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Converging to Convergence

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ABSTRACT

Empirical tests in the 1990s found little evidence of poor countries catching up with rich - unconditional convergence - since the 1960s, and divergence over longer periods. This stylized fact spurred several developments in growth theory, including AK models, poverty trap models, and the concept of convergence conditional on determinants of steady-state income. We revisit these findings, using the subsequent 25 years as an out-of-sample test, and document a trend towards unconditional convergence since 1990 and convergence since 2000, driven by both faster catch-up growth and slower growth of the frontier. During the same period, many of the correlates of growth - human capital, policies, institutions, and culture - also converged substantially and moved in the direction associated with higher income. Were these changes related? Using the omitted variable bias formula, we decompose the gap between unconditional and conditional convergence as the product of two cross-sectional slopes. First, correlate-income slopes, which remained largely stable since 1990. Second, growth-correlate slopes controlling for income - the coefficients of growth regressions - which remained stable for fundamentals of the Solow model (investment rate, population growth, and human capital) but which flattened substantially for other correlates, leading unconditional convergence to converge towards conditional convergence.

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1 Introduction

Studies of convergence in the 1990s found no tendency for poor countries to catch up with rich ones. If anything, there was divergence: rich countries growing faster than poor. National accounts data showed weak divergence across a large set of countries since the 1960s (Barro 1991), while historical data, for a smaller set of countries, showed stronger divergence starting as early as the 16th century, with the ratio of per capita incomes between the richest and the poorest countries increasing by a factor of five from 1870 to 1990 (Pritchett 1997). The lack of convergence was a major challenge to models where growth is based on accumulation of capital subject to decreasing returns or where copying technology is easier than developing new technologies. It led to two responses: first, a rejection of the neoclassical growth models and the development of poverty trap models and AK endogenous growth models, some of which predict divergence (Romer 1986); second, an emphasis on underlying determinants of steady-state income, such as human capital, policies and institutions, leading to growth regressions and tests of convergence conditional on them (Barro and Sala-i Martin 1992; Durlauf et al. 2005).

To update the stylized facts of convergence, we revisit these empirical exercises with twenty-five years of additional data. We consider global trends in income and growth, as well as factors that might determine them – which we term the correlates of growth - such as human capital, policies, institutions, and culture. We find substantial changes since the late 1980s, in growth, in its correlates, and in the cross-country relationship between them. While we do not provide a full analysis of the reasons, or causal determinants, we think this is still useful, as any understanding of development should match the cross-country patterns.

We begin with absolute convergence – poor countries growing faster than rich, unconditionally – and document convergence in income per capita in the last two decades. To study the trend in convergence, we regress ten-year growth in income per capita on income per capita and consider the evolution of the relationship since 1960. Doing so shows a steady trend towards convergence since the late 1980s, leading to absolute convergence since 2000, precisely when empirical tests of convergence fell out of fashion. In terms of magnitude, from 1985-1995 there was divergence in income per capita at a rate of 0.5% annually, while from 2005-2015 there was convergence at a rate of 0.7%.[1] While lower than the 2% "iron law of [conditional] convergence" (Barro 2012), this still represents a substantial change. Looking further back to 1960, when the widespread collection of national income data began, the trend in convergence was initially flat, with neither convergence nor divergence, followed by a decade of a trend towards *divergence* in the late 1970s and early 1980s.

Breaking down the trend towards absolute convergence since 1990, by subsets of countries, provides a fuller picture of the change. There has been both faster catch-up growth and a slow-down of the frontier. The richest quartile of countries had the fastest growth in the 1980s but

[1] Our base specification uses income per capita adjusted for Purchasing Power Parity, from the Penn World tables v10.0, but a similar trend is found using income per capita from the World Development Indicators, measured in constant 2010 USD, and also when using income per worker.

the slowest growth since, being flat in the 1990s and then declining since 2000. In contrast, the three other quartiles all experienced substantially accelerating growth through the 1990s and early 2000s, inconsistent with certain poverty trap explanations for the change in convergence, in which countries catch up once above a certain income threshold. Fewer lower-income countries have had growth disasters since the mid-1990s – but removing them has little effect on the recent trend towards convergence; instead, it removes the divergence in the late 1970s and early 1980s. The trend is also not driven by any one specific region, and convergence becomes stronger upon removing Sub-Saharan Africa or the bottom quartile of the income distribution from the date set.

Is convergence in the last twenty years just a blip, or does it represent a turning point in world history? It certainly could be a blip, as other have argued (Johnson and Papageorgiou 2020), for example due to high commodity prices. Yet, the trend has lasted for 25 years and is robust to removing resource rich countries, so we entertain the idea that it represents a turning point and consider its potential causes.

Within the framework of conditional convergence, we classify possible causes into two broad groups. First, those which lead to faster convergence conditional on growth correlates, which could include faster spread of technologies due to globalization, as well as greater capital and labor mobility. Second, our main focus, convergence in the growth correlates themselves - human capital, policies, institutions, culture - which may close the gap between unconditional and conditional convergence. While recent literature on economic growth and institutions emphasizes the stability and persistence of such correlates, using their historical determinants to identify their causal effects on economic outcomes (Acemoglu et al. 2001; Nunn 2008; Dell 2010; Michalopoulos and Papaioannou 2013), the finding that certain determinants of growth are highly persistent is not inconsistent with others changing, potentially rapidly, and being subject to global influences on policies and culture, for example.

To study whether growth correlates have changed, we classify them into four groups: *enhanced Solow fundamentals* – investment rate, population growth rate, and human capital – variables which are fundamental determinants of steady state income in the enhanced Solow model (Mankiw et al. 1992); *short-run correlates*, variables considered by the 1990's growth literature which may change in a relatively short time scale, typically policies; *long-run correlates*, those which change slowly if at all, and for which we will not have time variation, typically historical determinants of institutions and geography; and *culture*. Far from being static, even among highly persistent correlates we find that many have undergone large changes and themselves converged substantially across countries, towards those of rich countries.

For the Solow fundamentals and short-run correlates, we examine 35 variables in six categories: Solow fundamentals, labor force, political institutions, governance quality, fiscal policy, financial institutions. To tie our hands over which variables we include, we started from a list of variables commonly used in growth regressions, from the Handbook of Economic Growth chapter on "Growth econometrics" (Durlauf et al. 2005). We then constrained ourselves to those variables which were available for at least 50 countries by 1996, and we chose to focus on the period 1985-2015 as a compromise between the number of countries and the number of time periods. Among the 20 variables which are comparable across time, we find significant beta-convergence (a negative slope of growth regressed on level) in 17. Only credit to the private sector diverged. Moreover, of the 18 variables which were correlated with income in 1985, 15 "improved" on average, meaning they converged towards those associated with higher income. For a subset of correlates, we are also able to look further back, and we find similar, albeit slower, trends in 1960-1985.

Using different rounds of the World Value Survey, we also find evidence of convergence in culture. While culture does show persistence, eight out of the ten cultural variables we consider have been converging since 1990. For example, views on inequality, political participation, the importance of family, traditions, and work ethic have all been converging. While limited, the results of the exercise are consistent with papers in sociology and psychology studying cultural convergence (Inglehart and Baker 2000 and Santos et al. (2017)). In contrast, convergence was unlikely or impossible for long-run correlates, and we do not time variation to test for it.

