The Geometry of Growth and Inequality

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Abstract

I decompose mean economic growth into distribution-preserving and inequality-increasing components to recover a more inclusive measure of growth. I then show that the new measure of growth is equal to Atkinson's equally distributed equivalent growth. I also show that growth and societal inequality aversion embodied in the elasticity of marginal utility of consumption should be inseparably linked when factored into policy. Joint determination contrasts with the practice of arriving at estimates of the elasticity of marginal utility of consumption and economic growth trends separately, and then recombining them during policy applications, e.g., in estimating the wealth effect component of Ramsey Rule-based social discount rates. More generally, the geometric relationships that emerge between mean growth, equally distributed equivalent growth and the elasticity reveal a simple adjustment allowing the replacement of mean growth metrics such as gross domestic product per capita with equally distributed equivalent growth per capita. This has far-reaching implications as the inclusion of inequality considerations into national decision-making is of increasing interest globally.

Keywords Economic growth, Inequality, Elasticity of marginal utility of consumption, Equally distributed equivalent, Wealth effect

JEL Classification D63, H43, O43

1 Introduction

The Kaldor-Hicks compensation criterion (Hicks, 1939; Kaldor, 1939) has been an absolute boon for economists and policymakers. For 85 years practitioners have used it as justification for treating economic growth and inequality concerns separately. Governments could, for example, pursue national policies to support economic growth, then as an entirely separate matter enact a bit of social policy. By extension, magnitude-of-growth statistics such as growth

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in gross domestic product (GDP) per capita could be measured separately – and enter policy separately – from indicators of inequality aversion such as the elasticity of marginal utility of consumption, η.

Except, Kaldor and Hicks have been thoroughly wronged through the overprescription of the implications from their discussion of efficiency during the construction of socioeconomic policies and the study of economic growth. Speculatively, so too have members of societies where economic growth dominates policy. As soon as one moves from measuring growth only in magnitude, to also including an inequality dimension, I find both aspects of growth integrally linked. Subsequently, magnitude-of-growth and inequality aversion should not enter policy separately – doing so provides a dangerously incomplete picture of preferences and activity at both micro- and macro-economic scales. So, I derive a method to replace GDP per capita with Atkinson's (1970) equally-distributed-equivalent (EDE) level of growth, g_t^{Ede}, a measure which includes both growth and inequality influences. I do so without increasing the information burden over current levels when, say, estimating the wealth effect component of Ramsey Rule-based social discount rates (Ramsey, 1928).

The insufficiency of growth as a metric without distribution is, of course, known (Stiglitz, Sen, and Fitoussi, 2010; Piketty, 2015; Piketty, Yang, and Zucman, 2019; Lansing and Markiewicz, 2018) leading to hybrid growth-inequality measures and adjustments (Aghion et al., 2013; European Commission, 2014; Fleurbaey, 2009; Jones and Klenow, 2016; Sen, 1973; Stiglitz, 2012). However, incorporating inequality into growth need not occur ex-post as an ad hoc adjustment. Through a new approach to distributional growth accounting a more fundamental solution emerges.

The paper proceeds as: I first outline the data which I apply my distributional growth accounting method to as it helps frame the conversation. My method then forms the bulk of this report. Results then follow based on applying the methods to the data. I then derive some implications for social discounting as a major inroad for growth and inequality parameters into policy. I then return to a more general discussion and conclusion.

2. Data

I use Luxembourg Income Survey (LIS), Organisation for Economic Co-operation and Development (OECD), and World Bank income (WB-I) and consumption (WB-C) datasets to apply the methods in this paper. All data was accessed between January 8th and 10th, 2024. LIS and OECD data arrived in national currency in original year form, then consumer price index

(CPI) and purchasing power parity (PPP) adjusted using CPI and PPP estimates provided by LIS and OECD respective to their data. First, values were CPI adjusted within the country's currency to a common year, then equivalised to the common currency in the common year following standard practices. LIS data is equivalised to the U.S. dollar in 2017, and the OECD to the U.S. dollar in 2015. World Bank data was already available in 2017 U.S. dollars. Difference between base years is unimportant in my analysis.

In all cases, I use household level, survey-based data. OECD data is based on disposable household income defined as income less taxes and transfers. LIS instead use household income as the sum of both monetary income and the value of in-kind transfers. In both cases, household income is then equivalised to a standard size household. These datasets emphasise standardisation in data collection methods. World Bank household income and consumption data from the Poverty and Inequality Platform is instead a collection of, usually, statistics provided by country-level statistics offices. As such, methodologies differ between countries – it is beyond the scope of this paper to explore these differences within the World Bank's frequently used database. However, I make the distinction between household income and consumption-based measures.

For each dataset-country-year combination, I use national annual mean and median measures of income or consumption. All estimates in this paper are based on these annual estimates alone. Years included in each dataset are country specific and are clearly denoted in the results provided. Overall, the datasets start in years 1963, 1974, 1977, and 1963 for datasets LIS, OECD, WB-C, and WB-I, respectively, and all run up through the year 2022.

I visually analyse each country-dataset for consistency. That is, because this research relies on consistent growth trends, I limit periods of the start of each country-dataset to those which suggest that the country is on a consistent path. E.g., if a country followed a different growth trajectory from 1968-1999 than from 2000-2020, I constrain the analysis to the 2000-2020 period as illustrated in my first figure. However, I must then caveat that the global picture which emerges from this study is illustrative but not necessarily representative as recently unstable regimes are underrepresented.

As noted, economic growth as a measure of magnitude, e.g., GDP per capita growth, underrepresents the relationship between growth and inequality. Magnitude measures imply more (or less) potential to improve the consumption potential of society but retains no information on who gets to consume more (less). GDP per capita levels can be achieved via different combinations of factors: capital, labour, productivity, etc., e.g., Mankiw, Romer and

Weil (1992), but also by distributing differently the returns from growth to the public – an objective of much social policy. In this section I decompose mean growth into distributional components. Then in the next section I derive formulae for representing alternatives to GDP per capita growth with minimal additional information burdens.

To decompose growth, I use a lognormal distribution assumption – a useful simplification on the distribution of the returns to economic activity for our accounting purposes. It is tractable and a reasonable approximation for empirical income distributions (Pinkovskiy and Sala-i-Martin 2009) and perhaps more so for consumption distributions (Battistin, Blundell and Lewbel, 2009). As a two-parameter distribution, the lognormal is also compatible with two-part measures of social welfare that depend on the scale and spread of income. For the lognormal distribution, the mean, median, and mode take analytical forms $\bar{c}_t = exp(\mu_t + \frac{1}{2}\sigma_t^2)$, $\tilde{c}_t = exp(\mu_t)$, and $c_t^{Mo} = exp(\mu_t - \sigma_t^2)$. Subsequently, I can describe these measures in a two-dimensional space with cartesian coordinates of the form $\left(\frac{1}{2}\sigma^2, \mu\right)$. **Fig. 1** represents the growth paths of Ireland, the United Kingdom, and the United States – the author's countries of origin and residence – in such a space to illustrate the point. The identifying assumption is that for each country depicted, the within-country income distribution is lognormal in all periods. The graphs then contain the annual decomposition of levels of income as points, connected by arrows indicating directions of annual growth. Start and end years of the data as well as years where growth trajectories take a noticeable turn are highlighted. On the vertical axis we have $\ln(\tilde{c}_t)$ with corresponding horizontal lines as transformed median income levels of attainment. In each graph, the horizontal and vertical axes are at the same scale. So, corresponding to $\ln(\bar{c}_t)$, we also have levels of transformed mean income attainment with slopes of negative-one. We could also, if desired, include levels of $\ln(c_t^{Mo})$ with slopes of two. I also include black dashed lines orthogonal to levels of $\ln(\tilde{c}_t)$ and $\ln(\bar{c}_t)$ anchored to the beginning of recent stable growth trajectories which indicate optimal median and mean growth pathways, respectively. As we can observe, countries can have large distributional growth adjustments, be entirely stagnated in one or the other or both directions of growth, or entirely change their growth trajectory corresponding with key historical events.

