionals to assess whether the underlying "quality" of growth has been good, and has fundamentally been pro-poor.

This paper builds on Martinez and Mlachila (2013) who explored the quality of the recent high-growth episode in sub-Saharan Africa. They delved into the concept of good quality growth, defining it as one that is strong, stable, sustainable, increases productivity and leads to socially desirable outcomes, like improved standards of living, especially in the reduction of poverty. They draw on an extensive literature that discusses the various aspects of growth and how they matter (e.g., Berg et al. 2008; Johnson et al. 2007 on growth sustainability; Badinger 2010; Ramey and Ramey 1995 on growth volatility; Loayza and Raddatz 2010 on sectoral aspects of growth and poverty reduction; Yang 2008 on outward orientation etc.).

The main objective of this paper is to introduce an index of the quality of growth. The proposed quality of growth index (QGI) encompasses both the *intrinsic nature* of growth and its *social dimensions*. Following Martinez and Mlachila (2013), a good quality of growth—more than just its (high) level—is important to enhance living standards and welfare, and to create opportunities for better employment. Thus how growth is generated is critical for its sustainability and for accelerating employment creation and poverty reduction. Our index attempts to capture the multidimensional features of growth. That said, it also probably matters how the fruits of growth are managed by the state, notably through redistribution and public services.

Our QGI goes beyond the well-known Human Development Index (HDI) developed by the United Nations by concentrating not just on the *levels of incomes*, but the very *nature of growth*.[1] We argue that it does matter *how* one reaches from level *L1* to *L2* of income for various theoretical and empirical reasons that are elaborated on below. Arguably, since it is income level-based, the HDI is the result of millennia of growth. On the other hand, our index facilitates the assessment of the quality of various episodes of growth both within a country and across regions. There is ample evidence that not all growth is created equal: growth that is strong, stable, sustainable, increases total factor productivity, is broad-based

[1] Apart from income levels, the HDI also encompasses important aspects of human development such as education and health.

sectorally, and export-oriented is likely to be more efficient in fostering socially desirable outcomes.

Our QGI is also different from the recently developed Social Progress Index (Scott et al. 2014), as the latter focuses more on aspects that are close to the social dimension of the QGI, without accounting for the growth fundamental aspect, which is the core of the QGI.[2] That said, it is worth mentioning that there is a dynamic and complementary relationship among social indicators such as education and health, and growth. Empirical evidence confirms this two-way relationship between investment in education and health, and growth (Bils and Peter 2000).

The paper's key contribution is the rigorous development of the QGI, covering a wide panel of developing and emerging countries over 1990–2011. This allows us to explore how it has evolved over time and whether there are important regional variations in the quality of growth. It thus enables us to determine whether there has been some convergence in the quality of growth over time, or whether there exists a growth "quality trap". The paper also explores whether the quality of growth is related to other development indicators identified in the literature.

The baseline QGI is robust to a number of weighting schemes and inclusion of additional measures of social and inequality outcomes. While our preferred index is based on the idea of simplicity, transparency, and use of readily available data for the maximum number of developing countries, we conducted a number of robustness tests of various alternatives. The alternative weighting schemes include zero weighting of some elements of the index to address issues of possible correlation among the elements themselves. We generally find that the various computed alternative QGIs are highly correlated, thereby validating our baseline index.

The paper's main findings are fourfold. First, the quality of growth has been improving in the majority of countries over the past two decades. Second, the rate of convergence is relatively slow. Third, there are considerable cross-country variations across income levels and regions. Finally, empirical investigations show that political stability, public pro-poor spending, macroeconomic stability, financial development, institutional quality and external factors such as FDI, are associated with higher QGI.

The paper is organized as follows. The next section describes in detail the steps involved in the creation of the index and introduces the dataset. Section 3 presents the computed index itself, shows some stylized facts and the country ranking, tests the presence of convergence in the QGI dynamics and explores the potential drivers of the QGI. Section 4 checks the robustness of the index by examining various computation approaches. Section 5 presents concluding remarks.

2 Methodology and Data

In order to evaluate the evolution of the quality of economic growth across countries and over time, we build a Quality of Growth Index (QGI). This section first sets forth the methodology used to derive the QGI along with its rationale, then discusses the sensitivity of the index to alternative assumptions, and introduces the dataset.

The QGI is a composite index, resulting from the aggregation of two building blocks: the intrinsic nature of the growth sub-index ("growth fundamentals") and the social

[2] The social progress index encompasses three main dimensions: (1) the basic human needs, (2) the foundations of wellbeing, and (3) opportunity.

dimension sub-index representing the desired social outputs from growth, as illustrated by Fig. 1.

2.1 Growth Fundamentals

The sub-index for the intrinsic nature of growth encompasses four dimensions aiming at capturing the extent to which a given growth episode can be considered as of high quality, with regard to its (1) strength, (2) stability, (3) diversification of sources, and (4) its outward-orientation.

The strength of growth is measured by the annual change in real GDP per capita. We resort to GDP per capita instead of GDP, as the former is more in line with the concept of pro-poor growth which underlies the concept of quality of growth.[3] The strength of growth is an important aspect of the quality of growth since high growth is a necessary ingredient to put a dent to poverty (Dollar and Kraay 2002; Dollar et al. 2013). Accordingly, higher growth rate is expected to lead to substantial dent in poverty, and hence to a better QGI.

Stability can be approached from the perspective of the fluctuation of the level of growth. The literature offers several alternative proxies of growth stability. For instance, Guillaumont (2009) and Cariolle et al. (2016) build the Economic Vulnerability Index (EVI) using supply or demand shocks such as the instability of agricultural production or instability of trade volumes. We focus on the volatility of economic activity measured as GDP because we are mostly interested in the quality of the overall growth. This is in line with the mainstream literature on volatility and growth (e.g., Ramey and Ramey 1995). More specifically, the stability of growth is computed as the inverse of the coefficient of variation (CV) which is the ratio of the standard deviation over the mean. A 5-year rolling window is used to derive time-varying CVs.

Several papers have preferred the standard deviation or deviations from the trend (e.g., Collier and Dehn 2001; Cariolle et al. 2016). However, the standard deviation is scale-variant and does not facilitate cross-country comparisons. For our benchmarking purpose, a normalized and scale-invariant measure as captured by the CV is more appropriate. The CV offsets the apparent dispersion related to the level and allows a straight comparison of countries irrespective of the growth levels. It therefore allows smoothing out the influence of outliers such as small open economies that tend to be structurally more volatile or large countries with low growth that tend to be structurally less volatile. The higher the CV, the lower is the inverse of CV, and the less stable is the growth episode. However, growth instability is well-known to worsen poverty and equity, through a "hysteresis mechanism". Indeed, swings in growth trajectories are particularly harmful to the poor, since the erosion of their human capital in "bad times" is not made up when the economy pulls out of the shock (Behrman et al. 1999; Ames et al. 2001; Guillaumont and Kpodar 2006). Accordingly, a stable growth episode is expected to feed positively into the QGI.

The diversification of sources of growth captures the extent to which growth is considered as generated by diversified sources. It is proxied by a diversification index computed as one minus a Herfindahl–Hirschman index (HHI) using exports data. The higher the index of diversification of export products, the more diversified are the sources of growth. The rationale of using the diversification of exports lies in the findings that that export diversification is associated with stronger growth and lower output volatility

[3] Key trends and countries' ranks are broadly robust to the direct use of GDP levels instead of GDP per capita.

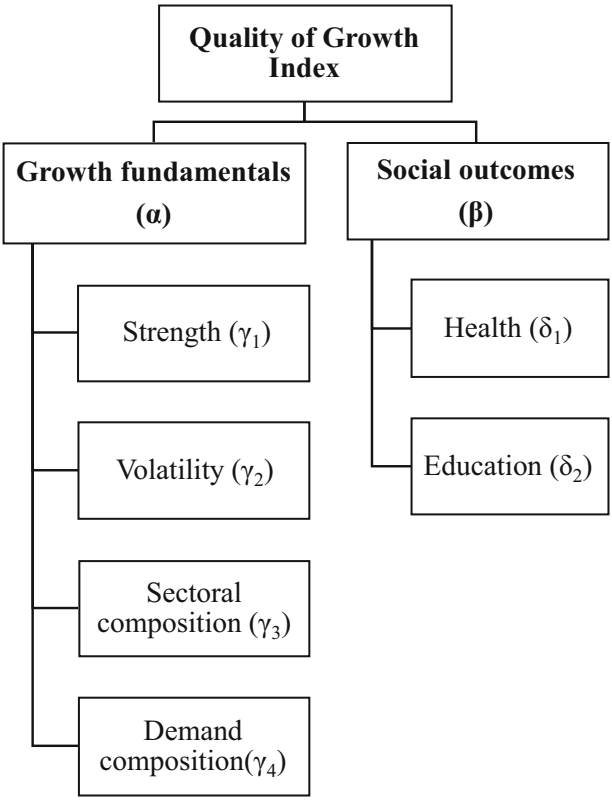

Fig. 1 Conceptual representation of the quality of growth index. *Note* α and β represent the weights ascribed to growth fundamentals and social dimension in the QGI. γ_1, γ_2, γ_3 and γ_4 stand for the respective weights of the strength, stability, sectoral composition, and demand composition of growth in the growth fundamentals sub-component, while δ_1 and δ_2 are the weights assigned to health and education in the social dimension sub-component

(Papageorgiou and Spatafora 2012), which are both conducive to higher QGI, as argued above.[4]

The degree of outward orientation of a growth momentum is proxied by the share of net external demand—in percentage of GDP,[5] as opposed to the share of domestic demand. The rationale for this dimension builds on the fact that an outward orientation of growth is more likely to raise productivity growth through several mechanisms, including learning-by-doing processes, importation of more advanced technology, transfer of knowledge, the discipline of the world market, competition, and foreign direct investment (Diao et al. 2006). Note, however, that such an outward orientation of growth may increase the country's vulnerability to external environment fluctuations and as such results in a more volatile and ultimately lower quality growth.[6]

[4] A more intuitive indicator is the HHI of GDP value added by sector. However, widespread missing data prevent us from using such data. More decisively, output diversification is highly correlated with exports diversification (Papageorgiou and Spatafora 2012).

[5] Net external demand equals to the difference between exports and imports, both as percent of GDP.

[6] This concern is somewhat addressed by accounting for the volatility of growth in the index.

2.2 Social Dimensions of Growth

As mentioned above, a strong, stable, diversified, and outward oriented growth may prove insufficient in alleviating poverty substantially and improve living standards. In this paper, we focus on the level rather than the change because several authors show that it is the stock of better social conditions that matters most than the change when it comes to reducing poverty (see e.g., Anand and Sen 2000; Scott et al. 2014). They argue that human development, in the form of people being better educated, healthier, less debilitated, and so on, is not only constitutive of a better quality of life, but it also contributes to a person's productivity and her ability to make a larger contribution to the progress of material prosperity. Hence, one could argue that what matters for the quality of growth is mostly the stock.