Are these two changes since the late 1980s related: the trend towards convergence in income and the convergence of many of the correlates of growth? We are naturally unable to do a full causal analysis and causality can run both ways. On the one hand, an extensive empirical literature argues that such correlates are important for economic development (Glaeser et al. 2004; Acemoglu et al. 2005), and the convergence literature itself turned towards convergence *conditional* on correlates (determinants of the steady state). On the other hand, modernization theory suggests that causation may run the other way, with converging incomes causing policies, institutions, and culture to converge. While recent literature uses instrumental variables to provide evidence on both directions of causation (Acemoglu et al. 2001; Michalopoulos and Papaioannou 2013; Dell 2010; Acemoglu et al. 2019, 2008), these studies build on earlier analysis which focused on stylized facts from empirical cross-country relationships (Barro 1996; Sala-i Martin 1997; Durlauf et al. 2005; Rodrik 2012), facts which any theory of growth should fit and which we revisit and update.[2]

To link the trends in growth and its correlates, we develop a simple empirical framework, revisiting two central cross-country relationships and documenting how they have changed since the 1980s. First, regressing correlates on income; a cross-sectional representation of the modernization hypothesis. Second, regressing growth on correlates, controlling for income; the basic specification for both growth regressions and for tests of conditional convergence. By the omitted variable bias formula, the gap between absolute convergence and conditional convergence is then given by the product of the slopes of these two relationships (correlate-income slopes and growth-correlate slopes), allowing us to break down the trend in absolute convergence into trends in these slopes, together with any trend in conditional convergence. In the main exercise, we do so comparing 1985 to the present, as that is when we have the best data and can run a balanced panel exercise. In supplementary analysis we also present trends since 1960, which is important as we want to

[2] Obviously we need to wait another twenty years to perform similar out-of-sample tests of the recent literature. Maseland (2021), in a related paper, studies long-run trends in the relationships between long-run correlates and income, using the trends to distinguish different models of growth.

understand why there was a change in income convergence in the late 1980s.

While the cross-sectional relationships between income and the correlates have changed in levels, their slopes have mostly remained stable, despite large changes in both income and the short-run correlates. Among 32 Solow and short-run correlates, regressing the cross-sectional correlate-GDP slope of 2015 on that of 1985 gives coefficients of 0.90 and 0.89, respectively, and R-squareds of 0.90 and 0.70. Moreover, while there is substantial prediction error by individual correlate, *on average* Solow and short-run correlates themselves have changed as much as would have been predicted by the changes in income, given the baseline cross-country relationship between the two.

In contrast, growth regression coefficients have shrunk substantially across the period and show relatively little autocorrelation. The coefficients of the Solow fundamentals have remained the most stable, with a slope of 0.86 and an R-squared of 0.95 when regressing coefficients in 2005 on those in 1985. The coefficients of short-run correlates have shrunk the most, such that there is almost no correlation in coefficients between the periods (slope 0.18, R-squared 0.06). For example, in 1985, a one standard deviation higher Freedom House Political Rights score predicted 0.6% higher annual GDP growth for the subsequent decade, yet the predictive power is negligible in the decade 2005-2015. Long-run correlates and culture fall somewhere between the two, with coefficients which are somewhat stable across the periods, although on average they also shrank.

As a result of the flattening of the growth-correlate relationships, absolute convergence converged towards conditional convergence, by the omitted variable bias formula. This helps to explain the trend towards absolute convergence, but has conditional convergence itself also become faster? While conditional convergence regressions typically condition on multiple correlates, our baseline specification conditions on one variable at a time, because of the difficulty in forming a balanced panel with multiple correlates and to tie our hand in terms of specification search. In our multivariate analysis, while not our main focus, we find no obvious trend in conditional convergence itself, which held throughout the period.

These results suggest an interpretation that is consistent with neoclassical growth models. Conditional convergence has held throughout the period. Absolute convergence did not hold initially, but, as human capital, policies, and institutions, have improved in poorer countries, the difference in institutions across countries has shrunk, and their explanatory power with respect to growth and convergence has declined. As a result, the world has converged to absolute convergence because absolute convergence has converged to conditional convergence.

However, this narrative leaves a key question unanswered: why did the growth regression coefficients shrink? One interpretation, consistent with a Fukiyama end of history view, is that policies and institutions used to matter, but now that they have converged, they matter less - their effects are non-linear. For example, perhaps terrible institutions are bad for growth, but so long as institutions are not disastrous, they matter much less, and there is convergence. However, our results could also be viewed as demonstrating the limits of our collective understanding: many of the policies which were significant in growth regressions in the 1990s no longer significantly predict growth today, and basic patterns of divergence which held for centuries have not held for the past 20 years. Consistent with this, perhaps earlier growth-regression specifications suffered from an overfitting problem and are now failing an out-of-sample test using subsequent data? Relatedly, it is natural to think that there a very large number of factors determine steady state income, some observable, many unobservable. The correlation between the observable and unobservable determinants may have shrunk. While these alternatives would also explain the shrinking of the gap between absolute and conditional convergence, they cannot explain the trend towards absolute convergence, although that could result from faster conditional convergence. The multitude of possible interpretations acts as a reminder of the difficulty of projecting the current trends we document forward, and the dangers of extrapolating from trends over the past quarter century, especially considering rising authoritarian populism, climate change, and pandemic threats, a theme we return to in the conclusion.

This paper describes trends in major macro-economic variables and the relationships between them, some of which have changed substantially in the last twenty years. The goal is descriptive, not causal. The first literature we contribute to is that regarding convergence, which flowered in the 1990s. Despite absolute convergence being a central prediction of foundational growth models, multiple papers found no evidence for absolute convergence in incomes across countries (Barro 1991; Pritchett 1997), but evidence of convergence within countries and across countries conditional on similar institutions (Barro and Sala-i Martin 1992). While we identify off cross-country variation, Caselli et al. (1996) and Acemoglu and Molina (2021) argue that countries should have fixed effects in convergence regressions, corresponding to their individual steady-state incomes. The tradeoffs are discussed at length in Durlauf et al. (2005) and we discuss our specification choice in Section 2. In short, we think that the country fixed effects absorb exactly the variation relevant for studying convergence. Consistent with this, if we allow country fixed effects to vary by decade, then they themselves have converged since the 1990s, so that our results do still appear in that framework, just absorbed into the "nuisance" parameters. More recently there have been several important additions to the classic convergence findings. Rodrik (2012) looks specifically at manufacturing and shows that within manufacturing, there has been absolute convergence. Grier and Grier (2007), a paper closely related to ours, also considers convergence in both income and in policies and institutions from 1961-1999. They contrast convergence in policies and institutions with divergence in incomes, arguing that this difference is hard to reconcile with neoclassical growth models. We agree with their conclusion for the period 1960-1990, but benefit from twenty years of additional data, and argue that convergence changed around 1990, and is since consistent with models of neoclassical growth and inconsistent with a class of endogenous growth theory models which predict divergence, such as AK models (Romer 1986) or some poverty trap models.

This is not the only paper to revisit the question of convergence with updated data. Roy et al. (2016), in particular, make the point that there has been absolute convergence in the last 20 years and, in concurrent work to ours, Patel et al. (2021) emphasize how this is in contrast to the previous stylized facts about convergence. Johnson and Papageorgiou (2020), in contrast, also uses the latest data and concludes that there is still no absolute convergence. The difference results in part from Johnson and Papageorgiou (2020) considering convergence from a fixed base date (1960), while we consider the trend in convergence over a moving time interval, and in part because we are willing to speculate that the trend in the last twenty-five years represents a fundamental change. Indeed, while we find a sustained trend towards convergence, we only find actual convergence for a relatively short period, whilst historically divergence has been the norm for several hundred years Pritchett (1997).

The paper also adds to the literature on the effects of culture and institutions. Recent papers use historical variation to identify the effect of institutions and culture on income, using either instruments (Acemoglu et al. 2001; Algan and Cahuc 2010) or spatial discontinuities (Dell 2010), and generally find that both play a central role. That empirical strategy requires focusing on long-run, persistent components of steady-state determinants, which can easily slide into a pessimistic view: the things that matter for growth can only change very slowly. However, while some, such as legal systems and trust, have deep historical roots and may change very slowly (Michalopoulos and Papaioannou 2013), many change rapidly, and there is no contradiction in culture both having a long-run effect and being subject to recent change. For example, gender roles have deep and important historical determinants (Alesina et al. 2013), but they have also changed substantially in the last 50 years, differentially across countries. While historical determinants continue to persist, we should also remain open to asking how recent changes in policies and institutions have affected growth, especially when considering policy changes.