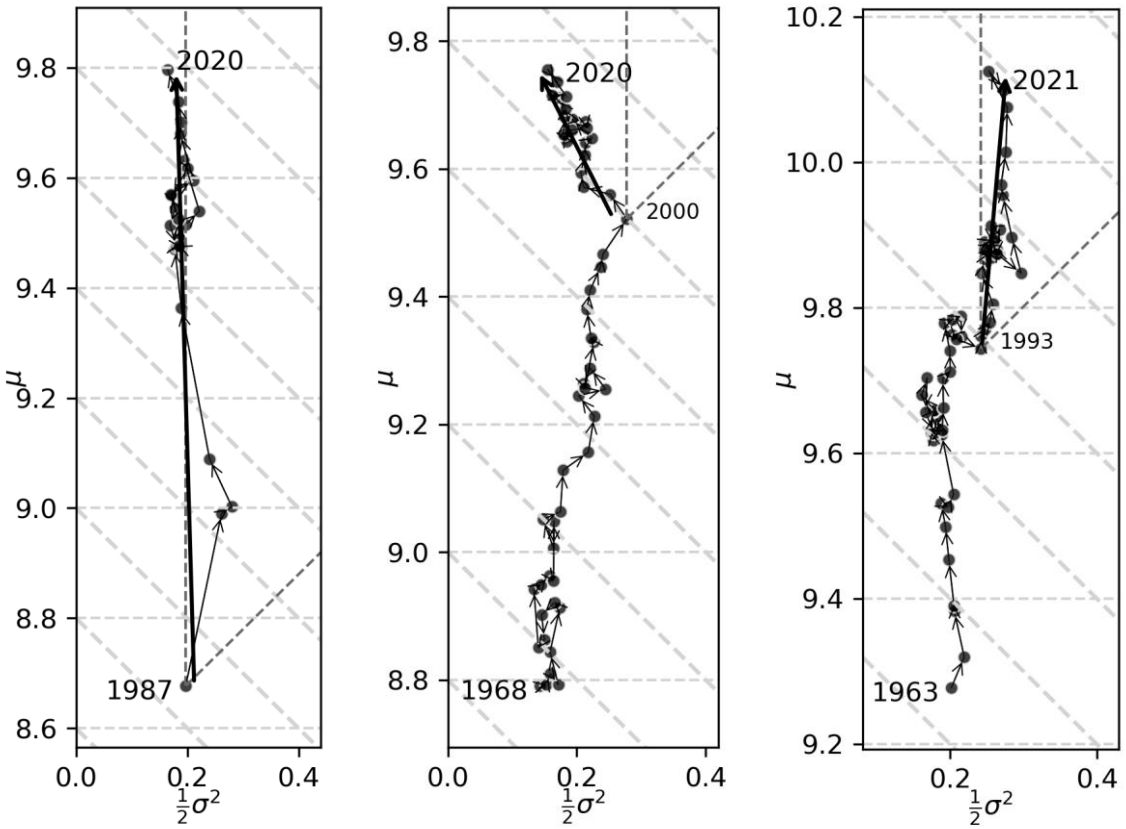


Fig. 1 Three illustrative growth paths in $\left(\frac{1}{2}\sigma^2, \mu\right)$ space – for Ireland (left), the United Kingdom (middle) and the United States (right) based on World Bank (2024) income data.

The respective growth rates for $\bar{c}_t$, $\tilde{c}_t$, and c_t^{Mo} are $\bar{g}_t = \frac{1}{t}\Delta\mu_{0,t} + \frac{1}{t}\frac{1}{2}\Delta\sigma_{0,t}^2$, $\tilde{g}_t = \frac{1}{t}\Delta\mu_{0,t}$ and $g_t^{Mo} = \frac{1}{t}\Delta\mu_{0,t} - \frac{1}{t}\Delta\sigma_{0,t}^2$ where $\Delta\mu_{0,t} = \mu_t - \mu_0$ and $\Delta\sigma_{0,t}^2 = \sigma_t^2 - \sigma_0^2$. Here, we observe the possibility that increases in σ^2 can drive growth in mean income through increasing inequality which can be measured as $\bar{g}_t - \tilde{g}_t = \frac{1}{t}\frac{1}{2}\Delta\sigma_{0,t}^2$. This implies that increases in GDP per capita can occur through inequality-driven growth – even exclusively so. Large segments of the population could then find that their economic outlook is not improving, in contrast to national statistics. At extremes, positive GDP per capita growth can occur due to a simultaneous increase in the income of the rich and decrease in the well-being of modal households, but also that mean growth might be entirely stagnated while either the extremely poor or wealthy (one or the other) find their conditions improving.[1] The general point is that the effectiveness of mean growth-type statistics such as GDP per capita growth are affected by how the returns from growth are distributed.

[1] The mean-modal spread also exceeds the mean-median gap suggesting the latter is insufficient in capturing the issue.

The relationships illustrated are reduced form and causality could run in many possible directions (Banerjee and Duflo, 2003).[2] Underlying different trajectories are differences in economic structures, policies, institutions and ownership of income generating assets. Preferences for inequality and distribution are likely an important part of this relationship, at least in democratic countries (Almås, Cappelen, Sørensen and Tungodden, 2024). Ultimately, the observed growth paths embody the political costs of growth, distribution and historical ownership of policy (Acemoglu, Naidu, Restrepo and Robinson, 2015). That is, Rawls' (1971) conception – institutions – and concept – the outcome of justice – suggest countries have different distributive institutions and hence outcomes.

3. Methods

I use simple methods to recover inclusive measures of growth and investigate the role of social preferences in determining the trajectory of growth and distribution. This is assumed to be the result of an intertemporal planning problem in which decision-makers have enacted policies based on levels of inequality aversion. Alternatively, indicated social preferences over distribution may be thought of as reduced-form representations of institutions and cultural traditions regarding the distribution of income within a given country. I suggest that differences in inequality aversion, or their broader conception, result in different trajectories in $\left(\frac{1}{2}\sigma^2, \mu\right)$.

To begin, in $\left(\frac{1}{2}\sigma^2, \mu\right)$ space, mean growth and a growth vector denoted g_t^V are related with the mean as a projection of the latter. I also note that information is lost when we rely on something more singular in meaning such as a magnitude of growth metric. So rather, through growth decomposition we recover g_t^V – it is a simple matter following Pythagorean:

$$g_t^V = \begin{cases} \sqrt{(\bar{g}_t - \tilde{g}_t)^2 + \tilde{g}_t^2} & if\ \bar{g}_t \geq 0 \\ -\sqrt{(\bar{g}_t - \tilde{g}_t)^2 + \tilde{g}_t^2} & if\ \bar{g}_t < 0 \end{cases} \quad (1)$$

where I have taken the extra step of preserving the sign of growth. Or, if we know the angle, θ, between $\bar{g}_t$ or g_t^V versus something like the mean-maximising growth path, it is also a simple matter. Let:

[2] Causality on distribution trends, stability, and geopolitical influence/interference are not part of this paper, but more complicated mechanisms for *enacting* social preferences warrants exploration.

(2) $$\theta(\tilde{g}_t, \bar{g}_t - \tilde{g}_t) = \begin{cases} \frac{4}{\pi}\left(ATAN2\left(\tilde{g}_t, (\bar{g}_t - \tilde{g}_t)\right) - \frac{\pi}{4}\right) & if\ \bar{g}_t \geq 0 \\ \frac{4}{\pi}\left(ATAN2(\ (\bar{g}_t - \tilde{g}_t), -\tilde{g}_t) + \frac{\pi}{4}\right) & if\ \bar{g}_t < 0 \end{cases}$$

based on ATAN2 (Organick, 1966) – an extension of $\frac{4}{\pi}\tan^{-1}\left((\bar{g}_t - \tilde{g}_t), \tilde{g}_t\right)$ into all quadrants – where $\frac{4}{\pi}$ results in an alternative scale to radians.[3] As will be seen, (2) has useful properties: $\theta(a,\ 0) = 1$ and $\theta(a,\ a) = 0$ for any real a. The degrowth scenario in terms of mean growth supposes that distributional preferences are preserved – growth and degrowth vectors in $\left(\frac{1}{2}\sigma^2, \mu\right)$ move in opposition. Then, in addition to (1),[4]

(3) $$g_t^V = \frac{\bar{g}_t}{\sqrt{2}\cos\left(\frac{\pi}{4}\theta\right)}$$

which also preserves the sign of mean growth through the relationship between θ and $\bar{g}_t$ in (2). (3) is convenient when we have something like $\bar{g}_t$ on hand, e.g., GDP per capita growth, and a conjecture on θ but lack information on $\tilde{g}_t$.