The pro-poor aspect of the quality of growth is therefore factored in its social dimension sub-index, through indicators capturing two of the most basic dimensions of human capital building. These include (1) a long and healthy life, and (2) an access to a decent education/knowledge,[7] which are both commonly acknowledged in the literature as key drivers of the changes in poverty levels (Schultz 1999).[8]

The health component captures the extent to which a country's population can enjoy a long and healthy life through the aggregation of two sub-components, namely: (1) the reverse of infant mortality rate; and (2) life expectancy at birth. Both these health measures are considered as key poverty symptoms, consistently with Amartya Sen's biological approach of measuring poverty (Sen 2003).

Education is captured by the primary school completion rate. The main motivation for using only this indicator is data availability. Several variables could also be good proxies for a country's educational level, including inter alia, the average years of schooling and the net primary school enrollment rate. However, the lack of observations on these variables over a long period for many countries, either in the well-known Barro and Lee (2013) database or the WDI dataset, prevents us from employing such variables. It is worth noting that missing observations also do exist in the primary school completion rate variable, but we retain this variable, as a "lesser evil".[9] Nevertheless, to avoid reducing considerably the sample size owing to missing values from the primary school completion rate, we made some assumptions allowing us to generate and fill up these missing values, consistently with the approach set forth in "Appendix 2".

[7] Several other opportunity variables (such as employment, inequality or poverty itself) and socially-friendly policy measures (including public spending allocated to health and education) are relevant candidates for capturing the pro-poor dimension of growth but are not considered in the construction of the QGI because of data limitation. Nevertheless, for the sake of robustness checks, we added the following three inclusiveness-related sub-components to the social dimension of the baseline QGI: educational equality (ratio of female to male primary schooling enrollment), geographical equality (ratio of rural to urban access to improved water), and generational equality (youth employment), using data from the World Bank's World Development Indicators. The associated QGI is not qualitatively different from the baseline QGI (see "Appendices 10 and 11"). Note, however, that accounting for these variables shrinks the sample size, with the observations falling to 336, down from 372 in the baseline.

[8] Health and education are key components of the very well-known Human Development Index (Klugman et al. 2011).

[9] Note that using average years of primary schooling (instead of primary schooling completion rate does not qualitatively change the computed baseline QGI, though leading to a substantial reduction of the sample, with observations falling to 316, down from 372 in the baseline (see "Appendices 10 and 11").

2.3 Construction of the Index

The construction of the QGI follows a two-step approach: first the variables are standardized into indices of same scale, and then are aggregated into a single index using different weights.

2.3.1 Standardization of the Components

The different variables presented above and representing the different components of the QGI are not expressed in the same unit, which makes their aggregation into a single index comparable to a "mixing apples and oranges" problem. Two main approaches allow us to deal with this issue, namely, the centered-reduced normalization or *Z*-score approach, and the Min–Max approach. The former consists of transforming a given variable X characterized by its mean μ and standard deviation σ, into an index or Z score expressed as follows:$Z = \frac{(X-\mu)}{\sigma}$. If X is normally distributed, then Z follows a centered-reduced normal distribution, with a zero mean and a unity standard deviation. With this standardization, all variables are expressed in the same unit, namely the standard deviation, and can therefore be meaningfully aggregated into a single index. But one matter of concern related to this approach is the sensitivity of the transformed Z variable to the presence of outliers. For example, small open economies (predominant in our sample) have much more volatile growth, implying higher values for σ compared to the rest of countries. This leads to a highly dispersed distribution of Z-score (unbounded by definition) and renders the standardization strategy less appropriate to rank countries.

The Min–Max approach also consists of transforming the variable X into an index Z', according to the following formula: $Z' = \frac{(X-X_{\min})}{(X_{\max}-X_{\min})}$, where X_{min} and X_{max} stand for the minimum (min) and the maximum (max) of X, respectively. Unlike the aforementioned Z variable, Z′ is bounded, ranging from 0 to 1, and is consequently less likely to have a highly dispersed distribution, rendering it more fit for the country ranking perspective of this paper. But a key issue in building Z′ relates to the choice of the minimum (X_{min}) and maximum (X_{max}) of X. What should be taken as the maximum value of life expectancy at life for example? Should it be what ideally desired (positive argument) is or rather the highest value actually observed in the considered panel of countries (objective argument)? Given the potential controversy surrounding the subjective or positive-based choice of "ideal" max and min for X, we base our standardization on the max and min actually observed in the sample. However, note that this choice has consequences on the construction of the QGI, since the QGI will be heavily influenced by how far countries stand relatively to the sample's maximum or minimum. The results would therefore depend strongly on the sample used. This is somewhat mitigated by the use of a broad sample of developing and emerging countries with available data.

2.3.2 Weighting Approach

We assign equal weights (50 % each) to the intrinsic nature of growth (α) and to the social dimension of growth sub-indices (β), respectively. Equal weight ($\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 25$ %) is also given to the four sub-components of the intrinsic nature sub-index, so is for the two sub-components of the social dimension of growth, namely health and education ($\delta_1 = \delta_2 = 50$ %). Equal weight (50 %) is also assigned to the two sub-components

of the health sub-index.[10] The main rationale for this weighting option, which is used in other well-known indices such as the Human Development Index (HDI) or the Economic Vulnerability Index (EVI), lies in its simplicity and transparency. But as well stressed by Guillaumont (2009), this equal weighting does carry a dose of arbitrariness, since the weights are determined by the number of components, and hence depends heavily on the components retained themselves.

Some alternative aggregation options (such as regression-based approach) exist in the literature but present several inconveniences for our purpose. The validity of the regression-based approach depends heavily on the quality of the regressions, including notably issues related to the endogeneity of the regressors. That said, in the robustness section, we make use of alternative weights for the intrinsic nature of growth and the social dimension of growth sub-indices.

2.3.3 Aggregation Approach

The QGI is calculated as the arithmetic mean—with equal weighting, but with alternative weighting subsequently, for robustness purpose, as mentioned before—of the intrinsic nature of growth and the social dimension of growth sub-indices. The same averaging approach is applied for these sub-indices themselves.[11] Simplicity and transparency are once again the main rationale for the choice of this aggregation strategy. But this strategy implicitly assumes the absence of interactions between the different components of the QGI, i.e., there is a substitutability relationship between the various components of the QGI. However, some complementarities may exist between the different components of the QGI, which would make the geometric averaging strategy more appropriate.[12] Indeed, a country's level of human capital— education and health—may influence the productivity of its economy, and hence its growth pace, and vice versa. Such complementarities may also be at work between the sub-components of each of the two major sub-indices of the QGI. For the sake of ensuring that the construction of the QGI and its associated country ranking is not skewed by the chosen averaging approach, we resort, in addition to the arithmetic averaging, to a geometric approach.

To sum up, the calculation of the QGI can be formally written as:

$$QGI = \alpha(Fundamentals) + \beta(Social) \tag{1}$$

with "growth fundamentals" dimension defined as $Fundamentals = \gamma_1\ Level + \gamma_2\ Stability + \gamma_3\ Diversification + \gamma_4\ Orientation$ and the "social dimension" defined as $Social = \delta_1\ School + \delta_2\ Health$.

Under the geometric averaging strategy carried out for robustness purpose, the QGI is defined as $QGI = (Fundamentals)^{\alpha_1}(Social)^{\alpha_2}$ where $Fundamentals = (Level)^{\gamma_1}(Stability)^{\gamma_2}(Diversification)^{\gamma_3}(Orientation)^{\gamma_4}$ and $Social = (School)^{\delta_1}(Health)^{\delta_2}$.

2.4 Data

For this paper, we use a panel data covering 93 developing countries between 1990 and 2011. The sample includes 57 middle-income countries and 36 low-income countries. To

[10] Given that the equal weights are somehow arbitrary; we conduct a sensitivity test by using alternative weights in the Sect. 4.

[11] This aggregating approach is also used for the construction of the EVI (Guillaumont 2009).

[12] This assumption underpins the construction of the popular HDI.

smoothen out the effects of short-term fluctuations on macroeconomic variables, each variable has been averaged over 5-year (1990–1994, 1995–1999, 2000–2004 and 2005–2011). The variables used in this study are drawn upon from various databanks, including the IMF *World Economic Outlook* database, the World Bank's *World Development Indicators* (WDI) database, COMTRADE, the International Country Risk Guide database, Barro and Lee (2013) and Sala-i-Martin (2006). Detailed sources and definitions of variables are provided in "Appendix 1". "Appendix 2" elaborates on the specific case of dealing with missing observations in the primary school completion rate.

3 Results

In this section, we highlight our key findings. First, we present out some stylized facts of the QGI. Second, we rank the QGI and categorize countries based on their performances. We also assess the convergence hypothesis in the QGI. Third, we put the QGI into perspective with the existing development and living standard indicators, and explore the potential drivers of the QGI.

3.1 Some Stylized Facts

This section builds on the benchmark computed QGI to rank the full sample countries over 1990–2011. The ranking results are reported in Table 1 below. Over the most recent subperiod, namely 2005–2011, Bulgaria emerges as the top performer, with a QGI of 0.843, followed by China (0.842) and Argentina (0.830), while Chad (0.334), Central African Republic (0.402) and Niger (0.415) are the poorest performers, respectively.

Table 1 Full sample QGI-based ranking

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
1	Malaysia	0.811	Malaysia	0.809	China	0.849	Bulgaria	0.843
2	China	0.772	Poland	0.790	Latvia	0.798	China	0.842
3	Thailand	0.754	Vietnam	0.784	Vietnam	0.792	Argentina	0.830
4	Argentina	0.750	China	0.784	Bulgaria	0.786	Vietnam	0.807
5	Chile	0.748	Chile	0.764	Lithuania	0.784	Indonesia	0.800
6	Uruguay	0.746	Thailand	0.754	Poland	0.782	Malaysia	0.798
7	Poland	0.742	Sri Lanka	0.753	Chile	0.777	Uruguay	0.794
8	Sri Lanka	0.733	Uruguay	0.749	Sri Lanka	0.767	Colombia	0.788
9	Indonesia	0.725	Argentina	0.742	Brazil	0.767	Poland	0.786
10	Vietnam	0.721	Lithuania	0.740	Malaysia	0.755	Panama	0.782
11	Panama	0.719	Mexico	0.736	Mexico	0.755	Brazil	0.780
12	Mexico	0.712	Indonesia	0.732	Argentina	0.752	Sri Lanka	0.779
13	Costa Rica	0.707	Panama	0.727	Cuba	0.751	Peru	0.778
14	Bulgaria	0.703	Brazil	0.726	Albania	0.750	Kazakhstan	0.776
15	Belarus	0.692	Albania	0.726	Tunisia	0.748	Chile	0.776
16	Jordan	0.689	Bulgaria	0.724	Thailand	0.748	Thailand	0.775
17	Colombia	0.685	Cuba	0.721	Panama	0.746	Lithuania	0.773