Our growth regressions exercise also provides an out-of-sample test of sorts for the predictive power of policies and institutions: with a limited sample size and many potential covariates, the growth regressions literature is vulnerable to overfitting; events since the publication of earlier papers provides a (limited) out-of-sample dataset (Hastie et al. 2009).

Finally, in studying changes to, and convergence in, policies, institutions, and culture, the paper adds to expansive literatures in political science, sociology, and psychology whereby the diffusion and convergence of numerous policies, institutions and cultural traits have been documented and studied (Dobbin et al. 2007).[3] Some of the changes in correlates have been gradual, possibly consistent with modernization theory (Acemoglu et al. 2008; Inglehart and Baker 2000), and indeed we do find that on average changes in correlates are consistent with predictions from income growth, based upon the cross-country relationship. However, many recent changes in policies and institutions are dramatic, such as global trends in the adoption of VATs, or marriage equality, or the Me Too movement, which may be better thought of as technology adoption through information diffusion. This technology diffusion may be passive or may, for example, result from the work of international organizations, who provide norms and information on perceived best practices (Clemens and Kremer 2016), and sometimes directly incentivize the adoption of different policies

[3] The social science literature on the diffusion of policies has proposed four theories for policy diffusion: social construction, coercion, competition, or learning. See Dobbin et al. (2007) for a review.

through conditionality. For example, the "Washington Consensus" encouraged lowers tariffs, lower inflation, and (word) of state-owned firms, all of which have been broadly adopted since. The end of the cold war ushered in a period of growth in democracy. In a closely related paper, Easterly (2019) argues that such "Washington Consensus" reforms may have been better for growth than previously believed, as growth has been higher recently in countries which adopted them. Finally, convergence and diffusion of culture are central topics in sociology and psychology. Two recent examples studying them using the World Value Surveys (among other data sources) as we do, are Inglehart and Baker (2000) and Santos et al. (2017).

The paper proceeds as follows. In section 2, we present the results on absolute convergence in income per capita and document a trend towards convergence since the 1990s. In section 3, we consider global trends in the correlates of growth - policies, institutions, human capital, and culture - and document considerable convergence across multiple dimensions. In section 4, we relate the trend towards convergence in income to the convergence in the correlates of growth, first considering the cross-country relationships between income and correlates (modernization theory), which have remained stable, then turning to the cross-country relationships between correlates and growth (growth regressions), which have flattened, and finally turning to the gap between unconditional and conditional convergence, which has shrunk. Section 5 concludes.

2 Convergence in income

Neoclassical growth models predict convergence towards steady-state income: poor countries should catch up with rich countries, at least among countries with similar underlying determinants of steady-state income. Empirical tests in the 1990s of *absolute* convergence - convergence across countries without conditioning on determinants of steady state income - found little evidence for it: if anything, rich countries were growing faster than poor (Barro 1991). We begin by revisiting these tests of absolute convergence, with 25 additional years of data. We use the same data sources and focus mainly on β-convergence, defined below.[4]

2.1 Empirical setup: measuring convergence

The convergence literature in the 1990s used three different datasets. First, standard cross-country sources such as the World Development Indicators and the Penn World Tables, which covered a sizeable span of countries from the 1960s onwards. Second, the Maddison dataset, which collected many sources of data to derive income per capita going back much further in time, for a smaller set of countries, which showed that divergence had been the norm for several hundred years (Pritchett 1997. Third, within-country panel datasets, to look at convergence within countries. For example, Barro and Sala-i Martin (1992) examined convergence within the US.

[4]Parallel results for σ-convergence are in Figure 1 Panel (b) and Appendix Figure A.5 Panel (b) with a fixed country sample

Our goal is to document what has happened to global cross-country convergence since the heyday of the literature in the 1990s. As such, we use the standard cross-country data sources, which cover 1960-present. In the main specification, we use the GDP per capita, adjusted for Purchasing Power Parity (PPP) from the Penn World Tables v10.0.[5] It is an unbalanced panel, as for many countries GDP per capita data only becomes available part way through the period. Nevertheless, we use the unbalanced panel for our main specification so as not to drop many of the poorer countries which become available later in the period (we also show robustness to using balanced panels, which make little difference to our results). We also drop very small countries and those which are extremely reliant on natural resource rents, as is common in studies of convergence. Specifically, we drop countries whose maximum population during the period was $< 200,000$, and those for whom natural resources accounted for at least 75% of GDP (as reported in the World Development Indicators) at some time during the period. [6]

We examine both β-convergence and σ-convergence. β-convergence is when poor countries grow faster on average than rich, while σ-convergence is when the cross-sectional variance of (log) income per capita is falling over time. The relationship between the two notions of convergence is well documented (Barro and Sala-i Martin 1992; Young et al. 2008). We focus on β-convergence for most of the analysis, with equivalent results for σ-convergence reported in the Appendix.

β-convergence β-convergence is when poorer countries grow faster on average than richer countries. Specifically, at a given time period t, it is when the country-level regression

$$log(GDP_{i,t+\Delta t}) - log(GDP_{i,t}) = \alpha + \beta log(GDP_{i,t}) + \epsilon_{i,t}$$

has a negative β coefficient, where $log(GDP_{i,t})$ is Log GDP of country i at time t. To show how β-convergence has changed over time, we plot β_t vs. t, where β_t comes for the following country-year level regression, clustered at the country level (μ_t is a year fixed effect on growth):

$$log(GDPpc_{i,t+\Delta t}) - log(GDPpc_{i,t}) = \beta_t log(GDPpc_{i,t}) + \mu_t + \epsilon_{i,t} \tag{1}$$

Much of the existing empirical convergence literature plots how β varies when holding the starting point t fixed (often at 1960) and varying the end point, $t + \Delta t$. Since we are interested in how the process of convergence may itself have changed over time, we instead hold Δt fixed and vary t. In the main specification we use 10-year averages, i.e. $\Delta t = 10$.[7]

[5]Specifically, for growth rates we use the variable "rdgpna", real GDP at constant 2017 national prices (2017 USD), and for growth levels we use "rdgpo", output-side real GDP at chained PPPs (2017 USD), as recommended by the PWT user guide.

[6]Figure A.1 shows the β-convergence after excluding small population countries and major mineral exporters.

[7]The dependent variable is the annualized growth — the geometric average growth rate in the next decade.

2.2 Results: converging to convergence

Figure 1 shows the scatter plot and regression of equation 1 for each decade since 1960. Convergence corresponds to a negative slope, and the shift to convergence since 2000 can clearly be seen in the raw data. Figure A.2 presents summary boxplots of these basic scatter plots, plotting the average growth by income quintile for each decade.

Figures 2a and 2b show the β- and σ-convergence coefficients from these regressions over the whole period 1960-2007. The first striking result is that there has been absolute convergence since the late 1990s, precisely when the best-known empirical tests of convergence were published. The point estimate for β-convergence becomes negative in the early 1990s, becoming significant in the late 1990s and staying significant since. Table 1 shows a point estimate of -0.65 in the 2000s, and -0.76 in the ten years after 2007, the most recent period we can consider. σ-convergence, represented by a negative slope in Figure 2, started slightly later, with the standard deviation in GDP per capita falling since the early 2000s. The difference in timing is consistent with β-convergence being a function of subsequent 10-year average growth.

The second result is that there has been a trend towards β-convergence - converging to convergence – since 1990. The coefficient started at around 0.5 in 1990 and has trended down towards -1 today. Looking further back to 1960, initially there is no clear trend, and then there is a trend towards *divergence* in the 1980s.[8] Table 1, Column (2), reports the results of our basic absolute convergence regression, Equation 1, with the addition of a linear year variable interacted with $log(GDP_{i,t})$. The interaction terms, representing the "convergence towards convergence", is negative and significant, with a point estimate of -0.025. The trend towards convergence is also apparent in the σ-convergence figure, where it is represented by a gradual decrease in slope, i.e. concavity of the plot.