The derivation of (3) is supported by **Fig. 2** where a somewhat typical vector, $\boldsymbol{g}$, indicating decreasing inequality is depicted. Vector projection $\boldsymbol{v} = |\boldsymbol{a}|\cos\left(\frac{\pi}{4}\theta\right)$ – the projection $\boldsymbol{v}$ from $\boldsymbol{a}$ on the left – equals $\boldsymbol{v} = |\boldsymbol{g}|\cos\left(\frac{\pi}{4}\right)$ – the projection $\boldsymbol{v}$ from $\boldsymbol{g}'$ on the right. To be clear, $|\boldsymbol{g}'| = |\boldsymbol{g}|$. Setting $|\boldsymbol{a}|\cos\left(\frac{\pi}{4}\theta\right) = |\boldsymbol{g}|\cos\left(\frac{\pi}{4}\right)$ results in the convenient expression $|\boldsymbol{a}| = \frac{\bar{g}_t}{\sqrt{2}\cos\left(\frac{\pi}{4}\theta\right)}$ as $\cos\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$. I also demonstrate the impact of a fixed $|\boldsymbol{g}|$ for all θ, denoted $|\boldsymbol{g}|_{\forall\theta}$. Note that while a specific vector $\boldsymbol{g}$ is identified by its separable components $|\boldsymbol{g}|$ and θ, this is no longer the case with $|\boldsymbol{a}|$. For a given $|\boldsymbol{g}|$, $|\boldsymbol{a}|$ changes in response to changes in θ as identified by $|\boldsymbol{a}|_{\forall\theta}$ following the line of projection of $\boldsymbol{a}$ onto and through $\boldsymbol{v}$. In economic growth terms, let $\Delta\boldsymbol{x} = \frac{1}{t}\frac{1}{2}\Delta\sigma_{0,t}^2$ and $\Delta\boldsymbol{y} = \frac{1}{t}\Delta\mu_{0,t}$, then $|\boldsymbol{g}| = \bar{g}_t$, $|\boldsymbol{a}| = g_t^V$, and additionally $|\Delta\boldsymbol{y}| = \tilde{g}_t$.

[3] Within the first $\frac{\pi}{2}$ radians, $\theta = \tan^{-1}(\tan(\theta)) = \tan^{-1}\frac{\bar{g}_t\sin(\theta)}{\bar{g}_t\cos(\theta)} = \tan^{-1}\left(\frac{\tilde{g}_t}{(\bar{g}_t - \tilde{g}_t)}\right)$. Adjustment $\frac{\pi}{4}$ orients θ relative to the mean growth maximising pathway. The sign is used in ATAN2 functions to determine the quadrant of the vector.

[4] With $\cos\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$, the adjustment back to the cartesian plane from the modified plane in θ, and $\frac{\pi}{4}\theta$, the angle between g_t^V and $\bar{g}_t$ vectors.

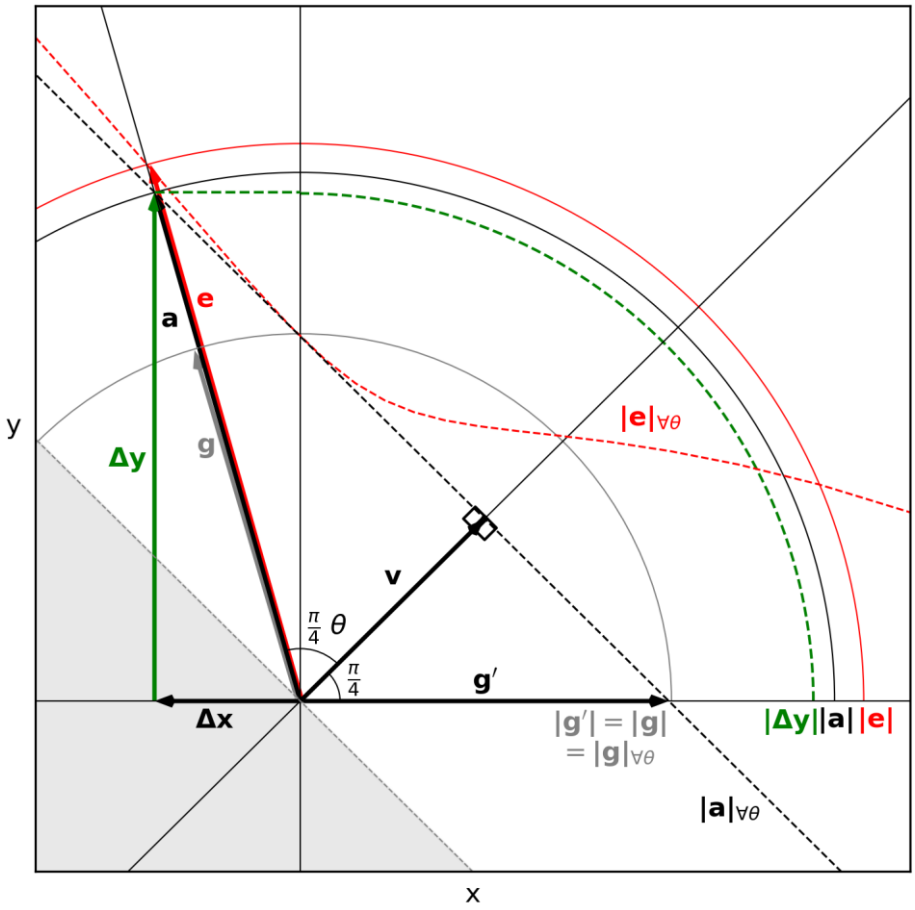


Fig. 2 Derivation of Results. When $\Delta \boldsymbol{x} = \frac{1}{t}\frac{1}{2}\Delta\sigma_{0,t}^2$, $\Delta \boldsymbol{y} = \frac{1}{t}\Delta\mu_{0,t}$ and $\theta = \eta$, the magnitudes of vectors $\boldsymbol{g}$, $\boldsymbol{a}$, $\boldsymbol{e}$ and $\Delta \boldsymbol{y}$ have standard economic growth interpretations as $|\boldsymbol{g}| = \bar{g}_t$, $|\Delta \boldsymbol{y}| = \tilde{g}_t$, $|\boldsymbol{a}| = g_t^V$ and $|\boldsymbol{e}| = \boldsymbol{g_t^{Ede}}$ following their derivation in the text. Note, any vectors into the light grey region would indicate degrowth trajectories.

Vector $\boldsymbol{e}$ in **Fig. 2** also follows the same growth trajectory identified by θ as $\boldsymbol{a}$ and $\boldsymbol{g}$. Let,

$$|\boldsymbol{e}| = \Delta y + (1 - \theta)\Delta x \tag{4}$$

Note that $|\boldsymbol{g}| = |\boldsymbol{a}| = |\boldsymbol{e}| = |\Delta \boldsymbol{y}|$ if $\theta = 1$ instead of the example trajectory. In economic growth terms, if $\theta = 1$, these vectors would lie on the median-maximising growth path on the y-axis. Also note that $|\boldsymbol{g}| = |\boldsymbol{e}|$ if instead $\theta = 0$, on the mean-maximising growth path. We also observe that the differences between $|\boldsymbol{a}|$ and close neighbour $|\boldsymbol{e}|$ are trivial near the y-axis but grow at rate:

$$\frac{|\boldsymbol{e}|}{|\boldsymbol{a}|} = 1 + \frac{\sqrt{2}}{\pi}(1 - \theta)^2. \tag{5}$$

Subsequently,

(6) $$|\boldsymbol{e}| = |\boldsymbol{a}|\left(1 + \frac{\sqrt{2}}{\pi}(1-\theta)^2\right) = \bar{g}_t \frac{1+\frac{\sqrt{2}}{\pi}(1-\theta)^2}{\sqrt{2}\cos\left(\frac{\pi}{4}\theta\right)}$$

Up to this point I have kept assumptions on societal preferences reserved. However, θ in the scale presented has a convenient economic interpretation of its own as well as enabling one for $|\boldsymbol{e}|$. Assume each agent in society has the same utility function of constant relative risk aversion (CRRA) form following Atkinson (1970):