Table 1 continued

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
18	Brazil	0.685	Peru	0.719	Uzbekistan	0.743	Mexico	0.768
19	Turkey	0.684	Costa Rica	0.716	Romania	0.740	Belarus	0.767
20	Ecuador	0.678	Tunisia	0.711	Georgia	0.739	Romania	0.766
21	Philippines	0.676	Romania	0.706	Peru	0.738	Tunisia	0.766
22	Cuba	0.674	Egypt, Arab Rep.	0.706	Costa Rica	0.737	Turkey	0.760
23	Syrian Arab Republic	0.673	Colombia	0.705	Armenia	0.737	Cuba	0.759
24	Romania	0.673	Jordan	0.699	Russian Federation	0.736	Jordan	0.759
25	Russian Federation	0.672	Bolivia	0.698	Belarus	0.735	Syrian Arab Republic	0.758
26	Kazakhstan	0.668	Turkey	0.697	Uruguay	0.733	Albania	0.755
27	Venezuela	0.667	Ecuador	0.696	Egypt, Arab Rep.	0.730	Russian Federation	0.753
28	Peru	0.661	Latvia	0.696	Indonesia	0.728	Costa Rica	0.751
29	Kyrgyz Republic	0.661	Armenia	0.696	Turkey	0.727	Latvia	0.750
30	Tunisia	0.656	Russian Federation	0.694	Jordan	0.725	Egypt, Arab Rep.	0.750
31	Moldova	0.655	Georgia	0.688	Colombia	0.724	Uzbekistan	0.748
32	Botswana	0.651	Syrian Arab Republic	0.687	Ecuador	0.723	Armenia	0.747
33	Lithuania	0.649	Kyrgyz Republic	0.685	Kazakhstan	0.717	Georgia	0.746
34	Egypt, Arab Rep.	0.630	Kazakhstan	0.682	Moldova	0.713	Ecuador	0.745
35	Armenia	0.630	Moldova	0.679	Kyrgyz Republic	0.710	Mongolia	0.738
36	Albania	0.628	Belarus	0.676	Philippines	0.700	Lao PDR	0.727
37	Paraguay	0.625	Philippines	0.671	Syrian Arab Republic	0.697	Moldova	0.721
38	South Africa	0.622	Paraguay	0.661	Bolivia	0.684	Paraguay	0.714
39	Kenya	0.619	Venezuela	0.660	Azerbaijan	0.682	India	0.714
40	Honduras	0.618	South Africa	0.654	El Salvador	0.681	Philippines	0.709
41	El Salvador	0.615	El Salvador	0.654	Paraguay	0.679	Bolivia	0.708
42	Algeria	0.612	Algeria	0.649	Mongolia	0.674	Honduras	0.705
43	Latvia	0.609	Iran, Islamic Rep.	0.641	Tajikistan	0.670	Kyrgyz Republic	0.703
44	Georgia	0.604	Botswana	0.639	Algeria	0.665	El Salvador	0.702
45	India	0.596	Uzbekistan	0.639	South Africa	0.663	Morocco	0.700
46	Iran, Islamic Rep.	0.594	Honduras	0.637	Iran, Islamic Rep.	0.655	Algeria	0.699
47	Namibia	0.588	Azerbaijan	0.635	Venezuela	0.655	Iran, Islamic Rep.	0.693
48	Mongolia	0.587	India	0.630	Namibia	0.651	South Africa	0.692

Table 1 continued

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
49	Bolivia	0.586	Namibia	0.623	India	0.649	Tanzania	0.690
50	Azerbaijan	0.577	Mongolia	0.615	Honduras	0.646	Bangladesh	0.678
51	Uzbekistan	0.572	Kenya	0.603	Lao PDR	0.644	Guatemala	0.673
52	Swaziland	0.569	Nicaragua	0.599	Nicaragua	0.637	Nicaragua	0.668
53	Ghana	0.566	Guatemala	0.592	Morocco	0.630	Venezuela	0.666
54	Guatemala	0.563	Ghana	0.588	Guatemala	0.621	Azerbaijan	0.666
55	Morocco	0.552	Lao PDR	0.587	Bangladesh	0.612	Tajikistan	0.653
56	Tajikistan	0.521	Bangladesh	0.584	Kenya	0.609	Namibia	0.648
57	Bangladesh	0.515	Tajikistan	0.580	Nepal	0.602	Kenya	0.646
58	Nicaragua	0.513	Morocco	0.571	Ghana	0.602	Ghana	0.642
59	Gabon	0.511	Nepal	0.557	Botswana	0.596	Nepal	0.641
60	Pakistan	0.507	Swaziland	0.548	Gambia, The	0.574	Botswana	0.637
61	Congo, Rep.	0.498	Gabon	0.541	Tanzania	0.562	Zambia	0.632
62	Nepal	0.491	Pakistan	0.519	Togo	0.553	Pakistan	0.602
63	Tanzania	0.482	Senegal	0.502	Cameroon	0.551	Madagascar	0.592
64	Senegal	0.480	Tanzania	0.499	Pakistan	0.544	Gabon	0.583
65	Lao PDR	0.478	Togo	0.499	Gabon	0.536	Ethiopia	0.574
66	Cameroon	0.451	Cameroon	0.497	Swaziland	0.536	Swaziland	0.574
67	Sudan	0.447	Sudan	0.492	Senegal	0.521	Rwanda	0.568
68	Madagascar	0.439	Cote d'Ivoire	0.471	Uganda	0.515	Togo	0.564
69	Cote d'lvoire	0.435	Equatorial Guinea	0.467	Zambia	0.504	Gambia, The	0.564
70	Lesotho	0.433	Madagascar	0.462	Madagascar	0.504	Senegal	0.558
71	Togo	0.430	Zambia	0.461	Congo, Rep.	0.492	Uganda	0.557
72	Yemen, Rep.	0.429	Congo, Rep.	0.460	Benin	0.474	Benin	0.554
73	Gambia, The	0.428	Gambia, The	0.452	Yemen, Rep.	0.471	Cameroon	0.529
74	Zambia	0.406	Malawi	0.451	Cote d'Ivoire	0.467	Congo, Rep.	0.525
75	Mauritania	0.404	Mauritania	0.449	Nigeria	0.462	Nigeria	0.517
76	Djibouti	0.400	Yemen, Rep.	0.443	Malawi	0.461	Mozambique	0.513
77	Uganda	0.394	Uganda	0.441	Sudan	0.455	Malawi	0.511
78	Congo, Dem. Rep.	0.392	Lesotho	0.429	Mauritania	0.453	Mauritania	0.510
79	Equatorial Guinea	0.386	Djibouti	0.410	Djibouti	0.449	Guinea	0.506
80	Nigeria	0.373	Benin	0.407	Guinea	0.447	Djibouti	0.502
81	Burundi	0.373	Nigeria	0.376	Equatorial Guinea	0.443	Cote d'Ivoire	0.498
82	Benin	0.362	Mozambique	0.371	Ethiopia	0.440	Sierra Leone	0.498
83	Mozambique	0.346	Guinea	0.371	Lesotho	0.424	Congo, Dem. Rep.	0.488
84	Malawi	0.340	Ethiopia	0.363	Sierra Leone	0.407	Yemen, Rep.	0.482
85	Central African Rep.	0.338	Burkina Faso	0.355	Burkina Faso	0.404	Lesotho	0.480

Table 1 continued

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
86	Sierra Leone	0.328	Central African Rep.	0.346	Rwanda	0.399	Sudan	0.476
87	Ethiopia	0.327	Congo, Dem. Rep.	0.343	Niger	0.376	Equatorial Guinea	0.452
88	Burkina Faso	0.324	Niger	0.330	Mali	0.371	Mali	0.442
89	Rwanda	0.320	Rwanda	0.327	Congo, Dem. Rep.	0.371	Burundi	0.425
90	Guinea	0.308	Sierra Leone	0.320	Mozambique	0.367	Burkina Faso	0.417
91	Mali	0.287	Mali	0.311	Burundi	0.356	Niger	0.414
92	Chad	0.286	Chad	0.298	Chad	0.340	Central African Rep.	0.402
93	Niger	0.258	Burundi	0.294	Central African Rep.	0.331	Chad	0.334

The QGI varies markedly across periods, countries, and income levels. The QGI has also improved over time (Fig. 2a). The average value of the QGI stands at 0.604 (Fig. 2). The minimum QGI is 0.258 for Niger over 1990–1994 and the maximum of 0.849 for China over 2000–2004. The QGI increases from 0.556 in 1990–1994 to 0.656 in 2005–2011. Moreover, a density plot shows that the distribution of the QGI is shifting to the right over time (Fig. 3a). At the same time, distributions have become narrower, denoting a certain level of convergence among countries over time.

Moreover, there are significant differences across regions. LA countries exhibit the highest QGI scores whereas sub-Saharan Africa lags behind with the lowest QGI (Fig. 2b). The density analysis shows that sub-Saharan African countries exhibit the flattest and leftmost density in their QGI distribution, with thick distribution tails (Fig. 3b). This suggests that sub-Saharan Africa is the poorest performing country group in terms of quality of growth. In addition, the flatter density along with the thick tails tend to signal the presence of greater inequalities in the QGI scores, with a few countries performing quite well, namely above the full sample average score, while the bulk of sub-Saharan African countries—roughly more than 60 % of observations—are left behind the full sample average score (0.604).

Furthermore, the QGI also varies by income levels (Fig. 2c).[13] The QGI is positively correlated with countries' income level. The upper-middle income countries record the highest QGI score, followed by the lower-middle income countries and the low-income countries, respectively. A density analysis suggests that the richer is a country group, the more in the right-hand side of the figure its density curve stands, confirming a positive association between countries' level of development and their ability to draw upon a better quality of growth from their growth momentum (Fig. 3c).

We also focus on the fragility status and resource endowment.[14] It emerges that fragile countries significantly underperformed the sample average by almost 16 % point (Fig. 2d).

[13] The country sub-sampling in terms of income refers to the World Bank's classification of countries.

[14] The list of fragile countries is drawn upon from IMF (2011) which is based on the World Bank's criteria of fragility while the list of resource-rich countries is extracted from IMF (2012).