This trend towards convergence is consistent with models of growth in which capital is subject to diminishing marginal returns, or where catch-up growth is easier than growth at the frontier. It is inconsistent with models of growth which predict long-run divergence, such as AK models, or some poverty trap models.

2.3 Econometric considerations and robustness to alternative specifications

There is an extensive literature on the tradeoffs of different econometric specifications to test for convergence, summarized in Durlauf et al. (2005). We follow the most standard approach, testing for β convergence using OLS with fixed effects for year, clustered at the country level. This approach is not without limitations, which we discuss below, but it is transparent and captures the cross-country variation which is our main focus.

We begin by replying to the three main critiques of the specification noted in the comment of Acemoglu and Molina (2021): unobserved country fixed effects, cross-country heterogeneity in

[8] In subsequent robustness exercises, not using PPP adjustments, the trend looks more like a steady trend towards convergence since 1960, except for a major reversal in the 1980s

convergence rates, and using annual growth rather than 10-year growth. We then discuss several additional considerations and robustness questions, such as whether measurement error may drive towards convergence through mean reversion, whether results are driven by panel imbalance, in particular the larger number of poor countries entering the panel over time, and whether results depend on the macroeconomic dataset used.

Specification, country fixed effects, and heterogeneity Our regression specification assumes homogeneous rates of convergence across countries and does not account for potential differences in steady state income, as discussed in Acemoglu and Molina (2021). We agree with the empirical finding of the authors and Caselli et al. (1996): the coefficients on current income change substantially when incorporating heterogeneity and country fixed effects, with strong convergence towards countries individual steady state income levels throughout, at a rate of at least 10%. However, we disagree that their specification is more economically meaningful for the question of convergence (or, in particular, that the coefficient on income in these specifications can be interpreted as causal). It is a different exercise, and one which is not without its own econometric issues (Durlauf et al. 2005).

We are interested in what has been happening across countries, over time; by definition, country fixed effects absorb cross-country differences and treat them as nuisance parameters. We agree that there are likely to be cross-country differences in steady-state income, but we wish to know how these differences have evolved. A priori, we do not know whether convergence to a fixed steady state, or evolution of country-level "steady state" income itself, is likely to be a more important determinant of growth, so we do not want to assume away the latter. Investigating the evolution of the potential determinants of the country-level steady states is precisely our exercise below, when we turn to conditional convergence, and to whether the potential determinants of steady-state income have converged. We view doing so with variation which we can explain – changes in correlates – as providing additional insights, but we can also do so with a fixed effects approach, which can be interpreted as another form of conditional convergence. To do so, however, we need to allow for the possibility that country "fixed effects" vary over time. Specifically, we modify the framework of Acemoglu and Molina (2021) to allow country fixed effects to vary by decade:

$$log(GDP_{i,t+\Delta t}) - log(GDP_{i,t}) = \beta_d log(GDP_{i,t}) + \mu_t + \gamma_{i,d} + \epsilon_{i,t} \tag{2}$$

$\gamma_{i,d}$ being a country-decade fixed effect.

Table A.1 reports the β_d estimated with average decade growth in Panel A and annual growth in Panel B, confirming the results of Acemoglu and Molina (2021). The coefficient stays strongly negative since 1960. The magnitude is quite stable and does not exhibit any declining pattern over time. We also find that using annual growth gives stronger convergence and we speculate below that annual GDP measurement errors might bias upwards a short-term reversal pattern.

In this paragraph in an earlier version of this paper, in analysis undertaken to respond to Acemoglu and Molina's discussion at the NBER Annual Conference on Macroeconomics, we incorrectly claimed that the fixed effects in this model show little stability over time. Our error was pointed out in Acemoglu and Molina (2021), their subsequent discussion paper. We thank the authors for this correction and have updated this paragraph accordingly (and removed the appendix figure which it referred to). As shown in Acemoglu and Molina (2021) the country fixed effects in this model are stable over time and have a high F-test statistic. This persistence of the fixed effects is primarily from the persistence of country income levels; country growth rates show little autocorrelation from decade to decade.

In this specification, country-decade fixed effects have converged across countries since 1990, suggesting that much of the action for studying the global income distribution may be being absorbed by these fixed effects. Figure A.3 plots standard deviations of fixed effects over time with a rolling time window of ten years. We see a fall in the standard deviation of the country fixed effects since 1990, the period in which we see a trend towards unconditional convergence in our preferred specification. This encourages us to study whether unconditional convergence has converged towards conditional convergence, the question we turn to below.

Moreover, the country fixed effects approach has its own econometric limitations, discussed further in Durlauf et al. (2005). The convergence coefficient in the country fixed effects model, β_d in Equation 2, is identified from time-series variation for all years in decade d, while the convergence coefficient in our main specification, β_t in Equation 1, is identified from cross-sectional variation in year t. Bernard and Durlauf (1996) shows that the two specifications may give very different answers and argues that the time-series β_d is a good estimate of convergence only if the sample distribution is a good approximation of the true underlying growth process; if historical growth is not stable, then the time-series model can be substantially biased. Our analysis includes uses a large set of countries, most of which experienced substantial changes in growth correlates during the period, potentially perturbing them far away from their steady states.

Averaging period Many of the original convergence studies used a fixed baseline year, considering how convergence in income per capita changed when varying the endline year. We argue that to consider trends in convergence itself, rather than use a fixed baseline year, it is better to consider convergence over a fixed interval of time, and how it changes when varying the baseline year. This raises a natural question of what the fixed interval of time should be and whether that interval matters. In the main results, we used a 10-year interval, considering 10 years a good trade-off between allowing us to see medium-frequency trends, without overloading the trend with annual noise. Acemoglu and Molina (2021) suggest we should use annual data. We think that annual data gets at high frequency phenomenon (e.g. weather streaks, business cycles), while ten year data gets at lower frequency phenomenon, such as long-run growth. Annual data is likely to introduce substantial noise. If this noise is measurement error in GDP, then growth regressions will be biased towards convergence and this bias will be larger over shorter periods, via mean reversion. Figure A.4 shows how the convergence coefficient varies when using 1-, 2-, 5- and 10-year averages. 10-year averages show the clearest trend towards convergence. Once we get to 1-year averages, the year-to-year variation dominates, and the trend which is apparent in 5- and 10- year averages is much less apparent.

Balanced panel Since the number of countries in the dataset is growing over time, our results could reflect the inclusion of the new countries over time, rather than global trends. To investigate this, we show, by decade, what convergence looks like from that decade until present day, among the balanced panel of countries whose data is available from the start of that decade. So, for example, for the 1970s, we plot the 10-year average convergence coefficient, from 1970 to present, for the set of countries who are in the dataset since 1970.

Figure A.5 displays the results of these investigations which hold the set of countries fixed over time. It shows that the change in convergence has little to do with the expansion of the set of countries over the time period - results are remarkably robust to different balanced panels, showing that the original results do indeed reflect a trend towards convergence since 1990.

While the trend towards convergence began around the time of the dissolution of the Soviet Union, the repercussions of which may have been an important driver of the change in convergence, the robustness of the trend to countries which existed before 1990 shows that the change was not mechanical from the addition of the former Soviet countries.

Measure of income Figure A.6 shows that our finding of a trend towards convergence is not specific to looking at income per capita (as opposed to per worker), nor to using income per capita in Purchasing Power Parity (PPP) adjusted terms from the Penn World Tables v10.0. Namely, we find a broadly similar pattern using income per worker instead of income per capita, using different measures of income from the PWT, and using the World Development Indicators data with income measured in constant 2010 US dollars. Indeed, in the later, the trend is more apparent, and seems to start from 1960, again with a decade of regression in the 1980s.

2.4 Which countries have driven the change?

To provide more details on the trend to absolute convergence, and to take a first step towards understanding its causes, we consider which countries have driven the change. We do so mainly by showing how the trend in convergence changes when removing different groups of countries.

Faster catch-up growth and a slow-down of the frontier Two very different and popular narratives could each lead to the observed trend to convergence: stagnation of the frontier – a drop in the growth rate of richer countries; or faster catch-up growth – a rise in the growth rate of poorer countries.