(7) $$u(c_i(t)) = \begin{cases} \frac{{c_{i,t}}^{1-\eta}}{1-n}, & if\ \eta > 0, \eta \neq 1 \\ \ln\left(c_{i,t}\right), & if\ \eta = 1 \end{cases}$$

with elasticity of marginal utility of consumption, η. Atkinson's EDE level of consumption is then $c^{Ede} = exp(\mu + (1-\eta)\frac{1}{2}\sigma^2)$ and EDE growth, $g_t^{Ede} = \frac{1}{t}\Delta\mu_{0,t} + (1-\eta)\frac{1}{t}\frac{1}{2}\Delta\sigma_{0,t}^2$ (Emmerling, Groom, and Wettingfeld, 2017). Which is to say, $|\boldsymbol{e}| = g_t^{Ede}$ when $\theta = \eta$, $\Delta x = \frac{1}{t}\frac{1}{2}\Delta\sigma_{0,t}^2$ and $\Delta y = \frac{1}{t}\Delta\mu_{0,t}$:[5]

(8) $$g_t^{Ede} = \bar{g}_t \frac{1+\frac{\sqrt{2}}{\pi}(1-\eta)^2}{\sqrt{2}\cos\left(\frac{\pi}{4}\eta\right)}.$$

For later expositional use denote the resulting multiplier:

(9) $$\tau(\eta) = \frac{1+\frac{\sqrt{2}}{\pi}(1-\eta)^2}{\sqrt{2}\cos\left(\frac{\pi}{4}\eta\right)}$$

Finally, I also note in **Fig. 2** $|\boldsymbol{e}|_{\forall\theta}$, the response of $|\boldsymbol{e}|$ to different paths identified by θ for a given magnitude $|\boldsymbol{g}|$. As we observe in the figure, g_t^{Ede} converges to and then equals $\bar{g}_t$ as $\eta \to 0$, and to $\tilde{g}_t$ as $\eta \to 1$. That is, the result that η and measures of growth including g_t^{Ede} are jointly determined and mechanically linked applies to allow growth paths.

4. Results

I decompose economic growth for the author's countries of origin, study and residence, plus available BRIC nations in this section. I also reserve an additional 118 country-dataset

[5] Where a trivial difference between g_t^{Ede} by equations (4) versus (8) emerges. This error is zero at $\eta = 1$, rising to 0.25% at $\eta = 0.56$ & 1.44 as a periodic function over period $\eta = 2$ attributed to the approximation in equation (2).

estimates for the appendix. As noted in the data section, these estimates are over recent periods of observed stability in the direction of growth. Fig. 3 provides an illustration of growth distributional decomposition. Key paths are plotted as dashed black lines for mean- and median-maximising growth corresponding with η values of zero and one, respectively. The modal-maximising growth path is similarly plotted. However, paths outside the "hourglass" of growth vectors related to η in the interval $[0, 2]$ are purely academic – they would imply sustained yet rapid collapses of socioeconomic structures. Due to that contradiction, they are unlikely to be observed in long-run growth in the wild – we do not have an example on hand. I also indicate in blue, growth vectors corresponding to economic growth in the United Kingdom, Ireland, and the United States tied to η values of 1.50, 1.08, and 0.82, respectively.

Clearly, growth does not follow the mean growth maximising path for any country in the dataset. I also observe that countries with substantially different levels of mean growth can be on the same growth-inequality trajectory and, conversely, different levels of mean growth can be arrived at by substantially different traditions of sharing the returns to growth.

The range of estimates over the full dataset demonstrate η values from 0.6 for Venezuela during a period of mean degrowth from 1981-2006, to 1.57 for the United Kingdom from 2000-2020. Many countries follow pathways indicating less – though usually some – divergence from median growth maximisation fitting with the oft used aphorism in economic growth discussions that "a rising tide lifts all boats." I also note that when a country is an outlier in terms of decreasing inequality they are, with few exceptions, developing countries undergoing substantial transformations and attempting to address poverty. When instead countries are outliers in terms of increasing inequality they are, with few exceptions, advanced economies where minimally acceptable standards of quality of life have been met for much of their populations. In fact, the United Kingdom is something of a curiosity as it follows a developing country-type growth path during the period of observation.

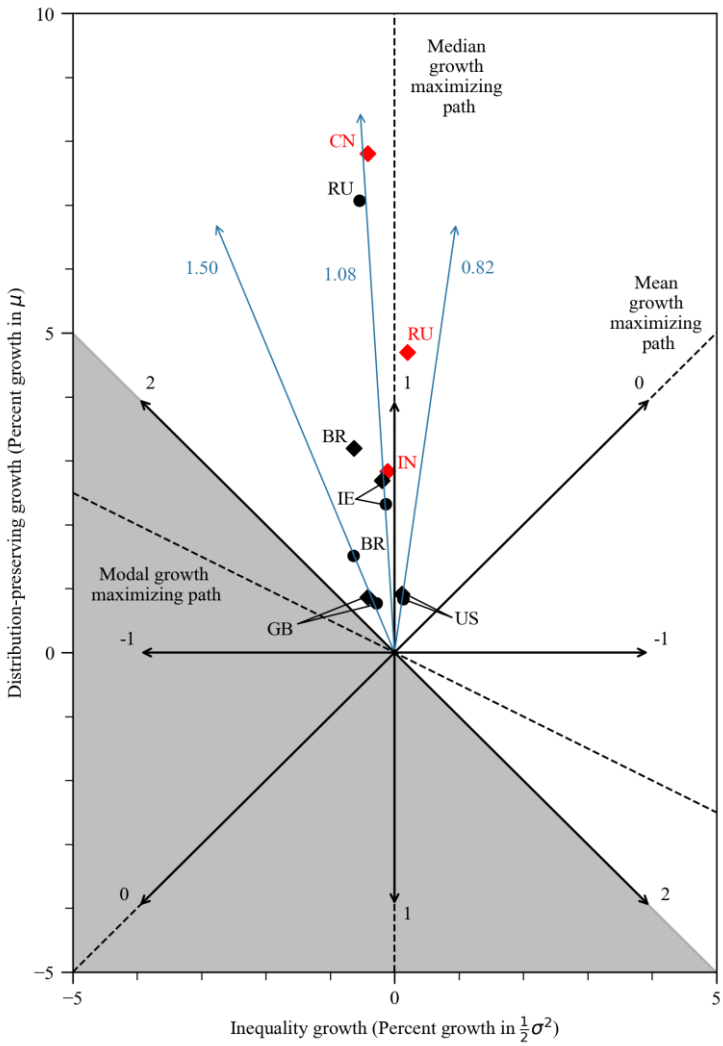


Fig. 3 Key distributional growth paths and illustrative examples based on distributionally decomposing long-run growth estimates for select countries denoted by their ISO 3166-1 A-2 country codes. World Bank income (WB-I) (black diamond markers), World Bank (2024) consumption (red diamond markers) and Luxembourg Income Study (2024) (black dot markers)-based estimates. Key η values noted in black and values of 0.82, 1.08, and 1.50 related to US, IE, and GB growth trajectories in blue. The grey area indicates that degrowth would be occurring.

For the selected countries, I also report in Table 1 estimates of $\bar{g}_t$, g_t^{Ede}, η and subsequently the EDE-based "wealth effect", ηg_t^{Ede}, discussed further in the next section. Unless $\eta = 1$, in every case we observe g_t^{Ede} differs from $\bar{g}_t$. Subsequently, policy advice built on $\bar{g}_t$-type metrics likely does not match conditions "on the ground." As such, I suggest g_t^{Ede} replace $\bar{g}_t$ in policy calculations – a change I have shown does not require substantial additional effort.