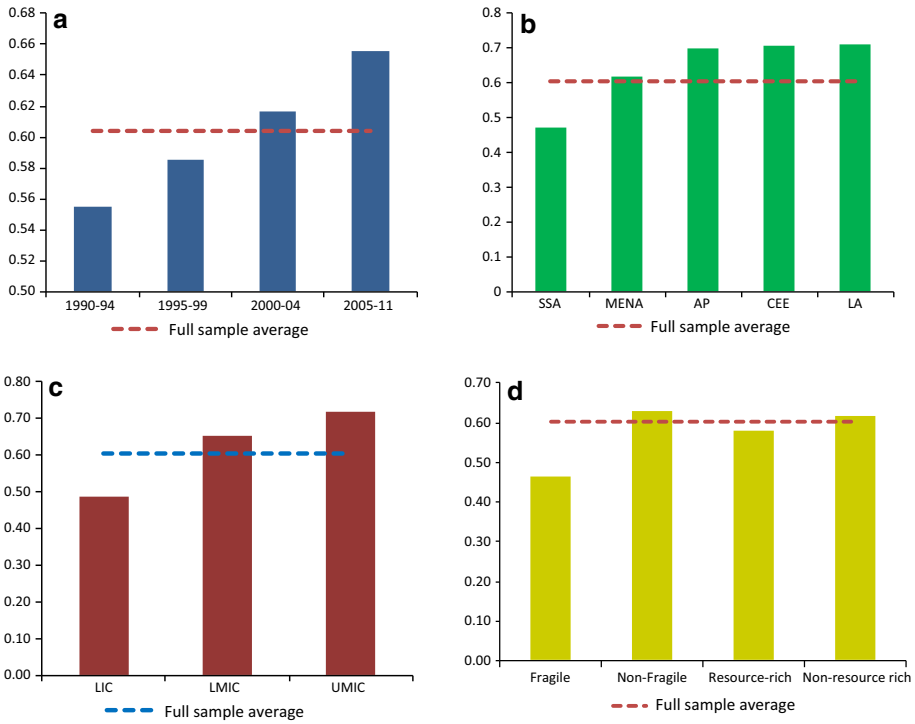

Fig. 2 QGI: Average values. **a** QGI by period, **b** QGI by region, **c** QGI by level of income, **d** QGI by fragility and resource-rich criteria. *Note*: AP, Asia and Pacific; CEE, Central and Eastern Europe; LA, Latin America; MENA, Middle East and North Africa; SSA, Sub-Saharan Africa; LIC, low-income countries; LMIC, lower-middle income countries; UMIC, upper-middle income countries

This suggests that fragile countries face tougher structural impediments when it comes to achieving better quality of growth. Likewise, resource-rich countries have QGI scores standing slightly lower than their non-resource rich peers, which may fuel the natural resource curse debate (Sachs and Warner 2001). From the density analysis (Fig. 3d), it clearly transpires that most fragile countries are concentrated in the left side of the distribution, with around 25 % of observations corresponding to a performance gap of as high as 0.2 point with regard to the full sample average, and around 40 % of observations corresponding to a QGI score higher than that of the former group, but lower than the full sample average (0.604). This confirms the previously-underscored message from Fig. 2d that fragility weighs severely on countries' underperformance in terms of QGI. The distribution of QGI also shows that below the sample average, the density curve for resource-rich countries' stands above the curve for non-resource rich countries, while the reverse is observed from the full sample average onwards. This therefore suggests that endowment in natural resources worked more as a curse rather than as a blessing for countries when it comes to achieving a better quality of growth.

3.2 Convergence Hypothesis

We first investigate the presence of convergence in the QGI process. To this end, we report in Table 2 below simple pooled OLS estimates linking the change in countries' QGI to

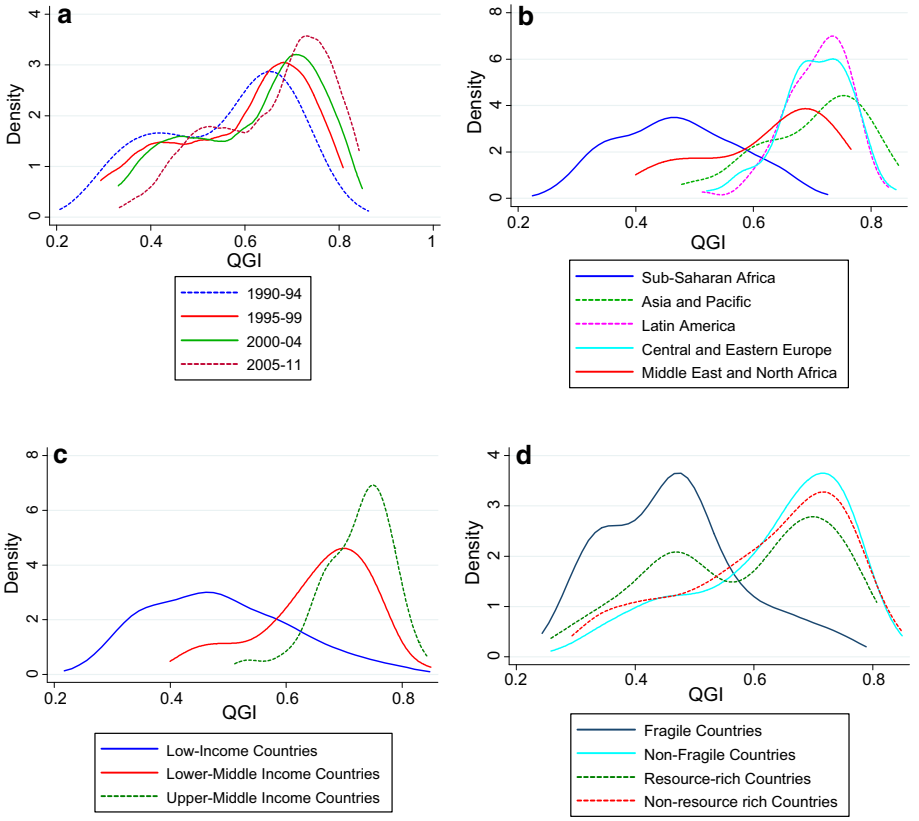

Fig. 3 QGI: Kernel density. **a** By period, **b** by region, **c** by income level, **d** fragility and resource-rich criteria

Table 2 Test of convergence hypothesis

Dependent variable	1 ΔQGI	2 ΔQGI
Lagged QGI (one period)	−0.066***	
	(0.0156)	
Initial QGI (1990–1994)		−0.068***
		(0.016)
Observations	279	279
R^2	0.072	0.074

Robust standard errors in brackets

*, ** and *** the significance level of 10, 5, and 1 %. Intercept included

their past QGI. The results show that some convergence is at play in the QGI process. Past QGI performance, expressed either as the lagged (one period) value of the QGI or the initial (1990–1994) value of the QGI, is found to be negatively associated with the growth rate of the QGI. This is reflected by the negative and significant estimated coefficient of the lagged QGI and the initial QGI. This result therefore suggests that the least performing countries tend to catch up the best performers over time.

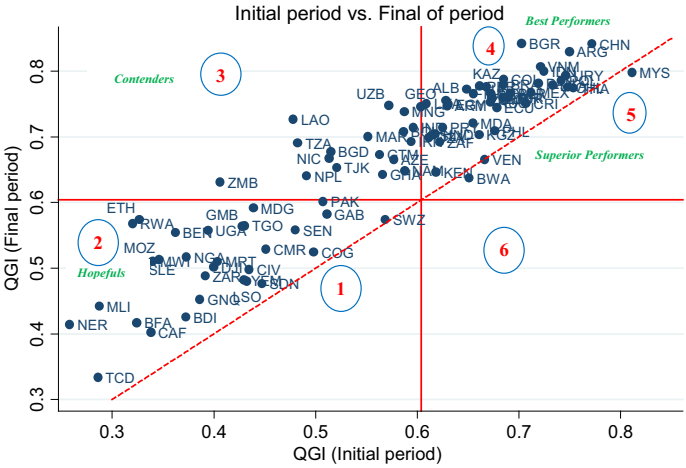

Fig. 4 Quality of growth over time

Second, building on this above-evidenced presence of convergence in the QGI process, we propose a categorization of countries, based on their QGI dynamics between the initial period (1990–1994) and the final period (2005–2011), as reflected in Fig. 4.

The sample average QGI score is underlined by the red horizontal and vertical lines representing the QGI values of the initial period and the final period, respectively. The dashed line represents the 45 degree line; the higher above this line, the greater the improvement in the level of the QGI. The intersection of these three lines yields 6 non-overlapping regions. It is worth mentioning that virtually all the countries have improved their quality of growth over the past two decades. Region 2 includes countries whose QGI scores in the starting period as well as in the final period stand below the sample average, but did improve between the two periods. This group is made up of low-income and/or fragile countries, mostly from sub-Saharan Africa and incidentally from MENA, which are labelled as the "hopefuls", in that they have reasonably good prospects of converging progressively toward the sample average country. Region 3 includes countries that were able to improve their QGI from below to above the sample average between the starting and the final period, and as such are dubbed as the "contenders", with a reference to the idea that they are contending to be among the high performers. This group includes mainly countries from Asia Pacific (for example Bangladesh, Laos and Nepal), from sub-Saharan Africa (for example Ghana,Tanzania and Zambia), from Middle East and North Africa (for example Algeria, Iran and Morocco), from Central and Eastern Europe (for example Azerbaijan, Tajikistan and Uzbekistan) and a few from Latin America (Guatemala and Nicaragua).

Region 4 encompasses countries that not only recorded a QGI score superior to the sample average, in the initial as well as in the final period, but also experienced an improvement in their QGI between the two periods. This country group is labelled as the "club of best performers", and includes chiefly upper-middle and lower-middle income countries. A noticeable finding is that a handful of sub-Saharan African countries belongs to this club of best performers, including notably Kenya, Namibia and South Africa. Finally, region 5 is characterized by countries that performed well above the sample average in terms of QGI in both the initial and the final periods, but have the particularity

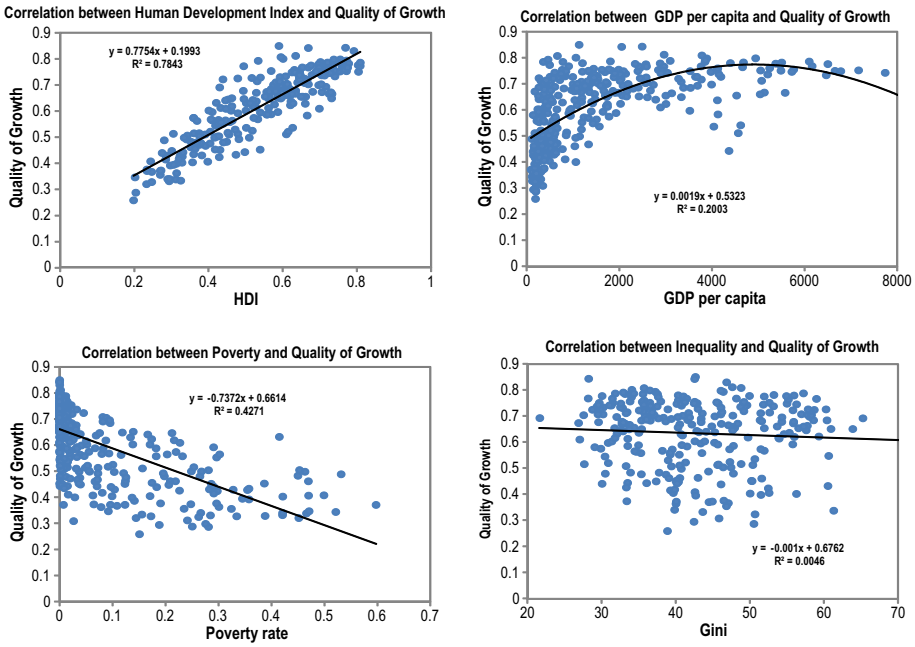

Fig. 5 Correlation between the QGI and existing development indicators

of having experienced a mild drop in their QGI between the two periods. This group comprises only two countries, namely Botswana and Malaysia, and is categorized as the "club of superior performers".

3.3 Putting the QGI into Perspective with Existing Development Indicators

To have an idea about where our proposed QGI stands compared to existing development indicators, we display in Fig. 5 correlations between the QGI and a selection of living standards variables. It appears that the QGI is positively correlated with the well-established United Nations (UN) HDI and real GDP per capita (albeit non-linearly), and negatively with the poverty rate and income inequality. These findings imply that the QGI could be another legitimate part of the toolkit available for gauging countries' progress toward inclusvie growth.