Figure 3 shows average 10-year growth rate by income quartile, where income quartile is re-calculated each year. The richest quartile of countries had the highest growth rate of all quartiles in the 1980s and then switched position entirely to have the lowest growth rate since 2000. The shift was driven both by a slow-down of growth at the frontier - the richest quartile of countries experienced flat growth in the 1990s and then a growth slowdown since 2000 – and faster catch-up growth - the other three quartiles experienced a substantial acceleration in growth in the 1990s. Removing one quartile at a time from our standard test for convergence, Figure A.7, it does appear that in the last decade the trend towards convergence is driven by the richest quartile versus the other quartiles, and that the poorest quartile has if anything been a drag on the trend towards convergence within the other quartiles.

Fewer growth disasters and more growth miracles Figure A.8 presents the trend in coefficients from Equation 1 when excluding countries which experienced disasters or growth miracles. The trend towards convergence remains robust, whether we drop episodes of especially low or episodes of especially high growth. Interestingly, the reversion in the 1980s disappears when excluding countries which had a negative 10-year growth rate.

Which regions are driving the change? Figure A.9 presents the trend in coefficients from Equation 1 when excluding countries from different regions. Again the trend remains robust, although the trend towards convergence in the last twenty years becomes stronger upon excluding Sub-Saharan Africa.

2.5 Club convergence

Convergence has been documented among OECD countries (or rich countries) as a group of relatively homogeneous countries (Barro and Sala-i Martin 1992), as evidence for club convergence – convergence among groups of countries which have similar institutions and culture. We revisit this result and show convergence among the rich countries has slowed and shifted towards the general global convergence pattern.

Figure A.10 plots the convergence coefficients in the country sub-sample with income above the Xth percentile.[9] Three decades from 1965 to 1995 yield a similar pattern - strong convergence among high-income countries (above the 60 percentile) while overall there was little absolute convergence. This pattern has changed in the period from 1995 to 2005, and in the most recent decade, convergence holds across a sample containing all countries, while convergence among the top 40% of countries by income has stopped.

These results, together with the above finding that growth has increased across the bottom three quartiles, are inconsistent with certain poverty trap explanations for the trend towards absolute income convergence. Namely, we see no evidence of there being an income threshold above which there is convergence, with more countries crossing the threshold over time.

3 Convergence in correlates of income and growth

We next consider global trends in factors that might be determinants of growth - policies, institutions, human capital, and culture - using the same empirical approach as above. While

[9] $X = 0$ corresponds to absolute convergence. X stops by 80, corresponding to the top 20% high-income countries. The sample size would be too small to obtain stable β if X rises above 80.

much recent literature emphasizes the persistence of institutions over time (Acemoglu et al. 2001; Michalopoulos and Papaioannou 2013; Dell 2010), we find substantial change and convergence. Overall, 17 out of the 32 Solow fundamentals and short-run correlates for which we have temporal variation exhibit β-convergence from 1985 to 2015, and the correlates have generally converged in the direction of those of more advanced economies, towards what we term development-favored institutions. Moreover, culture has also convergence, with 8 out of 10 measures of culture we consider displaying β-convergence in the World Value Surveys data.

3.1 Policies, institutions, measures of human capital, and cultural traits considered

We divide such potential correlates of income and growth into four groups: *enhanced Solow fundamentals* – investment rate, population growth rate, and human capital – variables which are fundamental determinants of steady state income in the enhanced Solow model (Mankiw et al. 1992); *short-run correlates*, other policy and institution variables considered by the 1990's growth literature which may vary at relatively high frequency; *long-run correlates*, institutions and their historical determinants which do not change or which only change slowly, which have been the focus of the recent institutions literature, and geographic correlates of growth; and *culture*.

To tie our hands, we started from a list of variables commonly used in growth regressions, from the Handbook of Economic Growth chapter on "Growth econometrics" (Durlauf et al. 2005), constraining ourselves to those variables which covered at least 40 countries from 1996. We then added to this list numerous cultural variables and historical determinants of institutions which have played a central role in the empirical growth literature since Durlauf et al. (2005). While we obviously cannot consider convergence for historical or geographic variables – they are however included in the empirical exercises in the next section – we are able to study convergence of multiple cultural variables, albeit with a smaller country sample than for the policy and institutional variables.

Table 2 summarizes the data sources and sample period of the resulting correlates. There are 5 enhanced Solow fundamentals and 27 short-run correlates divided into four broad categories: political institutions, governance, fiscal policy, financial institutions. Not all the short-term correlates are comparable over time, for example the World Governance Indicators and Heritage Freedom Scores are standardized each year. We obviously cannot study convergence nor average changes for such variables, but we include them in the table as we do use them for our analysis of the gap between unconditional and conditional convergence, in Section 4 of the paper. For certain figures in the paper, we pick one representative variable from each category, displayed in **bold** in the table: Polity 2 score, the WGI rule of law, government spending (% GDP), credit provided by the financial sector (% GDP). Equivalent figures with the other variables can be found in the Appendix.

To help interpret the direction of change of correlates, Table 3 Column (3) shows which correlates were "development-favored" in 1985 (or the earliest available year), defined by their correlation with log GDP in 1985. Correlates are defined as high (or low) development-favored if the coefficient from regressing the correlate on log GDP is positive (or negative), with statistical significance at a 10% level. A high-income country tends to have a higher Polity 2 score, higher rule of law score, higher government spending (as a % of GDP), more financial credit, and higher education attainment. Five correlates cannot be signed: taxes on goods and services, tax burden score, military expenditure, inflation, and central bank independence.

We first supplement Solow fundamentals with two measures about the labor force: gender inequality in education (male minus female in educational attainment) and labor force participation rate. High-income countries enjoy more gender equality in education and lower labor force participation.

Then, we use five variables to measure political institutions: the Polity 2 score from the Center of Systematic Peace (1960-2018), the Freedom House political rights score (1973-2018), the Freedom House civil liberty score (1973-2015), the Press Freedom score (1979-2018),[10] and the political stability score (1996-2018) from Worldwide Governance Indicators (WGI).

Governance variables - distinct from political institutions - measure whether the public system functions well. We use four variables (1996-2018) from the WGI Project: government effectiveness, regulatory quality, the rule of law, control of corruption; and five variables (1995-2019) from the Index of Economic Freedom by the Heritage Foundation: Overall economic freedom index, government integrity, business freedom, investment freedom, and property rights. The sample size of countries in the Economic Freedom database rises from 97 in 1995 to 145 in 2005, and then 159 in 2015. Variables under the governance and political institutions categories are all positively correlated with economic development.

The fiscal policy category mainly captures the following three dimensions: taxation, tariffs, and government interventions / expenditures. Taxation measurements include taxes on income and capital gains (percentage of total tax revenue), taxes on goods and services (percentage of total tax revenue), and a tax burden score. Equal-weighted and value-weighted tariffs are measures of the policy-induced barriers to trade. A state with strong government interventions and expenditures tends to have a lower private investment (% total investment), more government spending (% spending), and higher military expenditure. In general, high-income countries are more likely to adopt free trade and low government intervention, but there is not clear pattern in our data on taxation.

The financial institutions category includes six variables: a central bank independence index constructed by Garriga 2016; inflation, credit to the private sector (% GDP), and credit provided by the financial sector (% GDP), all from the WDI; and financial freedom and investment freedom scores from the Index of Economic Freedom. Higher financial development is positively associated with economic development, while central bank independence (CBI) and inflation are ambiguous

[10] The press freedom score ranges from 0 to 100. A high score represents less press freedom in the original data. We transform the data as 100 minus the original data so that high score translates into more press freedom

according to our approach. The high inflation of 1990 was not constrained to developing countries, but a global issue. Central bank independence adoption rose over time and inflation was brought under control (Rogoff 1985; Alesina and Gatti 1995; Fischer 1995; Alesina and Summers 1993; Grilli et al. 1991; Alesina 1988).