Table 1 Select Estimates

	Period	Dataset	$\bar{g}_t$	g_t^{Ede}	η	ηg_t^{Ede}
Brazil	2006-2022 (11)	LIS	0.88 (0.39)	1.83 (0.54)	1.51 (0.07)	2.76 (0.71)
Brazil	1981-2021 (37)	WB-I	2.56 (0.19)	3.35 (0.18)	1.25 (0.03)	4.18 (0.24)
China	2002-2020 (14)	WB-C	7.39 (0.30)	7.83 (0.30)	1.07 (0.01)	8.37 (0.31)
India	2004-2021 (10)	WB-C	2.72 (0.20)	2.84 (0.19)	1.05 (0.04)	2.98 (0.22)
Ireland	1987-2019 (23)	LIS	2.18 (0.34)	2.33 (0.36)	1.08 (0.02)	2.51 (0.39)
Ireland	1987-2020 (24)	WB-I	2.50 (0.35)	2.71 (0.33)	1.09 (0.04)	2.96 (0.33)
Russia	2000-2019 (12)	LIS	6.53 (1.05)	7.12 (1.22)	1.10 (0.02)	7.82 (1.42)
Russia	1999-2020 (17)	WB-C	4.90 (1.02)	4.71 (0.86)	0.95 (0.04)	4.46 (0.63)
United Kingdom	2000-2021 (22)	LIS	0.49 (0.06)	0.90 (0.09)	1.44 (0.05)	1.30 (0.15)
United Kingdom	2000-2020 (21)	WB-I	0.45 (0.06)	1.10 (0.13)	1.57 (0.06)	1.72 (0.24)
United States	1993-2021 (29)	LIS	0.97 (0.11)	0.87 (0.11)	0.80 (0.05)	0.69 (0.13)
United States	1993-2021 (29)	WB-I	1.03 (0.11)	0.93 (0.12)	0.84 (0.05)	0.78 (0.14)

Notes: Period includes the number of observations over the period in parentheses. Average annual growth rates $\bar{g}$ and g^{Ede} in per cent. Based on LIS, World Bank income (WB-I), and World Bank consumption (WB-C) data from 2024. All estimates reported are statistically significant at the 5-per cent level or better – usually substantially so – and standard errors are reported in parentheses. Additional country- and dataset-level estimates provided in the appendix.

Finally, I note that measures of η implied by growth vectors may differ from those measured by other means. Those implied by growth are the net effect of all societal influences, including those beyond the reach of national policy efforts such as deep-seated traditions.

5. Implications

Viewed through the lens of $\left(\frac{1}{2}\sigma^2, \mu\right)$ space, the concept of national policy should be to accumulate and distribute national wealth fitting with the conception, η. Subsequently, levels of g_t^{Ede} realised suggest the degree of success. But what if an entirely ill-fitting measure of growth and intent were to be used as the basis for national policy development? Here I review the implications of alternative growth and inequality aversion parameters in social discounting.

Note that there is no indication in the Ramsey Rule (Ramsey, 1928) approach to social discounting that $\bar{g}_t$ must be used – it was, and is, a choice of convenience. Were g_t^{Ede} the growth bases in the simple Ramsey Rule we would have:

$$r_t = \delta + \eta g_t^{Ede} \tag{10}$$

Using $\bar{g}_t$ instead warrants a correction to the "wealth effect", $\eta\bar{g}_t$, by $\tau(\eta)$ which is close to $\left(\sqrt{2}\cos\left(\frac{\pi}{4}\eta\right)\right)^{-1}$ for most observed growth trajectories – the adjustment to the simple Ramsey Rule based social discount rate to instead base it on g_t^V. In the United Kingdom, (9) suggests raising the social discount rate – shifting a greater share of resources towards the present to address immediate needs. For $\eta = 1.44, 1.57$, $\tau(\eta) = 1.81, 2.44$, respectively. In the United

States, the social discount rate would instead be lowered versus current recommendations – to spread wealth between generations. For $\eta = 0.80, 0.84$, $\tau(\eta) = 0.89, 0.91$, respectively.

But really, this is about conception and concept – intentions and results. Has the resulting growth path matched what was intended by decisionmakers? Then, the estimates of g_t^{Ede} and η from this paper should be adopted in pairs into policy to avoid inconsistency. If instead, g_t^{Ede} is wildly off course from expectations, some other sort of adjustment is in order. Say, for example, a country's leaders insist that they intend to pursue mean-maximising growth. Then, η should be set to zero and simple Ramsey Rule-based discounting derived from any growth basis $\left(\bar{g}_t, g_t^V, g_t^{Ede}\right)$ becomes $r_t = \delta$. But that implications may be shocking to anyone advocating for mean growth maximising policies with the intention to boost consumption in the present. I also note that a mean growth maximising trajectory is entirely different from what is suggested by the observed growth of every country we analyse.

6. Discussion

Notionally, g_t^{Ede} reflects the outcome – Rawl's concept – of the growth and distributional objectives of society, and η the intention – Rawl's conception. Such a model makes the efficiency-equity trade-off in society explicit via an income distribution and social inequality aversion. Although this approach at first glance might threaten to do away with the standard representative agent, I have also provided a means of approximating such an agent. They are, after all, pervasive in the foundations of policy – no need to unnecessarily burn bridges.

Elsewhere, van der Ploeg, Emmerling and Groom (2023) show that in a lognormal framework with a CRRA utility function, Atkinson's EDE income can be used as the appropriate summary statistic for growth and indeed that there is a correspondence between the EDE income and the percentile of the income distribution for each value of η. They show (in their appendix A) that higher inequality aversion implies a lower percentile of the income distribution is the focus of policy with values of $\eta = 0, 1, 2, 4$ relate to the 84, 50, 15 and 0.1 percentiles of the distribution – entirely fitting with the spirit of my results. These equivalences illustrate that with societal income inequality, different summary statistics of the income distribution become important from a welfare perspective, and in this sense represent society as a whole.

I have provided a measure of growth in a space shaped by the lognormal distribution yet initially independent of a utility functional form assumption. At that minimal scale of structure, we can observe whether economic growth is on a trajectory that suggests a country seeks to

maximise growth or is pursuing another objective. I then use a CRRA utility assumption to link growth to inequality aversion. Measuring departures from a notionally desired growth-distribution path then is more informative than a magnitude-only measure such as GDP per capita growth and more directly actionable than, say, a dashboard of metrics a la Stiglitz, Sen and Fitoussi (2010).

I also note that running an economy along vectors further afield, say those implied by η values approaching zero or beyond two is a dangerous endeavour. Growth paths associated with values below international norms indicate transfers to the wealthy in the present at the expense of both the poor today and a poorer future overall. On the other hand, higher implied η values suggest redistributions to the poor today at the expense of – again – the future. However, the latter may nevertheless be justified in moderation to address disturbing levels of poverty in the present – to ensure that a future exists for those alive today.

I note that the calibration used to arrive at the η estimates relies on implications from EDE consumption, namely that $\eta = 1$ is related to median growth and $\eta = 0$ to mean growth. Other bases such as in Buchholz and Schumacher's (2010) no-envy in the relative sense (NER) condition – which appears to associate distribution-preserving median growth with $\eta = 2$ could lead to different results but would also require a different modelling approach. However, I find that my estimates of η are in the ballpark – though generally smaller – than others derived via well-tread methodologies.[6] Similar but not identical estimates are to be expected as the approach is based on the relationship with economic growth and therefore the net effect of all economic and social activities influencing income distribution.

I suggest that whether g_t^{Ede} has departed from society's preferred distributional growth path indicates whether growth policy will be regarded as equitable and internally consistent. It also informs on another way that GDP per capita growth falls short of what the factor decomposition literature predicts due to savings-distribution relationships (Saez and Zucman, 2016). So too, distributional growth estimates of η versus expectations indicate whether GDP per capita growth will continue to miss the mark if η is based on stable societal preferences. Another advantage of benchmarking to an η is that it is connected to a growth path rather than a target

[6] Evans (2005) – the benchmark in the literature – provides estimates for 20 OECD countries based on Stern's (1977) national tax data approach, with mean values of 1.35 and 1.42 based on two estimation points of reference. Groom and Maddison (2019) provide five revealed preference-based estimates for the United Kingdom which are spot on with the estimates in this paper of about 1.5. Other estimates exist based on tax, demand, consumption, or other preference revealing bases individually or through public choice. Among these are estimates for 50 countries based on happiness surveys in Layard, Mayraz, and Nickell (2008) with a mean of 1.26, estimates on 17 Latin American countries in Moore, Boardman, and Vining (2020) with a mean of 1.33, and six transitioning Eastern European countries in Seçilmiş and Akbulut (2019) with means of 1.52 and 1.19 in 2000 and 2015 respectively. Many individual country estimates in the same ballpark can also be found.

level of growth and so has a dynamic perspective "baked in". However, measuring the abstract quality η consistently and frequently by other means to compare to the values suggested by the approach would be challenging. Another challenge is the interpretation of the units of divergence of η measures – the difference between two measures of inequality aversion with one reflecting societal preference and the other reflecting preferences implied by observed performance. I have also made zero progress in determining why different distributional growth paths emerge, nor did I intend to.