3.4 Drivers of the QGI: An Appraisal

3.4.1 Pairwise Correlation

We investigate the key factors driving the QGI scores. We first adopt a pairwise correlation approach. We focus on living standards, politico-institutional indicators and external financing conditions. Figure 6a points to a strong correlation between the QGI and politico-institutional factors. On the one hand, institutional quality, as measured by the quality of bureaucracy, the rule of law or the control of corruption, is positively associated with the QGI, but the correlation is less marked with the latter. On the other hand, more political stability, as proxied by government stability goes hand-in-hand with a higher QGI.

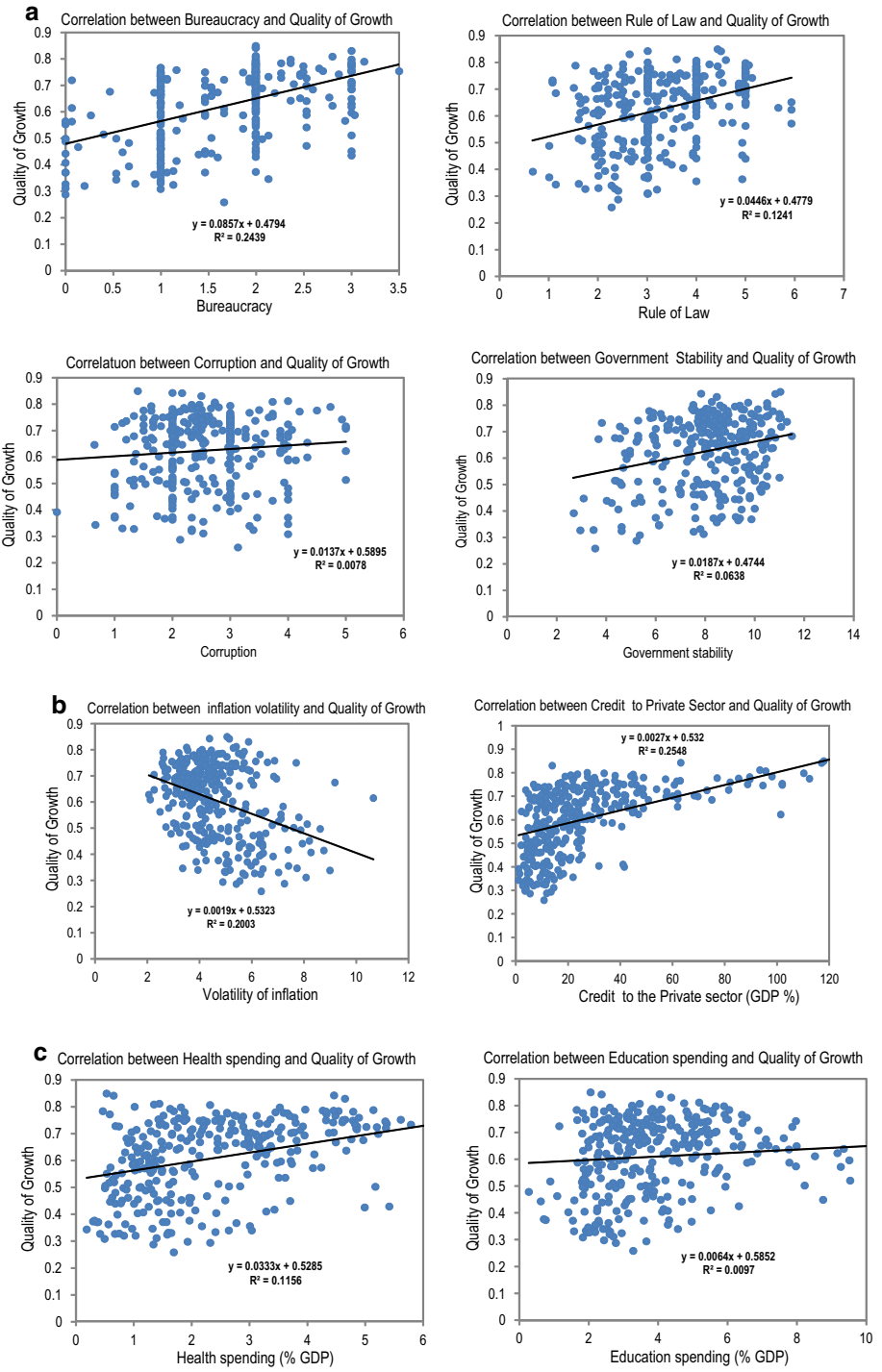

Fig. 6 Quality of growth index: key correlations. **a** QGI and politico-institutional factors, **b** QGI and domestic macroeconomic environment, **c** QGI and social spending, **d** QGI and external environment

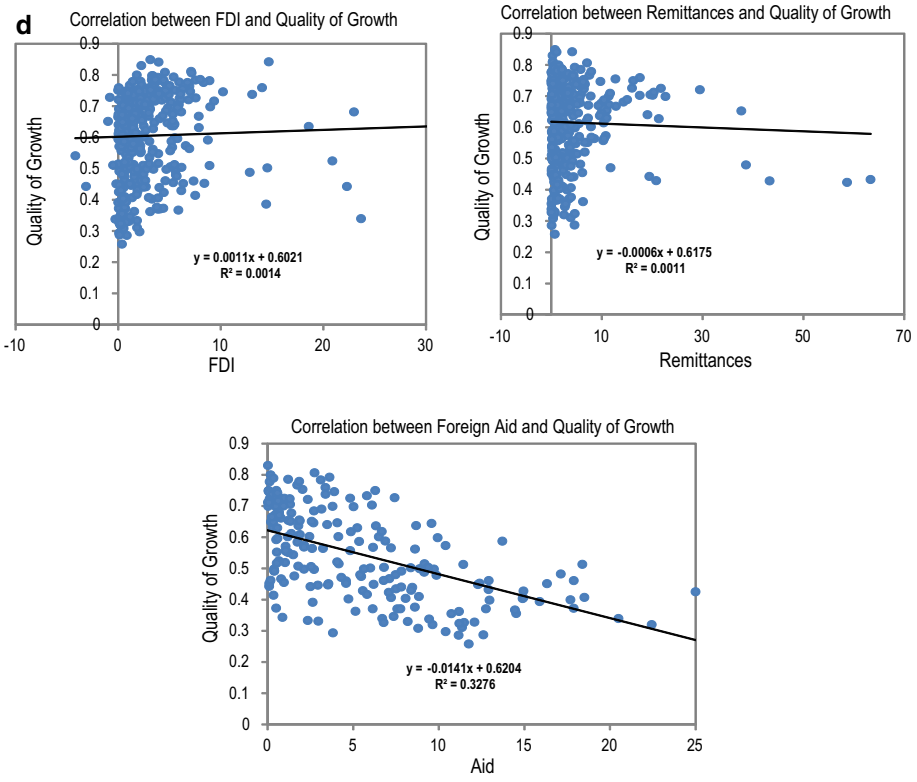

Fig. 6 continued

A sound and stable macroeconomic environment as well as a better access to credits for financing good projects may be conducive to higher QGI scores. Indeed, Fig. 6b shows that the volatility of inflation and credit to the private sector are negatively and positively correlated with the QGI, respectively. Figure 6c points out a relevance of social spending in achieving a good quality of growth. The QGI is positively linked with public spending in education and health sectors. The correlations with external conditions, portrayed in Fig. 6d reveal somewhat a weak association between the QGI and both FDI and remittances. The correlation between the QGI and foreign aid[15] is markedly negative, likely owing to the fact that foreign aid is mostly allocated to low-income countries.[16]

3.4.2 Econometric Analysis

Altogether, the results above are simple unconditional correlations and should not be viewed as causal links between the QGI and the variables considered. In what follows, we

[15] An approximation of the funds effectively transferred to developing countries, is computed by subtracting from total aid technical cooperation because it comprises education or training fees of nationals from recipient countries at home or abroad and payments to consultants or advisors for recipient countries. Furthermore, emergency flows (humanitarian aid, food aid) are subtracted as they are naturally countercyclical.

[16] Less charitably, this may rather reflect the ineffectiveness of foreign aid in improving the quality of growth in the recipient countries.

attempt a preliminary appraisal of the factors driving potentially the QGI by carrying out some conditional estimates of the influence of these factors on the QGI. We perform OLS-based estimates using lagged (one period) values of the explanatory variables to account for likely delays in the influence of these variables on the QGI, and mitigate endogeneity issues. Table 3 reports the estimation results.[17]

The baseline results focus on domestic macroeconomic factors, and are depicted in column 1 of Table 3. First, it emerges that devoting more public resources to social sectors allows improving the quality of growth. Second, stable government is found to be conducive to a better quality of growth. This suggests that less frequent changes of governments, which implies a lower uncertainty faced by government members as to whether they will be left out, may increase their focus toward implementing effectively the country's development agenda and hence achieve a good quality of growth rather than getting involved in rent-seeking activities. Third, the coefficient of the volatility of inflation is negative and significant, implying that macroeconomic stability is a necessary ingredient for attaining pro-poor growth outcomes. Another striking result is the positive impact of financial development on QGI. This suggests that greater financial development, especially if accompanied by higher access to credit, may help unleash the private sector's potential for creating wealth and decent jobs for the population, and hence achieving a good quality growth ultimately. Last, but not the least, column 1 sheds light on the importance of structural factors such as institutional quality in steering up countries' QGI scores. The quality of institutions is measured by the average of quality of bureaucracy, the rule of law and the control of corruption. However, as already evidenced in Fig. 5b above, the quality of bureaucracy seems to matter the most for improving the QGI, since the effect of rule of law on the QGI is positive but not significant whereas the coefficient of control of corruption does not have the expected positive sign but also is not significant (columns 5 to 7). Columns 2 to 4 of Table 3 allow assessing the role of external conditions for the QGI. FDI is found to be positively related to the QGI. This suggests that FDI, by contributing to close the domestic saving gaps, play a pivotal role in achieving a good quality of growth in developing countries. The coefficient of remittances is also positive but not significant. For foreign aid the result is somewhat puzzling (column 4), as its effect is significantly negative. As indicated earlier, this is not necessarily a statement about aid ineffectiveness, but may rather point to a mere empirical regularity that aid is mainly allocated to poorer countries.[18]

Finally, it is worth noting that our empirical investigation is based on a partial correlation analysis after controlling for the simultaneity bias. Further research is warranted to uncover the causal links—when longer time coverage of the QGI will be available, before pretending to draw robust causal links between the QGI and these potential factors.

4 Robustness of the QGI to Alternative Specifications

We assess the sensitivity of the QGI in several aspects.

First, as flagged in the methodology section, the benchmark QGI (QGI1) used so far stems from an equal weighting aggregation approach. In the following, we consider alternative weighting scenarios. Four alternative QGI (QGI2, QGI3, QGI4 and QGI5) are considered. QGI2 refers to the index derived from the following weighting combination,

[17] "Appendix 9" depicts signs and significance levels of the QGI's drivers for different sub-sampling.

[18] For a detailed discussion on the debate on aid effectiveness, see Burnside and Dollar (2000), Collier and Dollar (2001), Guillaumont and Chauvet (2001) or Easterly et al. (2003).