The following sections examine average changes in correlates from 1985 to 2015 as well as their rate of convergence, β_{Inst}, estimated from the following equation:[11]

$$\Delta_{1985 \longrightarrow 2015} Inst_i = \beta_{Inst} Inst_{i,1985} + \alpha + \epsilon_i$$

The country sample is time-varying (mostly increasing) as datasets add new countries into the sample. In the Appendix, we also plot the standard deviations of the correlate metrics as the σ-convergence for correlates (Figures A.11 - A.13).

Before presenting results for individual correlates, we test the convergence of all of our short-run correlates jointly in table A.2, which presents the joint significance of each category using seemingly unrelated regressions. All variables are available since 1996. Thus we report results for 1996-2006 in Panel A and 2006-2016 in Panel B. For both decades, we confidently the hypothesis that convergence in correlates does not exist.

3.2 Enhanced Solow fundamentals

Human capital Human capital is a robust predictor of income growth, as emphasized in the seminal literature Lucas Jr (1988), Barro (1991), Mankiw et al. (1992), Sala-I-Martin (1997), Barro and Lee (1994).[12] Education augments labor productivity (Lucas Jr (1988)), facilitates technological progress (Romer (1990)), and can help promote structural transformation into industry (Squicciarini and Voigtländer (2015)).[13]

We measure time-varying human capital with the Barro-Lee average schooling years of population, age 20-60. Figure A.14 Panel C reports the β-convergence. The convergence in human capital starts from 1975. Since 1975, poor countries start to gain faster growth in educational attainment and gradually catch up with rich countries. In addition, education levels in some well-educated populations have stagnated, and the data implies that 13 average years of education appears to be a soft cap for many countries.[14] We also observe a meaningful shrinking in education attainment inequality across gender. The education gender gap reduced by 8.1% per decade on average.

[11] If data were not available in 1985, we use the earliest available year for the analysis. For example, the rule of law score from WGI start in 1996. Table 3 Column (4) reports the 1996 average and the baseline year for the correlate convergence β_{Inst} in Column (7) is 1996 as well.

[12] While human capital is not something which can be directly manipulated by policy, many policies can significantly influence educational attainment, such as budgetary decisions, school-building campaigns, curriculum, and minimum school leaving age.

[13] See Krueger and Lindahl (2001) for extensive reviews on micro and macro empirical evidence on schooling and growth.

[14] In 2010, only nine countries - Switzerland, Denmark, United Kingdom, Iceland, Japan, South Korea, Poland, Singapore, United States - have population with more than 13 years of education. South Korea and Singapore are the only two nations pushed the number above 14.

Investment Investment is development-favored, according to our definition, and we observe a moderate growth from 22.07% in 1985 to 24.18% in 2015, which translates to 0.23 standard deviations in 1985. Figure A.14 Panel B indicates that convergence in investment has been stable (around -6) since 1985. Figure 4 Panel B exhibits strong mean-reversion, with one percent higher investment in 1985 corresponds to a negative growth of 2.98% per decade. With most countries slowly decreasing their investment, certain developing countries like Mozambique, Ethiopia, and Angola, increased investment.

Population growth Developed economies feature lower population growth. Population growth slow down from 1.99% in 1985 to 1.42% in 2015, translating to -0.43 standard deviations in 1985. Figure A.14 Panel A reports the beta convergence which fluctuates between -4 and -2 before 2000, after which we witness a sharp decline towards -6. After 2000, population growth has fallen for poor countries, while it has stagnated for most of the rich countries. Figure 4 Panel A reports that most countries in our sample witnessed a decrease in population growth from 1985 to 2010.

3.3 Short-run correlates

Labor Force Education attainment became more gender-balanced from 1985 to 2015. Male education was 0.97 years more than women in 1985, and the number reduces to only a 0.33-year advantage. Not surprisingly, countries with larger gender differences experienced more gap reduction. The labor force participation rates remain stable around 62.5% in the recent three decades, but β-convergence also holds — one percent higher labor participation rate correlates with a 0.66 percent reduction in 1985-2015.

Political Institutions Political institutions exhibit pervasive β-convergence and σ-convergence, with particularly strong convergence in the 1990s. We use the polity 2 score form the Polity IV project as our primary democracy measure, which ranges from -10 to 10. -10 represents dictatorship and 10 represents perfect democracy. Figure A.15 shows that the average polity 2 score hits its low point in 1978, at below -2, then the score gradually climbed back to zero in 1990. Then, the average democracy score jumped up to 2 after the dissolution of the Soviet Union, and persistently improved to above 4 in the next 25 years.

Figure A.11 shows the plot of coefficients for β-convergence in political institutions. Polity 2 score, political rights, and civil liberty yield similar results, including in the rate of convergence. The long-run average of coefficients is around -0.2. The deep institutional reforms in the 1990s lead the coefficients to drop below -0.3 in that decade and then gradually move back the historical average of -0.2. The institutional convergence is statistically significant in any single year's cross-sectional regression. β-convergence in media freedom and political stability also holds since 1995 and the convergence pattern is very stable in the recent two decades.

Panel B reports the standard derivation of the four political institutions.[15] The σ-convergence

[15] WGI political stability scores are re-scaled year by year. Thus, β and σ convergences are not well-redefined.

of democracy started in 1990. The standard deviation of polity 2 score fluctuates around 7.5 before 1990, sharply declines to 6.5 in 2000, and persistently decreases to 6 in 2015. The four other variables show a similar pattern: the standard deviation after 2000 is lower than that prior to 1990.

The broad adoption of democracy is a central aspect of the convergence of political institutions. Figure 4 plots the change in the democracy score from 1990 to 2010 against the democracy score in the baseline year 1990. The spread of democracy is a global phenomenon, not just constrained to Soviet Union countries. Many countries with Polity 2 score below 5 radically shift their political institutions towards democracy.

Meanwhile, movements away from democracy are also relatively common. Table A.3 summarizes the proportion of countries with increases and downgrades in democracy scores. Even after 1980, in each decade roughly 10% of countries experienced falls in their democracy scores. If we focus, admittedly somewhat arbitrarily, on countries with a Polity 2 score reduction of at least three in a decade, then most democracy degeneration events happen in countries with positive democracy scores — 6 out of 8 in the 1980s, 5 out of 5 in the 1990s, 7 out of 7 in the 2000s, 4 out of 5 in 2010-2015.

Developing countries are much more likely to experience political reforms, both towards democracy and against democracy, while rich countries successfully maintain their democratic politics. Table A.4 shows logit regressions of increases or decreases in Polity 2 score on income level for the six decades. Panel A reveals that low-income countries are only more likely to gain democracy in the 1960s and 1990s, but not much in other periods. However, in Panel B, low-income countries are also more exposed to democracy setbacks, except in the 1990s.

Fiscal Policy Despite a lack of consensus on optimal fiscal policy, global average government spending has stayed close to 16% of GDP throughout 1985 to 2015. Moreover, there has been sizeable and statistically significant beta convergence in government spending. Figure 4 Panel E shows that one percent higher government spending in 1996 predicts 1.61 percent reduction in the next two decades, where a high t-stat of 9.6 and the R-squared is as high as 41%.

This pattern is not unique to government spending but is common to all fiscal policy variables. The convergence β ranges from -3.46 (equal-weighted tariff) to -1.60 (private investment), significant at the 1% level.

A large empirical literature argues that lower policy-induced barriers to trade are associated with faster economic growth (Frankel and Romer 1999). We document a significant trade liberalization from 1990 to 2010 - equal-weighted tariffs drop from 9.46% to 4.36%, and value-weighted tariffs drop from 8.11% to 3.09% - more than a 50% cut on average. The β-convergence coefficient fluctuates around -6 but gradually moves to -4 in recent decades. The magnitude is notably large compared with other correlates, in both equal-weighted and value-weighted tariff data. Figure A.12 Panel B3 shows that the variance of tariffs sharply reduces in 1995, and that trade liberalization expands internationally. The standard deviation of tariffs stays below 5 after 2010.