7. Conclusion

Dasgupta (2008) notes "Although there is no obvious reason why η should be independent of C, I follow Cline, Nordhaus, and Stern and assume that η is a constant" in reference to consumption in the CRRA utility function as in (7). Here, I find both Dasgupta's suspicion and praxis are correct – metrics on consumption are linked to η, but η identify constant growth trajectories over substantial periods of time. Subsequently, I find it difficult to return to viewing measures of growth as one-dimensional magnitudes.

Yet, growth models and national growth statistics typically treat growth and distribution as largely separate issues. Distribution is posited as the result of returns to, and ownership of, factors of production alone, not as a societal and policy choice itself. GDP per capita growth is perhaps fitting for purposes from that perspective. Instead, we find it is a simple matter to reintegrate a measure of distribution into growth and estimate societal distributional preferences implied by the direction of a distribution-inclusive measure of growth. Such resulting measures of economic performance highlight the essential, dynamic equity-efficiency trade-off between income – and by extension savings, distribution and welfare. I find this forces introspection on the evolving income distribution and the question: is this how society ought to be growing?

The measure presented can be taken as agnostic to inequality in that changes in inequality can be viewed as either good or bad depending on any true underlying societal preferences. g_t^{Ede} and η capture whether a country seems to prefer decreasing inequality to support the poor, more uniform gains to "lift all boats", or increasing inequality when standards of living for much of the population are less concerning.

My approach differs substantially from other measures of inequality, e.g., the Gini coefficient (Gini, 1912; Lorenz, 1905), which imply less inequality is always preferred. I also observe that social preferences through inequality aversion parameter η likely do change over

time when societal interests, objectives and norms shift. I suggest that when economic policy continues to be based on a prior expectation, countervailing "headwinds" are being built against societal interests. $\bar{g}_t$-focused policies when society follows g_t^{Ede} suggests a mismatch and subsequently a drag on creating wealth. The result is – speculatively – an increasing need for social support systems and government interventions to keep society and the economic system embedded in it functioning.

Finally, I have shown that g_t^{Ede} is simply a growth vector allowed to "free-range" a bit more in $\left(\frac{1}{2}\sigma^2, \mu\right)$ space – nothing to be afraid of. I have also shown that the information burden necessary to estimate g_t^{Ede} is lower than previously thought – no more than $\bar{g}_t$ and η are necessary. These are parameters already present in many public policy calculations such as Ramsey Rule-based social discount rates. As such, we have lowered the barrier to incorporating c_t^{Ede} and g_t^{Ede} into policy and perhaps replacing $\bar{g}_t$ with a more appropriate metric.

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Appendix

Table A1 Additional Estimates (1 of 4)

	Period	Dataset	$\bar{g}_t$	g_t^{Ede}	η	ηg_t^{Ede}
Albania	2002-2020 (8)	WB-C	2.83 (0.24)	2.92 (0.31)	1.04 (0.04)	3.03 (0.40)
Armenia	2004-2021 (18)	WB-C	1.15 (0.35)	1.63 (0.44)	1.30 (0.16)	2.11 (0.70)
Australia	1981-2018 (12)	LIS	1.59 (0.20)	1.44 (0.20)	0.84 (0.03)	1.21 (0.21)
Australia	1995-2020 (10)	OECD	2.28 (0.23)	2.15 (0.21)	0.91 (0.02)	1.97 (0.19)
Australia	1981-2018 (12)	WB-I	1.68 (0.18)	1.59 (0.18)	0.92 (0.03)	1.46 (0.20)
Austria	1994-2020 (25)	WB-I	1.12 (0.07)	1.23 (0.06)	1.10 (0.03)	1.35 (0.07)
Bangladesh	2000-2022 (5)	WB-C	1.63 (0.06)	1.90 (0.03)	1.16 (0.02)	2.21 (0.04)
Belarus	1998-2020 (23)	WB-C	7.42 (0.57)	7.65 (0.60)	1.04 (0.00)	7.93 (0.63)
Belgium	1985-2021 (25)	LIS	1.25 (0.10)	1.26 (0.08)	1.01 (0.02)	1.28 (0.06)
Belgium	2004-2021 (14)	OECD	0.98 (0.08)	1.16 (0.07)	1.18 (0.06)	1.37 (0.11)
Belgium	1985-2020 (24)	WB-I	1.37 (0.16)	1.39 (0.11)	1.02 (0.05)	1.42 (0.07)
Bolivia	2005-2021 (16)	WB-I	2.04 (0.29)	4.92 (0.77)	1.56 (0.03)	7.70 (1.28)
Brazil	2006-2022 (11)	LIS	0.88 (0.39)	1.83 (0.54)	1.51 (0.07)	2.76 (0.71)
Brazil	1981-2021 (37)	WB-I	2.56 (0.19)	3.35 (0.18)	1.25 (0.03)	4.18 (0.24)
Burkina Faso	1994-2018 (6)	WB-C	3.71 (0.30)	4.63 (0.41)	1.22 (0.07)	5.63 (0.75)
Canada	1971-2019 (43)	LIS	1.10 (0.06)	0.97 (0.06)	0.80 (0.03)	0.78 (0.08)
Canada	2000-2021 (22)	OECD	1.45 (0.05)	1.61 (0.04)	1.12 (0.01)	1.80 (0.05)
Canada	1971-2019 (43)	WB-I	1.17 (0.07)	1.17 (0.09)	1.00 (0.02)	1.16 (0.11)
Chile	1990-2017 (13)	LIS	3.00 (0.23)	3.47 (0.19)	1.15 (0.02)	4.00 (0.18)
Chile	2006-2022 (8)	OECD	2.13 (0.21)	2.97 (0.43)	1.29 (0.07)	3.84 (0.72)
Chile	1987-2020 (15)	WB-I	2.52 (0.19)	3.83 (0.13)	1.35 (0.03)	5.16 (0.18)
China	2002-2020 (14)	WB-C	7.39 (0.30)	7.83 (0.30)	1.07 (0.01)	8.37 (0.31)
Colombia	2001-2021 (19)	WB-I	2.51 (0.45)	3.36 (0.50)	1.27 (0.04)	4.26 (0.59)
Costa Rica	2003-2022 (20)	WB-I	1.91 (0.35)	1.86 (0.32)	0.97 (0.04)	1.80 (0.31)
Cote d'Ivoire	1985-2018 (11)	WB-C	-1.43 (0.74)	-1.40 (0.77)	0.97 (0.10)	-1.37 (0.82)
Czech Republic	2004-2016 (5)	LIS	1.87 (0.41)	2.06 (0.54)	1.11 (0.04)	2.29 (0.68)
Czech Republic	1996-2020 (19)	WB-I	2.23 (0.10)	2.20 (0.09)	0.98 (0.01)	2.16 (0.09)
Denmark	1987-2016 (9)	LIS	1.00 (0.11)	0.87 (0.11)	0.75 (0.06)	0.65 (0.12)
Denmark	1985-2019 (19)	OECD	0.99 (0.02)	0.85 (0.02)	0.68 (0.05)	0.58 (0.05)
Denmark	1987-2020 (22)	WB-I	0.96 (0.08)	0.83 (0.07)	0.70 (0.05)	0.58 (0.05)
Dominican Republic	2004-2021 (18)	WB-I	2.17 (0.40)	3.90 (0.29)	1.44 (0.06)	5.60 (0.29)
Ecuador	2000-2022 (21)	WB-I	2.78 (0.66)	4.25 (0.74)	1.35 (0.04)	5.75 (0.87)
El Salvador	1998-2022 (24)	WB-I	1.16 (0.19)	2.82 (0.12)	1.57 (0.05)	4.41 (0.13)
Estonia	2000-2016 (6)	LIS	5.21 (0.39)	5.79 (0.58)	1.12 (0.03)	6.47 (0.79)
Estonia	2004-2021 (18)	OECD	5.15 (0.35)	5.53 (0.40)	1.08 (0.01)	5.98 (0.46)
Estonia	1993-2020 (19)	WB-I	4.80 (0.30)	5.16 (0.27)	1.08 (0.02)	5.60 (0.28)
Finland	1994-2021 (28)	OECD	1.68 (0.12)	1.58 (0.11)	0.91 (0.02)	1.44 (0.10)
Finland	1995-2020 (20)	WB-I	1.60 (0.20)	1.61 (0.15)	1.00 (0.04)	1.61 (0.10)
France	1970-2018 (28)	LIS	1.09 (0.13)	1.16 (0.16)	1.07 (0.02)	1.25 (0.19)
France	1996-2021 (9)	OECD	0.83 (0.15)	0.85 (0.08)	1.02 (0.11)	0.86 (0.06)
France	1970-2020 (30)	WB-I	1.46 (0.13)	1.58 (0.17)	1.09 (0.03)	1.73 (0.22)
Georgia	2009-2021 (13)	LIS	3.41 (0.73)	5.61 (0.83)	1.39 (0.04)	7.81 (0.99)
Germany	1985-2020 (18)	OECD	0.73 (0.14)	0.69 (0.13)	0.92 (0.04)	0.64 (0.12)
Germany	2001-2019 (19)	WB-I	0.78 (0.10)	0.80 (0.10)	1.03 (0.04)	0.83 (0.11)