Table 3 Determinants of Quality of Growth over 1990–2011

Dependent variable	[1] QGI	[2] QGI	[3] QGI	[4] QGI	[5] QGI	[6] QGI	[7] QGI
Social spending-to-GDP ratio (one period lag)	1.340***	1.292***	1.318***	1.363***	1.451***	1.296***	1.573***
	(0.341)	(0.339)	(0.348)	(0.464)	(0.333)	(0.338)	(0.336)
Government stability (one period lag)	0.017***	0.014***	0.014***	0.007	0.015***	0.017***	0.017***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Log of inflation volatility (one period lag)	−0.017***	−0.016***	−0.017***	−0.020***	−0.018***	−0.016***	−0.018***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Credit to private sect.-to-GDP ratio (one period lag)	0.106***	0.108***	0.107***	0.061	0.114***	0.092***	0.118***
	(0.027)	(0.026)	(0.028)	(0.043)	(0.026)	(0.027)	(0.026)
Aggregated institutional quality (one period lag)	0.029**	0.029**	0.029**	0.036**			
	(0.014)	(0.014)	(0.014)	(0.014)			
FDI-to-GDP ratio (one period lag)		0.628**					
		(0.260)					
Remittances-to-GDP ratio (one period lag)			0.196				
			(0.160)				
Foreign Aid-to-GDP ratio (one period lag)				−1.184***			
				(0.209)			
Rule of law (one period lag)					0.013		
					(0.008)		
Quality of bureaucracy (one period lag)						0.038***	
						(0.012)	

Table 3 continued

Dependent variable	[1] QGI	[2] QGI	[3] QGI	[4] QGI	[5] QGI	[6] QGI	[7] QGI
Control of corruption (one period lag)							−0.005
							(0.011)
Observations	163	163	156	101	163	163	163
R^2	0.423	0.438	0.427	0.638	0.417	0.447	0.408

Robust standard errors in brackets

*, ** and *** the significance level of 10, 5, and 1 %. Intercept included, but not reported

namely, $\alpha = 2/3,\ \beta 1/3$, and by symmetry for QGI3 $\alpha = 1/3,\ \beta 2/3$. QGI4 corresponds to the specification that assigns respectively $\alpha = 3/4$ and $\beta = 1/4$ as weights for the intrinsic nature and the social dimension of growth, and conversely for QGI5. Remark that the great emphasis put on the intrinsic nature sub-component ($\alpha = 3/4$) compared the social dimension sub-component in QGI5 allows us to highlight to some extent the distinct nature of the QGI with respect to the UN HDI, which focuses primarily on human development while the QGI rather focuses overridingly on growth fundamentals. Key findings are as follows. First, key trends with all indices are not quantitatively and qualitatively different from the benchmark ones (QGI1). This is confirmed by the correlation matrix of the five QGIs ("Appendix 5"), which underscores that these indices are highly and significantly correlated, with a correlation coefficient ranging from 0.91 to 0.99.

Second, to capture possible interactions between the different components of the QGI, we consider a geometric averaging approach, instead of the arithmetic one previously used. This strategy does not alter substantially the ranking, as provided in "Appendix 3". This is also pinned down in "Appendix 6", which reports a Spearman's rank order correlation test. The *P* value for a lack of correlation between the arithmetic mean-based and geometric mean-based country ranking is zero, and the test statistic for the correlation between the two sets of ranking is quite large, standing at 0.995, suggesting that both these ways of deriving the QGI lead to consistent results, from a ranking standpoint.

Third, we rebased the Min–Max normalization of the different components of the QGI on region-specific minimum and maximum values. As underscored in the methodology section, given that the min and max used to standardize the different variables are endogenous to the retained sample, the performance gap may vary tremendously. "Appendix 7" displays the results of the Spearman's rank correlation test between this ranking based on a region-specific standardization and the benchmark one. It appears that both sets of ranking lead significantly to comparable results. Furthermore, the correlation matrix of these two sets of QGI leads to the same conclusion, as it clearly points out that these two series are highly and significantly correlated ("Appendix 8").

Fourth, so as to gauge the additional information brought by the stability, diversification and outward-orientation sub-components, we compute three alternative QGIs, wherein we assign, respectively a: (1) zero weight to growth stability; (2) zero weight to diversification; (3) zero weight to outward-orientation. Put simply, we use the following weighting scheme for the intrinsic nature building bloc of the QGI, respectively: (1/3, 0, 1/3, 1/3), (1/3; 1/3; 0; 1/3), and (1/3, 1/3, 1/3, 0). These alternative specifications did not change qualitatively the baseline result (see "Appendices 10 and 11"). For the sake of further robustness checks, we computed additional QGI, using the following alternative weighting scheme for γ_1, γ_2, γ_3 and γ_4:(1/2, 1/2, 0, 0), (1/2, 0, 1/2, 0), (1/3, 1/3, 1/6, 1/6), (1/3, 1/6, 1/3, 1/6). These alternative specifications did not change qualitatively the baseline result as well (see "Appendices 10 and 11"). In addition, we use the principal component methodology and derive the following weighting schemes: ($\gamma_1 = 0.38,\ \gamma_2 = 0.27,\ \gamma_3 = 0.23,\ \gamma_4 = 0.12$); ($\delta_1 = 0.90,\ \delta_2 = 0.10$); and ($\alpha = 0.75,\ \beta = 0.25$). The resulting QGI is not qualitatively different from the baseline QGI (see "Appendices 10 and 11").

Another potential avenue for further tweaking the robustness checks of our results could be to assess their sensitivity to using flow (as opposed to stock) variables for building the social sub-component of the QGI. One might indeed question the consistency of our composite QGI, in that most of the sub-indices under the growth fundamentals sub-component are based on flow variables (growth, volatility, etc.) while those under the social dimension building block are stock-based (education and health levels). However, we refrained from employing flow variables for constructing the social dimension sub-

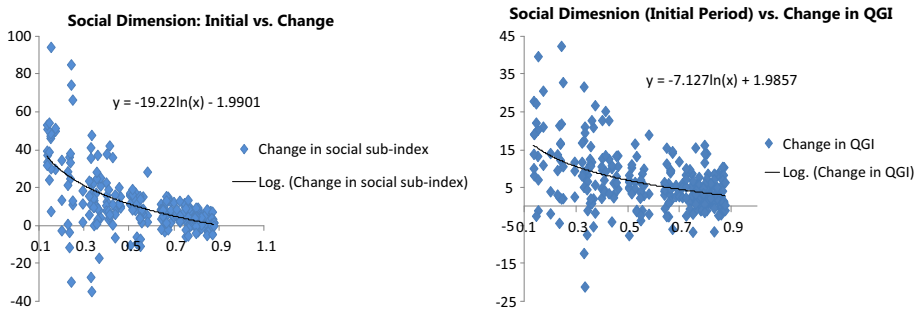

Fig. 7 Social dimension and QGI over time: convergence

component, as this could have biased the results (scores and ranking), given the very nature of the variables underlying the social dimension building block. There are indeed upper bound limits to what can be achieved in terms of school enrollment or life expectancy (at least from a finite time horizon perspective for the latter), which signals that the stock of better social conditions matters most than the change when it comes to reducing poverty (see e.g., Anand and Sen 2000; Scott et al. 2014), thus warranting using stock-based variables instead of flow-based ones. For example, a country X that experiences a stagnation of its life expectancy at birth at around 80 years still over-performs a country Y that experiences an increase in its life expectancy at birth but from 40 to 45 over a given timeframe. Analogously, a country that maintains a 100 %primary school enrollment rate over a 5-year horizon remains in a better position than a country that improves the primary school enrollment rate to 70 %, up from 50 % over the same time horizon. In a nutshell, since the dynamics of these social dimension variables exhibit a marked convergence over time (as illustrated in Fig. 7), using flow-based measures of sub-component of the social dimension building block would lead to misleading conclusions about the quality of growth across countries and time.

5 Conclusion

Improving living standards and reducing poverty are the ultimate goal of any growth strategy in developing countries. A nascent literature shows that countries with strong, stable, and broad-based growth are more likely to improve living standards and reduce poverty rates. This paper contributes to the literature and proposes a *Quality of Growth Index (QGI)* that captures both the intrinsic nature and the social dimension of growth, with the view that a "good quality of growth" is more than just the level of growth and should improve individuals' welfare. Hence, "good growth" should feature sound fundamentals and notable achievements in social outcomes.

Based on data availability, the QGI is designed as a composite index of sub-indexes capturing the "growth nature" aspect and the "desirable social outcomes" aspect. For the "growth fundamentals" sub-index, four dimensions are considered of good quality: the strength of growth, the stability of growth, the diversification of the sources of growth, and the outward orientation of growth. For the "social outcomes" sub-index, the most basic indicators of human capital are used: health proxied by life expectancy at birth and infant survival rate at birth and education proxied by primary school completion rate. These variables are supposed to reflect countries' progress toward better social indicators.

The paper has brought out the following stylized facts of the QGI. First, we find that the QGI scores well when compared with other welfare measures such as the UN HDI, poverty rates, income inequality and income per capita measures. Second, while the QGI has broadly improved over time, it has varied markedly across regions, income levels with LIC and sub-Saharan African countries lagging behind. In the same vein, structural factors such as fragility and resource endowment tend to be associated with lower QGI. Third, we explore the possibility of the existence of a "poor growth quality trap". We do find that there is a convergence in the quality of growth over time, though at a slow pace.

Building on the QGI, we also investigate the main drivers of the quality of growth. Empirical estimates indicate that institutions and policies tend to be associated with good quality growth. We find that the QGI is higher in a stable political environment. The quality of institutions, especially the quality of bureaucracy that ensures the capacity of government to deliver good public services, is also positively associated with higher QGI. Sound macroeconomic policies that help produce stable and broad-based growth contribute to better QGI. These include the share of spending allocated to social sectors, price stability, financial development and inclusion, and FDI.

The QGI is a positive step in understanding how high growth could lead to better social outcomes. It provides a comprehensive measure of the very nature of growth despite the paucity of data. It is also a dynamic concept and allows cross-country comparisons. Potential future research, as data become available, could enhance and broaden the scope of the QGI by including labor market and inequality measures. These would undoubtedly improve the inclusiveness dimension of the QGI.

For now, the QGI developed in this paper could serve as a benchmarking tool to guide policies for an inclusive growth.

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Appendix 1

See Appendix Table 4.