Financial Institutions We see mixed evidence regarding financial credit convergence: there is modest convergence, while there is also substantial credit growth in a few large highly-leveraged developed economies.[16] Credit is development-favored, according to our definition, and we do observe substantial credit expansion from 49.4% of GDP in 1990 to 69.15% of GDP in 2010, which translates into 0.47 standard deviations in 1990. One percent higher credit in 1990 corresponds to a -0.98% decrease per decade. However, the convergence pattern is less persistent over time — Figure A.14 Panel F shows the convergence is particularly concentrated in the 1980s and 1990s.

Figure 4 Panel F implies that convergence happens in both directions. Under-leveraged economies, such as Denmark, Australia, and South Korea, expanded their financial sector. At the same time, many countries de-leveraged: out of 123 countries in our sample, 40 reduced the amount of credit. Highly-leveraged economies were more likely to contract credit, potentially to manage the risk of recessions. In total, twelve countries held credit-to-GDP ratio above 100% in 1990; they reduced credit by 23% on average after two decades.[17] At the other extreme, seventeen countries with credit below 15% of GDP in 1990 expanded their credit by 21% through 2010.

Financial stability also increased significantly. For example, episodes of high inflation became much less frequent. Figure A.13 Panels A1 and B1 report the convergence pattern for inflation. We do not find robust convergence until 1980, when episodes of very high inflation were still widespread. The β-convergence coefficients have stayed significantly negative since 1980. σ-convergence has happened since 1990: the standard deviation runs from the peak above 30 to the trough below 5 in 2010. Modern monetary policy reduced the occurrence of hyper-inflation and contributed to the convergence in inflation. Figure A.16 plots the proportion of countries which experience a) inflation above 200%, b) inflation above 100%, c) inflation above 50%, d) inflation above 15% in a specific year. All the four lines start to decline since 1995. From 1972 to 1995, about 35% of countries had annual inflation above 15% and 10% countries experienced inflation over 100%. After 2000, almost no country had inflation above 50% while less than 10% countries had inflation above 15%.

3.4 Culture

We adopt two data sources to measure culture. The World Value Surveys allow us to study the evolution of culture. To best match the time horizon considered for other correlates, we pick countries surveyed in Waves 3 (1995-2009) and Wave 6 (2010-2014), leaving us with 33 countries in our sample to test cultural convergence. To expand the country sample, we turn to the Hofstede

[16] There is almost surely divergence if we weight countries by their credit market size. Credit growth is highly concentrated in countries with low interest rates and in reserve currencies, e.g., US dollars, Euro, and Japanese Yen.

[17] Three developed economies - US, UK, and Japan - are notable exceptions: highly leveraged economies which continue to expand bank credit. Japanese credit was over 200% of GDP in 1990, and the interest rate dropped below 1% in 1996. The US and UK were both highly leveraged, over 100% relative to GDP, and continued to increase by approximately another 100%. Similarly, both countries lowered interest rates to near zero after the 2008 financial crisis and the 2020 Covid-19 induced recession. The unprecedented low-interest rates further fueled outstanding credit.

dimensions of national culture, which are available for 69 countries. Section 4 studies the culture-growth relationships using the Hofstede data.

Each cultural variable constructed from the World Value Survey aggregates responses from age groups 20 to 40, using population weights.[18] For each country, we compare perceptions held by the young generation (age 20-40 in Wave 6) to the senior generation (age 20-40 in Wave 3). We compute the annualized cultural change between Waves 3 and Wave 6 and adjust for the survey year difference in a given wave. We then regress the annualized cultural change on the Wave 3 level to obtain the cultural convergence β.

We report our results in Table A.6, which shows that β-convergence holds for eight out of ten cultural variables. In political views, the willingness to participate in boycotts converges by 6.4% annually, interest in politics by 2.7%, opinions on the importance of politics by 1.8%, and the recognition of authority by 1.8%. In views on work-life balance, the importance of family and work converge by 4.4% and 3.3%, respectively. Also, the younger generation reaches more agreements on social issues than the older generation. Between the waves, perceptions on the importance of tradition and of reducing inequality also converged by 7.1% and 2.7% per year, finding them less and more important on average, respectively. Finally, on two deep cultural variables, the level of trust and the importance of religion, we find no convergence.

4 Linking converging income with convergence of its correlates

Are these two changes since the late 1980s related, the trend towards convergence in income and the convergence of many of the correlates of income and growth? We are naturally unable to do a full causal analysis and causality can run both ways. On the one hand, an extensive empirical literature argues that correlates such correlates are important for economic development (Glaeser et al. 2004; Acemoglu et al. 2005), and the convergence literature itself turned towards convergence *conditional* on correlates (determinants of the steady state). On the other hand, modernization theory suggests that causation may run the other way, with converging incomes causing policies, institutions, and culture to converge. Recent literature uses instrumental variables to provide evidence on both directions of causation, using historical determinants of institutions to establish their effect on long-run growth (Acemoglu et al. 2001; Michalopoulos and Papaioannou 2013; Dell 2010; Acemoglu et al. 2019), and using instruments for income to test modernization theory (Acemoglu et al. 2008). These studies build on earlier analysis which focused on stylized facts which any theory of growth should fit, either from growth regressions (Barro 1996; Sala-i Martin 1997; Durlauf et al. 2005; Rodrik 2012) or from the observation that rich countries often share a common set of policies and institutions: on average, they are more democratic, less corrupt; they have robust financial systems, more effective governance, better social order, etc. It is these earlier analyses - of empirical cross-country relationships - which we return to in this section, updating their findings with twenty years more data.

[18] Appendix A.5 provides the survey question list for each cultural variable.

We revisit the cross-sectional relationships between correlates and income levels and growth rates, detailing how the relationships have changed since 1985 and linking these changes to the emergence of absolute convergence in the past two decades. First, we consider the relationship between income levels and correlates, a simple cross-country representation of modernization theory. Then, we turn to the relationship between income growth and correlates, controlling for income levels – the classic growth regressions. Finally, we turn to conditional convergence - the prediction of neoclassical growth models. A simple decomposition, combining the two cross-country relationships via the omitted variable bias formula, of the gap between unconditional and conditional convergence provides a partial answer to the question of whether the trend to absolute convergence occurred because absolute convergence has converged to conditional convergence, or because conditional convergence itself has become faster?

4.1 Simple empirical framework

For our simple empirical investigation of the link between income, correlates, and growth, we consider two basic cross-country regressions. First, the cross-country relationship between income and correlates, a simple test of modernization theory:

$$I_{i,t} = \nu_t + \delta_t log(GDPpc_{i,t}) + \epsilon_{i,t} \tag{3}$$

where δ_t is the slope of the relationship and ν_t is a year-t fixed effect.

Second, the relationship between correlates and growth, controlling for income - the classic growth regression, and also the standard formulation of conditional convergence:

$$\Delta_t log(GDPpc_{i,t}) = \alpha_t + \beta_t^* log(GDPpc_{i,t}) + \lambda_t I_{i,t} + \epsilon_{i,t} \tag{4}$$

where $I_{i,t}$ can be an individual correlate or a set of correlates, λ_t is the growth regression coefficient(s) of the correlate(s), when controlling for baseline income, and β_t^* is the conditional convergence coefficient, controlling for the correlate(s).