Notes: Period includes the number of observations in parentheses. Average annual growth rates $\bar{g}$ and g^{Ede} in percent. Based on LIS, OECD, World Bank income (WB-I), and World Bank consumption (WB-C) data (2024). All estimates reported are statistically significant at the 10-per cent level or better – usually substantially so – and standard errors are reported in parentheses.

Table A2 Additional Estimates (2 of 4)

	Period	Dataset	$\bar{g}_t$	g_t^{Ede}	η	ηg_t^{Ede}
Ghana	1991-2016 (5)	WB-C	3.54 (0.21)	3.39 (0.22)	0.94 (0.02)	3.20 (0.25)
Greece	1995-2020 (20)	WB-I	-1.52 (0.68)	-1.40 (0.69)	0.88 (0.09)	-1.24 (0.73)
Guatemala	1986-2014 (6)	WB-I	3.13 (1.40)	4.06 (1.21)	1.24 (0.11)	5.06 (1.06)
Guinea	2002-2018 (4)	WB-C	2.85 (0.24)	4.76 (0.33)	1.40 (0.01)	6.66 (0.42)
Hungary	1995-2021 (19)	OECD	2.17 (0.23)	2.28 (0.21)	1.06 (0.03)	2.42 (0.22)
Hungary	1999-2020 (18)	WB-I	2.31 (0.32)	2.40 (0.30)	1.05 (0.04)	2.51 (0.30)
India	2004-2021 (10)	WB-C	2.72 (0.20)	2.84 (0.19)	1.05 (0.04)	2.98 (0.22)
Indonesia	2012-2022 (11)	WB-C	3.46 (0.22)	4.53 (0.40)	1.25 (0.03)	5.67 (0.62)
Ireland	1987-2019 (23)	LIS	2.18 (0.34)	2.33 (0.36)	1.08 (0.02)	2.51 (0.39)
Ireland	1987-2020 (24)	WB-I	2.50 (0.35)	2.71 (0.33)	1.09 (0.04)	2.96 (0.33)
Israel	2004-2021 (18)	LIS	2.29 (0.15)	2.86 (0.18)	1.22 (0.02)	3.49 (0.23)
Israel	1985-2020 (18)	OECD	2.04 (0.11)	2.07 (0.11)	1.02 (0.03)	2.11 (0.14)
Israel	1979-2018 (22)	WB-I	1.89 (0.16)	1.91 (0.20)	1.01 (0.03)	1.93 (0.26)
Italy	1986-2020 (26)	WB-I	1.18 (0.13)	1.21 (0.13)	1.03 (0.02)	1.25 (0.13)
Kazakhstan	1996-2018 (19)	WB-C	4.26 (0.55)	4.72 (0.59)	1.11 (0.02)	5.25 (0.64)
Korea	2012-2021 (10)	OECD	2.23 (0.18)	2.85 (0.15)	1.23 (0.06)	3.51 (0.26)
Lao PDR	2002-2018 (4)	WB-C	3.64 (0.13)	3.23 (0.16)	0.79 (0.04)	2.56 (0.25)
Latvia	2004-2021 (18)	OECD	4.53 (0.57)	4.91 (0.57)	1.09 (0.02)	5.35 (0.58)
Latvia	2005-2020 (16)	WB-I	4.14 (0.65)	4.38 (0.66)	1.07 (0.04)	4.67 (0.71)
Lithuania	2013-2020 (8)	LIS	7.55 (0.29)	8.01 (0.19)	1.07 (0.02)	8.55 (0.22)
Lithuania	2004-2021 (18)	OECD	5.00 (0.56)	4.79 (0.60)	0.94 (0.03)	4.51 (0.67)
Lithuania	1993-2020 (18)	WB-I	6.41 (0.60)	6.25 (0.67)	0.97 (0.02)	6.05 (0.77)
Luxembourg	1985-2019 (35)	LIS	1.20 (0.13)	1.11 (0.12)	0.87 (0.03)	0.97 (0.11)
Luxembourg	1986-2021 (20)	OECD	1.36 (0.24)	1.27 (0.23)	0.90 (0.03)	1.15 (0.22)
Luxembourg	1985-2020 (36)	WB-I	1.28 (0.14)	1.17 (0.14)	0.86 (0.03)	1.01 (0.14)
Madagascar	1980-2012 (8)	WB-C	-2.06 (0.26)	-1.94 (0.21)	0.92 (0.07)	-1.78 (0.19)
Malaysia	2003-2018 (7)	WB-I	4.91 (0.28)	5.69 (0.31)	1.16 (0.01)	6.58 (0.36)
Malta	2006-2020 (15)	WB-I	3.24 (0.20)	3.03 (0.16)	0.90 (0.04)	2.74 (0.18)
Mauritania	2004-2014 (3)	WB-C	2.21 (0.26)	4.10 (0.74)	1.45 (0.03)	5.96 (1.20)
Mexico	1998-2022 (14)	LIS	1.06 (0.30)	2.02 (0.29)	1.46 (0.07)	2.95 (0.32)
Mexico	2000-2020 (9)	OECD	0.77 (0.18)	1.83 (0.22)	1.56 (0.08)	2.86 (0.38)
Mexico	2000-2020 (12)	WB-I	0.82 (0.17)	1.49 (0.19)	1.44 (0.08)	2.14 (0.30)
Moldova	2001-2021 (20)	WB-C	4.44 (0.77)	5.23 (0.80)	1.17 (0.02)	6.12 (0.84)
Mongolia	2002-2018 (8)	WB-C	3.70 (1.28)	3.77 (1.14)	1.02 (0.06)	3.85 (0.98)
Morocco	2000-2013 (3)	WB-C	3.35 (0.05)	3.47 (0.07)	1.04 (0.01)	3.61 (0.10)
Netherlands	1983-2018 (13)	LIS	1.26 (0.11)	1.19 (0.11)	0.92 (0.02)	1.10 (0.11)
Netherlands	1977-2021 (22)	OECD	0.93 (0.10)	1.00 (0.10)	1.08 (0.02)	1.09 (0.11)
Netherlands	1983-2020 (22)	WB-I	1.35 (0.14)	1.47 (0.12)	1.10 (0.04)	1.62 (0.11)
New Zealand	1995-2020 (18)	OECD	1.73 (0.06)	1.98 (0.06)	1.14 (0.03)	2.26 (0.09)
Nicaragua	1993-2014 (6)	WB-I	3.49 (0.31)	5.03 (0.11)	1.31 (0.05)	6.61 (0.23)
Nigeria	1996-2018 (6)	WB-C	1.26 (0.19)	3.00 (0.57)	1.56 (0.11)	4.68 (1.20)
Norway	1979-2021 (13)	LIS	2.05 (0.13)	1.98 (0.13)	0.96 (0.01)	1.90 (0.13)
Norway	1986-2021 (18)	OECD	1.99 (0.14)	1.93 (0.14)	0.96 (0.03)	1.86 (0.16)
Norway	1979-2019 (22)	WB-I	2.41 (0.11)	2.47 (0.13)	1.03 (0.02)	2.54 (0.16)

Notes: Period includes the number of observations in parentheses. Average annual growth rates $\bar{g}$ and g^{Ede} in percent. Based on LIS, OECD, World Bank income (WB-I), and World Bank consumption (WB-C) data (2024). All estimates reported are statistically significant at the 10-per cent level or better – usually substantially so – and standard errors are reported in parentheses.