Table 4 Data sources and definition

Variables	Definition	Sources
Quality of growth index (QGI)	Composite index ranging between 0 and 1, resulting from the aggregation of components capturing growth fundamentals and from components capturing the socially-friendly nature of growth. The higher the index, the greater is the quality of growth	Authors' own calculations
Poverty rate	Proportion (percent) of the population living with less than one dollar a day	Sala-i-Martin (2006)
Human development index (HDI)	Geometric mean of normalized indices measuring achievements in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living	UN HDI database, available at: http://hdrstats.undp.org/en/indicators/103106.html

Table 4 continued

Variables	Definition	Sources
Inflation	Inflation rate based on the CPI index	World economic outlook
GDP per capita growth rate	Annual change of per capita product	World development indicators (WDI)
Life expectancy at birth	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	
Infant mortality rate	Number of infants dying before reaching one year of age, per 1000 live births in a given year	
Credit to private sector	Domestic credit to private sector, namely credit offered by the banks to the private sector, as percent of GDP	
Foreign direct investment (FDI)	Net inflows of foreign direct investments, as percent of GDP	
Remittances	Workers' remittances and compensation of employees (Percent of GDP), calculated as the sum of workers' remittances, compensation of employees, and migrants' transfers	
Primary school completion rate	Percentage of students completing the last year of primary school	WDI, with authors' estimations for missing observations
Index of diversification of export products	Complement of a Herfindahl–Hirschman index (HHI) of the concentration of countries' export products	COMTRADE
Foreign official aid	Official development aid actually disbursed, as percent of GDP	Jeanneney and Tapsoba (2012)
Public health spending	Public resources allocated to heath spending, as percent of GDP	IMF dataset
Public education spending	Public resources allocated to education spending, as percent of GDP	
Quality of bureaucracy	Index of the institutional strength and quality of the bureaucracy, ranging from 0 to 4. The higher the index, the stronger the quality of the bureaucracy	International country risk guide (ICRG 2009)
Rule of law	Index assessing the strength and the impartiality of the legal system, as well as the popular observance of the law. The index ranges from 0 to 6, with a higher value of the index reflecting a higher institutional quality	
Control of corruption	Index assessing the control of corruption within the political system. It ranges from 0 to 6, with a higher value of the index reflecting a better control of corruption	
Government stability	Index ranging from 0 to 12 and measuring the ability of government to stay in office and to carry out its declared program(s).The higher the index, the more stable the government is	

Appendix 2. Dealing with Missing Observations in the Primary School Completion Rate

Observations for primary school completion rate are missing for some countries. In order to avoid reducing considerably the sample size when using this indicator as a proxy for the social dimension of the quality of growth, we estimate these missing observations according to the following approach:

1. First, we compute for each country the primary completion rate (*Complest*) by dividing the average years of primary schooling (from Barro and Lee 2013) with the average duration of primary school (from WDI, 2010).
2. Second, to ensure that the computed completion rates (*Complest*) are consistent with the actual rates, we proceed as follows:

   - For a given country at a given year, if the actual completion rate (*Complact*) is available, then we keep this *Complact* as the completion rate (*Compl*) to be considered for the calculation of the QGI index.
   - For a given country at a given year, if *Complact* is missing, then we consider *Complest* adjusted for the average deviation between *Complest* and *Complact* (in the neighborhood of the year for which *Complact* is missing). The neighborhood considered spans from the 5 years preceding the year for which the observation is missing to the 5 years following the year for which the observation is missing.[19]

     $$Compl_{it} = Compl\_est_{it} + \lambda_{it}$$

     where i et t stands for country i and period t, respectively, with $\lambda_{it} = mean(Compl\_act_{ij} - Compl\_est_{it}), \quad j = \overline{t-4,\ t+4}$.

Appendix 3

See Appendix Table 5.

Table 5 Country ranking using geometric mean-based QGI

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
1	Malaysia	0.804	Malaysia	0.802	China	0.843	China	0.836
2	China	0.757	China	0.781	Latvia	0.790	Bulgaria	0.826
3	Thailand	0.748	Poland	0.780	Vietnam	0.785	Argentina	0.823
4	Chile	0.736	Vietnam	0.778	Bulgaria	0.776	Vietnam	0.798
5	Uruguay	0.730	Chile	0.750	Poland	0.769	Indonesia	0.794
6	Argentina	0.728	Thailand	0.748	Lithuania	0.766	Malaysia	0.790
7	Indonesia	0.723	Sri Lanka	0.744	Chile	0.762	Uruguay	0.776

[19] Note that "5" also corresponds to the interval over which the data are averaged in the calculation of the QGI.

Table 5 continued

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
8	Poland	0.720	Uruguay	0.731	Sri Lanka	0.746	Poland	0.772
9	Sri Lanka	0.718	Indonesia	0.729	Brazil	0.743	Panama	0.769
10	Vietnam	0.713	Argentina	0.724	Tunisia	0.740	Colombia	0.767
11	Panama	0.704	Mexico	0.716	Malaysia	0.739	Peru	0.765
12	Mexico	0.700	Lithuania	0.713	Uzbekistan	0.738	Sri Lanka	0.765
13	Costa Rica	0.690	Brazil	0.712	Mexico	0.737	Kazakhstan	0.764
14	Bulgaria	0.682	Panama	0.712	Thailand	0.733	Thailand	0.764
15	Colombia	0.677	Bulgaria	0.704	Cuba	0.730	Brazil	0.761
16	Turkey	0.673	Peru	0.704	Panama	0.730	Lithuania	0.761
17	Brazil	0.671	Egypt, Arab Rep.	0.700	Argentina	0.729	Chile	0.760
18	Belarus	0.664	Albania	0.699	Russian Federation	0.728	Belarus	0.756
19	Philippines	0.664	Tunisia	0.698	Albania	0.726	Tunisia	0.754
20	Ecuador	0.662	Costa Rica	0.698	Georgia	0.723	Romania	0.751
21	Jordan	0.654	Colombia	0.690	Armenia	0.723	Russian Federation	0.747
22	Romania	0.651	Bolivia	0.690	Egypt, Arab Rep.	0.721	Uzbekistan	0.745
23	Venezuela	0.648	Cuba	0.689	Romania	0.721	Mexico	0.745
24	Peru	0.645	Romania	0.688	Indonesia	0.720	Turkey	0.742
25	Russian Federation	0.644	Turkey	0.684	Peru	0.719	Albania	0.741
26	Tunisia	0.644	Latvia	0.679	Costa Rica	0.715	Jordan	0.739
27	Syrian Arab Republic	0.643	Ecuador	0.678	Uruguay	0.710	Cuba	0.738
28	Cuba	0.641	Jordan	0.675	Turkey	0.709	Egypt, Arab Rep.	0.738
29	Kyrgyz Republic	0.641	Armenia	0.671	Belarus	0.707	Latvia	0.736
30	Botswana	0.639	Russian Federation	0.671	Kazakhstan	0.704	Syrian Arab Republic	0.736
31	Moldova	0.635	Georgia	0.664	Colombia	0.703	Armenia	0.735
32	Lithuania	0.625	Syrian Arab Republic	0.663	Jordan	0.703	Costa Rica	0.729
33	Egypt, Arab Rep.	0.623	Philippines	0.659	Kyrgyz Republic	0.699	Georgia	0.726
34	Kazakhstan	0.621	Kazakhstan	0.656	Ecuador	0.697	Lao PDR	0.722
35	Paraguay	0.615	Kyrgyz Republic	0.656	Moldova	0.685	Mongolia	0.720
36	South Africa	0.613	Moldova	0.651	Philippines	0.683	Ecuador	0.719
37	Kenya	0.611	El Salvador	0.646	El Salvador	0.672	India	0.710

Table 5 continued

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
38	Honduras	0.606	Paraguay	0.646	Bolivia	0.668	Bolivia	0.700
39	El Salvador	0.603	South Africa	0.645	Azerbaijan	0.665	Philippines	0.699
40	Albania	0.599	Venezuela	0.639	Mongolia	0.662	Moldova	0.697
41	Algeria	0.594	Belarus	0.638	Tajikistan	0.661	Paraguay	0.694
42	Latvia	0.594	Algeria	0.635	Syrian Arab Republic	0.656	Morocco	0.691
43	India	0.591	India	0.626	South Africa	0.653	Honduras	0.687
44	Bolivia	0.582	Botswana	0.626	Paraguay	0.651	El Salvador	0.684
45	Armenia	0.581	Honduras	0.623	India	0.646	Tanzania	0.682
46	Namibia	0.577	Namibia	0.614	Lao PDR	0.641	South Africa	0.681
47	Mongolia	0.575	Azerbaijan	0.609	Namibia	0.641	Kyrgyz Republic	0.678
48	Ghana	0.564	Uzbekistan	0.607	Algeria	0.640	Algeria	0.666
49	Swaziland	0.560	Mongolia	0.607	Honduras	0.629	Bangladesh	0.662
50	Azerbaijan	0.555	Kenya	0.590	Nicaragua	0.623	Guatemala	0.658
51	Georgia	0.540	Ghana	0.586	Morocco	0.617	Nicaragua	0.651
52	Guatemala	0.537	Lao PDR	0.584	Venezuela	0.611	Namibia	0.641
53	Morocco	0.529	Nicaragua	0.581	Guatemala	0.608	Ghana	0.640
54	Iran, Islamic Rep.	0.518	Iran, Islamic Rep.	0.579	Bangladesh	0.605	Iran, Islamic Rep.	0.639
55	Bangladesh	0.505	Bangladesh	0.577	Iran, Islamic Rep.	0.603	Kenya	0.635
56	Tajikistan	0.501	Guatemala	0.572	Ghana	0.600	Nepal	0.631
57	Nepal	0.487	Tajikistan	0.556	Nepal	0.596	Tajikistan	0.630
58	Gabon	0.485	Nepal	0.554	Kenya	0.594	Zambia	0.618
59	Congo, Rep.	0.483	Morocco	0.549	Gambia, The	0.569	Botswana	0.616
60	Uzbekistan	0.479	Swaziland	0.542	Botswana	0.562	Pakistan	0.595
61	Nicaragua	0.475	Gabon	0.520	Tanzania	0.553	Venezuela	0.593
62	Pakistan	0.475	Pakistan	0.494	Togo	0.542	Madagascar	0.581
63	Tanzania	0.472	Tanzania	0.488	Cameroon	0.537	Azerbaijan	0.578
64	Lao PDR	0.462	Togo	0.487	Swaziland	0.528	Swaziland	0.567
65	Senegal	0.454	Cameroon	0.482	Pakistan	0.521	Rwanda	0.564
66	Yemen, Rep.	0.413	Senegal	0.477	Uganda	0.509	Ethiopia	0.563
67	Cameroon	0.409	Sudan	0.455	Gabon	0.501	Gambia, The	0.558
68	Cote d'lvoire	0.405	Zambia	0.448	Senegal	0.501	Togo	0.557
69	Madagascar	0.404	Cote d'Ivoire	0.445	Zambia	0.494	Gabon	0.554
70	Togo	0.404	Congo, Rep.	0.443	Madagascar	0.472	Benin	0.551
71	Gambia, The	0.403	Malawi	0.438	Benin	0.466	Uganda	0.549