Table A3 Additional Estimates (3 of 4)

	Period	Dataset	$\bar{g}_t$	g_t^{Ede}	η	ηg_t^{Ede}
Pakistan	1987-2018 (13)	WB-C	2.79 (0.28)	2.84 (0.28)	1.02 (0.02)	2.90 (0.30)
Panama	2003-2021 (18)	WB-I	4.10 (0.34)	4.95 (0.51)	1.19 (0.03)	5.89 (0.70)
Peru	2004-2019 (16)	LIS	3.00 (0.47)	4.66 (0.60)	1.36 (0.02)	6.34 (0.75)
Peru	1997-2021 (25)	WB-I	2.33 (0.31)	3.85 (0.36)	1.40 (0.04)	5.37 (0.48)
Philippines	2006-2021 (6)	WB-I	1.65 (0.29)	2.81 (0.26)	1.41 (0.06)	3.97 (0.32)
Poland	1995-2020 (19)	LIS	3.59 (0.19)	3.68 (0.25)	1.03 (0.02)	3.79 (0.34)
Poland	2005-2021 (17)	OECD	4.07 (0.26)	4.63 (0.26)	1.14 (0.01)	5.26 (0.27)
Poland	1995-2019 (18)	WB-I	3.81 (0.14)	4.04 (0.20)	1.07 (0.02)	4.31 (0.29)
Portugal	2012-2020 (9)	WB-I	3.33 (0.32)	3.56 (0.29)	1.08 (0.05)	3.84 (0.34)
Romania	1997-2020 (16)	LIS	4.11 (0.55)	4.22 (0.52)	1.03 (0.02)	4.37 (0.51)
Romania	1994-2020 (18)	WB-I	4.13 (0.78)	4.20 (0.79)	1.02 (0.02)	4.30 (0.80)
Russia	2000-2019 (12)	LIS	6.53 (1.05)	7.12 (1.22)	1.10 (0.02)	7.82 (1.42)
Russia	1999-2020 (17)	WB-C	4.90 (1.02)	4.71 (0.86)	0.95 (0.04)	4.46 (0.63)
Senegal	1991-2018 (6)	WB-C	3.11 (0.60)	3.97 (0.62)	1.23 (0.12)	4.89 (1.00)
Slovakia	2004-2018 (9)	LIS	2.12 (0.63)	2.62 (0.61)	1.21 (0.06)	3.17 (0.64)
Slovakia	2005-2019 (15)	WB-I	1.60 (0.27)	2.15 (0.32)	1.27 (0.04)	2.72 (0.40)
Slovenia	1997-2015 (7)	LIS	1.83 (0.13)	1.70 (0.14)	0.89 (0.04)	1.51 (0.17)
Slovenia	2004-2021 (18)	OECD	1.07 (0.23)	1.07 (0.23)	1.00 (0.03)	1.06 (0.23)
Slovenia	1997-2020 (19)	WB-I	1.91 (0.24)	1.88 (0.23)	0.98 (0.01)	1.84 (0.22)
Spain	1980-2019 (27)	LIS	1.58 (0.18)	1.71 (0.17)	1.09 (0.03)	1.86 (0.16)
Spain	1980-2020 (29)	WB-I	2.09 (0.17)	2.18 (0.18)	1.05 (0.01)	2.29 (0.19)
Sri Lanka	2002-2019 (6)	WB-C	2.79 (0.21)	3.06 (0.18)	1.10 (0.04)	3.38 (0.22)
Sweden	1975-2021 (27)	LIS	2.07 (0.11)	1.92 (0.10)	0.89 (0.01)	1.72 (0.10)
Sweden	1975-2021 (19)	OECD	1.90 (0.16)	1.79 (0.14)	0.92 (0.01)	1.64 (0.13)
Sweden	1975-2020 (25)	WB-I	1.77 (0.07)	1.66 (0.06)	0.90 (0.02)	1.50 (0.05)
Switzerland	2000-2018 (15)	WB-I	0.72 (0.07)	0.83 (0.13)	1.15 (0.08)	0.95 (0.20)
Taiwan	1981-2016 (11)	WB-I	2.40 (0.73)	2.33 (0.73)	0.96 (0.02)	2.24 (0.74)
Tajikistan	1999-2015 (6)	WB-C	6.93 (1.30)	6.78 (1.28)	0.97 (0.02)	6.59 (1.27)
Thailand	1994-2021 (23)	WB-C	2.95 (0.17)	3.72 (0.19)	1.22 (0.01)	4.55 (0.21)
Tunisia	1995-2015 (5)	WB-C	2.85 (0.08)	3.64 (0.07)	1.23 (0.02)	4.49 (0.10)
Turkiye	2004-2020 (13)	OECD	2.79 (0.49)	2.85 (0.52)	1.03 (0.03)	2.92 (0.56)
Turkiye	2009-2019 (11)	WB-C	3.26 (0.34)	2.77 (0.28)	0.62 (0.05)	1.72 (0.13)
Uganda	2002-2019 (6)	WB-C	2.24 (0.53)	2.55 (0.59)	1.14 (0.03)	2.91 (0.66)
Ukraine	2002-2020 (19)	WB-C	3.22 (0.49)	3.44 (0.50)	1.07 (0.02)	3.69 (0.53)
United Kingdom	2000-2021 (22)	LIS	0.49 (0.06)	0.90 (0.09)	1.44 (0.05)	1.30 (0.15)
United Kingdom	2000-2020 (21)	WB-I	0.45 (0.06)	1.10 (0.13)	1.57 (0.06)	1.72 (0.24)
United States	1993-2021 (29)	LIS	0.97 (0.11)	0.87 (0.11)	0.80 (0.05)	0.69 (0.13)
United States	1993-2021 (29)	WB-I	1.03 (0.11)	0.93 (0.12)	0.84 (0.05)	0.78 (0.14)
Uruguay	2007-2022 (14)	LIS	1.94 (0.51)	2.99 (0.87)	1.36 (0.03)	4.06 (1.24)
Uruguay	2007-2021 (15)	WB-I	1.81 (0.51)	3.09 (0.76)	1.41 (0.03)	4.35 (1.03)
Venezuela	1981-2006 (13)	WB-I	-2.68 (0.57)	-2.28 (0.50)	0.60 (0.25)	-1.36 (0.75)
Vietnam	1992-2020 (12)	WB-C	6.30 (0.50)	6.63 (0.57)	1.06 (0.01)	7.02 (0.67)

Notes: Period includes the number of observations in parentheses. Average annual growth rates $\bar{g}$ and g^{Ede} in per cent. Based on LIS, OECD, World Bank income (WB-I), and World Bank consumption (WB-C) data (2024). All estimates reported are statistically significant at the 10-per cent level or better – usually substantially so – and standard errors are reported in parentheses.

Table A4 Additional Estimates (4 of 4)

Dataset	Countries	$\bar{g}_t$	g_t^{Ede}	η	ηg_t^{Ede}
LIS	28 (487)	1.89 (0.14)	2.29 (0.17)	1.13 (0.02)	2.67 (0.21)
OECD	23 (383)	1.64 (0.08)	1.99 (0.09)	1.15 (0.02)	2.32 (0.12)
WB-I	49 (959)	1.65 (0.05)	2.08 (0.05)	1.13 (0.01)	2.52 (0.07)
WB-C	30 (310)	4.26 (0.12)	4.63 (0.12)	1.09 (0.01)	5.04 (0.14)

Notes: Period includes the number of observations in parentheses. Average annual growth rates $\bar{g}$ and g^{Ede} in per cent. Based on LIS, OECD, World Bank income (WB-I), and World Bank consumption (WB-C) data (2024). All estimates reported are statistically significant at the 10-per cent level or better – usually substantially so – and standard errors are reported in parentheses.