Table 5 continued

Rank	1990–1994		1995–1999		2000–2004		2005–2011	
	Country	QGI	Country	QGI	Country	QGI	Country	QGI
72	Sudan	0.399	Gambia, The	0.437	Malawi	0.454	Senegal	0.546
73	Zambia	0.385	Equatorial Guinea	0.436	Cote d'Ivoire	0.451	Cameroon	0.526
74	Congo, Dem. Rep.	0.383	Uganda	0.431	Congo, Rep.	0.446	Malawi	0.506
75	Uganda	0.381	Mauritania	0.422	Mauritania	0.439	Mauritania	0.503
76	Equatorial Guinea	0.378	Madagascar	0.411	Guinea	0.424	Guinea	0.502
77	Mauritania	0.366	Yemen, Rep.	0.408	Sudan	0.423	Mozambique	0.502
78	Burundi	0.364	Lesotho	0.396	Lesotho	0.415	Cote d'Ivoire	0.486
79	Djibouti	0.344	Benin	0.383	Yemen, Rep.	0.407	Sierra Leone	0.476
80	Malawi	0.320	Djibouti	0.339	Ethiopia	0.393	Congo, Dem. Rep.	0.473
81	Lesotho	0.316	Nigeria	0.317	Djibouti	0.391	Djibouti	0.469
82	Rwanda	0.298	Guinea	0.315	Nigeria	0.385	Lesotho	0.468
83	Central African Rep.	0.297	Congo, Dem. Rep.	0.312	Sierra Leone	0.363	Nigeria	0.464
84	Benin	0.295	Central African Rep.	0.290	Rwanda	0.362	Congo, Rep.	0.456
85	Nigeria	0.291	Sierra Leone	0.279	Equatorial Guinea	0.360	Mali	0.435
86	Mozambique	0.277	Rwanda	0.278	Congo, Dem. Rep.	0.347	Burundi	0.420
87	Sierra Leone	0.259	Burkina Faso	0.263	Mali	0.347	Yemen, Rep.	0.416
88	Burkina Faso	0.259	Mali	0.262	Burkina Faso	0.344	Equatorial Guinea	0.406
89	Guinea	0.221	Mozambique	0.260	Burundi	0.321	Sudan	0.406
90	Chad	0.184	Burundi	0.243	Chad	0.304	Burkina Faso	0.393
91	Niger	0.164	Ethiopia	0.229	Niger	0.289	Niger	0.390
92	Mali	0.153	Niger	0.195	Mozambique	0.286	Central African Rep.	0.373
93	Ethiopia	0.002	Chad	0.168	Central African Rep.	0.278	Chad	0.220

Appendix 4

See Appendix Table 6.

Table 6 QGI for the full sample over 1990–2011: descriptive statistics

Variables	Obs	Mean	Std.	Min	Max
1: Benchmark result					
QGI1	372	0.604	0.140	0.258	0.849
2: Robustness to alternative specifications					
QGI2	372	0.591	0.116	0.299	0.836
QGI3	372	0.618	0.167	0.217	0.868
QGI4	372	0.584	0.105	0.319	0.829
QGI5	372	0.624	0.182	0.197	0.881

QGI1 corresponds to the QGI obtained using $\alpha = \beta = 1/2$, QGI2 when using ($\alpha = 2/3,\ \beta = 1/3$), QGI3 when using ($\alpha = 1/3,\ \beta = 2/3$), QGI4 when using ($\alpha = 3/4,\ \beta = 1/4$) and QGI5 when using ($\alpha = 1/4,\ \beta = 3/4$)

Appendix 5

See Appendix Table 7.

Table 7 Correlation matrix of the alternative QGIs

	QGI1	QGI2	QGI3	QGI4	QGI5
QGI1	1				
QGI2	0.987***	1			
	(0.000)				
QGI3	0.994***	0.962***	1		
	(0.000)	(0.000)			
QGI4	0.963***	0.994***	0.927***	1	
	(0.000)	(0.000)	(0.000)		
QGI5	0.988***	0.950***	0.999***	0.910***	1
	(0.000)	(0.000)	(0.000)	(0.000)	

*** The significance level of 1 %; *P* value in brackets

Appendix 6

See Appendix Table 8.

Table 8 Spearman's rank order correlation test (Arithmetic mean-based vs. Geometric mean-based QGI)

Number of observations	372
Spearman's rho	0.995
Ho: *Arithmetic mean-based QGI* and *Geometric mean-based QGI* are independent	
$P > \|t\| = 0.0000$	

Appendix 7

See Appendix Table 9.

Table 9 Spearman's rank order correlation test

Variables	$QGIAPC_1$ versus $QGIAPC_2$	$QGICEEC_1$ versus $QGICEEC_2$	$QGILAC_1$ versus $QGILAC_2$	$QGIMENA_1$ versus $QGIMENA_2$	$QGISSA_1$ versus $QGISSA_2$
Spearman's rho	0.988	0.98	0.98	0.961	0.999
Number of observations	48	64	68	40	144
Ho*: The two sets of QGI indices are independent*					
P value	0.000	0.000	0.000	0.000	0.000

Subscript 1 refers to the benchmark QGI score by region while subscript 2 refers to the region-specific one

APC Asian and Pacific Countries, *CEEC* Central and Eastern European Countries, *LAC* Latin American Countries, *MENA* Middle East and North Africa, *SSA* Sub-Saharan Africa

Appendix 8

See Appendix Table 10.

Table 10 Correlation matrix between the benchmark QGI and the region-specific QGI

	$QGIAPC_1$	$QGICEEC_1$	$QGILAC_1$	$QGIMENA_1$	$QGISSA_1$
$QGIAPC_2$	0.993***				
	(0.000)				
$QGICEEC_2$		0.984***			
		(0.000)			
$QGILAC_2$			0.982***		
			(0.000)		
$QGIMENA_2$				0.964***	
				(0.000)	
$QGISSA_2$					0.999***
					(0.000)

Subscript 1 refers to the benchmark QGI score by region while subscript 2 refers to the region-specific one; *P* value in brackets

*** The significance level of 1 %

APC Asian and Pacific Countries, *CEEC* Central and Eastern European Countries, *LAC* Latin American Countries, *MENA* Middle East and North Africa, *SSA* Sub-Saharan Africa

Appendix 9

See Appendix Table 11.

Table 11 Determinants of quality of growth on different subsamples

Dependent variable: QGI	[1] LIC	[2] MIC	[3] 1990–1999	[4] 2000–2011	[5] SSA	[6] Non-fragile	[7] Resource-rich
Social spending-to-GDP ratio	(+)*	(+)*	(+)***	(+)*	(+)***	(+)***	(+)*
Government stability	(+)***	(+)	(+)***	(−)	(+)***	(+)***	(+)***
Log of inflation volatility	(−)**	(−)**	(−)***	(−)**	(−)**	(−)***	(−)**
Financial depth	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***
Aggregated institutional quality	(+)*	(+)	(+)***	(+)***	(+)*	(+)**	(+)**
FDI-to-GDP ratio	(+)	(+)*	(+)*	(+)*	(+)	(+)***	(+)
Remittances-to-GDP ratio	(+)**	(−)	(−)	(+)	(+)	(+)	(+)
Foreign Aid-to-GDP ratio	(−)***		(−)***	(−)***	(−)***	(−)***	(−)***
Rule of law	(+)	(+)**	(+)	(+)	(+)	(+)	(+)*
Quality of bureaucracy	(+)***	(+)	(+)***	(+)***	(+)***	(+)***	(+)***
Control of corruption	(−)	(−)*	(+)	(+)	(−)	(−)	(+)
Observations	71	158	96	133	78	159	52
R-squared	0.558	0.218	0.509	0.370	0.541	0.432	0.566

(+) and (−) a positive and negative effect respectively, while *, **, and *** the significance level of 10, 5, and 1 % respectively

LIC Low-income countries, *MIC* Middle-income countries, *SSA* Sub-Saharan Africa, *Non-Fragile* non-fragile countries, *Resources-rich* Resources-rich countries

Appendix 10

See Appendix Table 12.

Table 12 Descriptive statistics for additional robustness checks-related QGI (full sample over 1990–2011)

Variables	Obs	Mean	Std.	Min	Max
1: Benchmark result					
QGI1	372	0.604	0.140	0.258	0.849
2: Robustness to alternative specifications					
QGI6	372	0.647	0.141	0.292	0.864
QGI7	372	0.579	0.148	0.200	0.861
QGI8	372	0.571	0.130	0.282	0.819
QGI9	372	0.516	0.136	0.207	0.821
QGI10	372	0.630	0.154	0.223	0.864
QGI11	372	0.575	0.138	0.241	0.837
QGI12	372	0.613	0.144	0.246	0.849
QGI_PCA	372	0.557	0.101	0.275	0.802
QGI13	336	0.610	0.113	0.319	0.828
QGI14	316	0.576	0.121	0.264	0.871

QGI1 corresponds to the baseline QGI, obtained using $\alpha = \beta = 1/2$. QGI6 to QGI12 are the ones obtained when keeping the equal weight assignment between the intrinsic nature and social dimension building blocks ($\alpha = \beta = 1/2$) but assigning different weights ($\gamma 1, \gamma 2, \gamma 3, \gamma 4$) to the sub-components of the intrinsic nature building bloc, namely (1/3, 0, 1/3, 0), (1/3, 1/3, 1/3, 0), (1/3, 1/3, 0, 1/3), (1/3, 1/3, 0, 0), (1/3, 0, 1/3, 0), (1/3, 1/3, 1/6, 1/6), (1/3, 1/6, 1/3, 1/6) for QGI6, QGI7, QGI8, QGI9, QGI10, QGI11, and QGI12, respectively. QGI_PCA corresponds to the QGI obtained when using the following weights derived from principal component analyses: ($\gamma_1 = 0.38$, $\gamma_2 = 0.27$, $\gamma_3 = 0.23$, $\gamma_4 = 0.12$); ($\delta_1 = 0.90$, $\delta_2 = 0.10$); and ($\alpha = 0.75$, $\beta = 0.25$). QGI13 corresponds to the QGI obtained when adding the following three inclusiveness-related sub-components to the social dimension of the baseline QGI: educational equality (ratio of female to male primary schooling enrollment), geographical equality (ratio of rural to urban access to improved water), and generational equality (youth employment). QGI14 corresponds to the QGI obtained using the same weighting scheme than in the baseline QGI, but with average years of primary schooling (instead of the primary school completion rate) as proxy for educational level

Appendix 11

See Appendix Table 13.

Table 13 Correlation matrix for additional robustness checks-related QGI (full sample over 1990–2011)

	QGI1	QG6	QGI6	QG8	QGI9	QGI10	QGI11	QGI12	QGI_PCA	QGI13	QGI14
QGI1	1										
QGI6	0.992***	1									
	(0.000)										
QGI7	0.993***	0.981***	1								
	(0.000)	(0.000)									
QGI8	0.977***	0.953***	0.958***	1							
	(0.000)	(0.000)	(0.000)								
QGI9	0.962***	0.925***	0.961***	0.985***	1						
	(0.000)	(0.000)	(0.000)	(0.000)							
QGI10	0.977***	0.986***	0.985***	0.914***	0.907***	1					
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
QGI11	0.996***	0.978***	0.991***	0.988***	0.983***	0.962***	1				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)					
QGI12	0.997***	0.995***	0.996***	0.960***	0.948***	0.990***	0.989***	1			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
QGI_PCA	0.921***	0.899***	0.942***	0.880***	0.905***	0.921***	0.923***	0.926***	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
QGI13	0.989***	0.977***	0.988***	0.963***	0.957***	0.969***	0.986***	0.987***	0.940***	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
QGI14	0.951***	0.944***	0.952***	0.918***	0.910***	0.943***	0.945***	0.953***	0.906***	0.943***	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

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