In this framework, when conditioning on a single correlate, the omitted variable bias formula allows us to decompose the difference between absolute convergence (β) and conditional convergence (β^*) as the product of the income-correlate slope, δ_t, and the growth regression coefficient, λ_t:

$$\beta_t - \beta_t^* = \delta_t \times \lambda_t \tag{5}$$

In turn, we can decompose any *change* in absolute convergence ($\beta_{t_2} - \beta_{t_1}$) into changes in four components: the underlying process of conditional convergence ($\beta_{t_2}^* - \beta_{t_1}^*$), the income-institution relationship ($\lambda_{t_1}(\delta_{t_2} - \delta_{t_1})$), the income-growth relationship ($\delta_{t_1}(\lambda_{t_2} - \lambda_{t_1})$), and the interaction term.[19]

[19] We primarily focus on the first three components: the change in conditional convergence β, marginal contribution of λ change (holding δ fixed in year t_1), and marginal contribution of δ change (holding λ fixed in year t_1). The

Data availability varies substantially across different correlates, making it difficult to construct a balanced panel with many correlates. This has two implications for our analysis. First, we largely focus on univariate versions of the growth regression, i.e. equation 4 including one correlate at a time. This misses the effect of changes in the relationships across correlates, so we also run several multivariate analyses trading off the number of correlates with the size of the panel. Second, in the main analysis we focus on the time period 1985-2015, since that is the period over which the majority of our correlate variables are available for a large number of countries. We also present trends in results since 1960, for those correlates for which we have the data to do so.

4.2 Correlate-Income relationship and modernization theory

Prosperity is correlated with the rule of law, democracy, fiscal capacity, education, among others. We have shown above that income has started to convergence and that correlates have converged substantially. Are these changes related? Did countries simply shift along the lines in the cross-country relationship between income and correlates, in line with the predictions of modernization theory, or did the lines themselves change?

Figure A.17 investigates this, plotting whether changes in correlates are as would be expected from changes in income, given the baseline cross-country relationship between the two. Overall, we see that actual changes are on average in line with those predicted from income growth: the fitted line is approximately on the 45-degree line. This can be viewed as modernization theory passing a (weak) out-of-sample test for the correlates specified in the 1990s, using new data. It also suggests that overall, levels of correlates *conditional on income* have remained constant.

However, for individual correlates, the actual changes are generally quite far from those predicted by baseline relationships, pushing back on the explanatory power of a simple modernization theory explanation. Education and financial development have improved by much more than predicted by income growth. Education has increased, and the gender gap in education became significantly smaller. Many "best practices" of financial institutions have been broadly pursued as well: well-managed inflation, central bank independence, credit expansion as a crucial part of the economic stimulus package and lower tariffs to embrace globalization. Political institutions improved almost as much as predicted. Meanwhile, from 1985 to 2015, measures of governance stagnated or even declined: property rights protection, investment freedom, business freedom, and political stability experienced sizable decline.

We have shown correlates have changed as predicted by their cross-country relationship with income, on average, but what has happened to these cross-country relationships themselves? Figure 5, which normalizes correlates by their in 1985 shows the slopes of these correlate-income regressions, the δ_ts in Equation (3) , changed remarkably little. The slopes in 1985 is sufficient to explain the 69% of variation in slopes three decades later. The explanatory power (R-squared)

interaction term is the residual captures the co-movement between δ_t and λ_t, which is not our primary focus in the decomposition. Quantitatively, the interaction term is not crucial as we will show δ does not move much in Section 4.2.

rises to 87.5% if three outliers (financial credit, credit to private sector, and tertiary education) are excluded. The other 30 correlates scatter precisely along the 45-degree line. The results are also reported in Table 4.

While the 1985 versus 2015 comparison is our main specification, in Figure A.18 we also report the trends in the correlate-income slopes since 1960, averaged within each group of correlates. To make the average meaningful, we first renormalize the correlates such that their correlate-income slope is positive in 1985 (i.e. we multiply the correlate by minus one, throughout, if the slope is negative in 1985). The signs of the correlate-income relationships are highly stable, so this normalization does not bias our results for the average slope in 1985 relative to other years. Also, as many correlates are not available before 1985, and the set of countries for which correlates is available is growing, we repeat the exercise for several different balanced panels. In particular, for each decade, we trace one plot holding constant the set of correlates and the set of countries for which they were available at the start of the decade. The exercise shows the robustness of the correlate-income slopes over time for each of the four correlate types.

4.3 Growth-Correlate relationship and growth regressions

Recent empirical growth papers use historical variation to identify the effect of institutions and culture on income, using either instruments (Acemoglu et al. 2001; Algan and Cahuc 2010) or spatial discontinuities (Dell 2010), and generally find that both play a central role. Such an approach can only identify the effect of persistent institutions and cultural traits, and while some, such as legal systems and trust, have deep historical roots and appear to change very slowly (Michalopoulos and Papaioannou 2013), many change rapidly as we have shown above, and there is no contradiction in institutions both having a long-run effect and being subject to recent change. While historical determinants continue to persist, we should also remain open to asking how recent changes in policies and institutions have affected growth, especially when considering policy changes.

Here we return to the basic growth regression specification, cognizant of its limitations as a causal framework. For this question – the effect of correlates on growth - we are more sympathetic to the view of Acemoglu and Molina (2021) and agree that including country fixed effects may make sense, although our results in Section 2 point to shortcomings of that framework too. Our exercise, without country fixed effects, has the advantage of providing an out-of-sample test of sorts for the predictive power of policies and institutions identified as important in the 1990s literature. With a limited sample size and many potential covariates, the growth regressions literature is vulnerable to overfitting; events after the publication of papers provide an out-of-sample dataset. In twenty years, we could run a similar exercise to test the correlates and identification strategies proposed more recently.

Growth regression coefficients, the λ_ts in Equation (4), fell somewhat in magnitude over time for human capital and other Solow fundamentals (the investment rate and the population growth rate), but they were correlated. Education, for example, strongly predicts higher economic growth at a roughly similar magnitude in decades 1985-1995 and 2005-2015. A one s.d. increase in educational attainment predicts 0.96% annualized GDP growth in 1985-1995, and the number falls to 0.70% for 2005-2015. Countries in which females and males have more equal access to education resources have grown faster: a one s.d. reduction in the gender gap (in schooling years) predicts 0.55% higher GDP growth in 1985-1995, and 0.26% in 2005-2015.

In contrast, coefficients on short-run correlates beyond the enhanced Solow fundamentals (those correlates which can change over relatively short horizons) fell more substantially from 1985-2005, with essentially zero correlation between the two periods. Table 4 Columns (4) and (5) report λ_{1985} and λ_{2005}.[20] Figure 6 plots λ_{2005} re-estimated with the same country sample[21] two decades later 2005-2015. The slope of the correlate-growth relationships have shrunk towards zero and the slope of fitted line in Figure 6 is only 0.206.

Long-run correlates (those which can only change slowly, if at all) and culture fall in between Solow fundamentals and short-run correlates in the persistence of their correlation with growth. Figure 6 Panel B shows that the slope of the long-run correlate-growth relationship has shrunk towards zero with 0.408 as the slope of the fitted line. However, the correlate-growth relationship is more stable for culture with 0.739 as the slope of the fitted line.

As we did for correlate-income slopes, while the 1985 versus 2005 comparison is our main specification, in figure A.19 we also report the trends in the growth-correlate slopes since 1960, averaged within each group of correlates. We apply the same normalization as for correlate-income slopes, namely we first renormalize the correlates such that their correlate-income slope is positive in 1985 (i.e. we multiply the correlate by minus one, throughout, if the slope is negative in 1985). Again, as many correlates are not available before 1985, and the set of countries for which correlates is available is growing, we repeat the exercise for multiple balanced panels, one from the start of each decade. The figures support the results above, showing that the flattening of growth regression coefficients from 1985 to 2005 reflects a gradual trend over that period. It also appears that growth regression coefficients peaked around the 1980s, but we do not place too much weight on that result, as data availability is sparse prior to then, especially for short-run correlates.

Why did growth regression coefficients shrink as correlates converged? We provide two hypotheses, for future work. First, many correlates, both observable and unobservable, are likely correlated with each other, so that the regression coefficient on any one will not just reflect its underlying causal impact, but also its correlation with others. The rapid convergence in correlates may have been associated with a reduction in the correlation between them, and hence a reduction in this omitted variable bias. Second, correlates may have non-linear effects: perhaps policies and institutions used to matter when there were large differences across countries, but now that they have converged, any remaining differences matter less.

[20] Our time horizon shrinks to 1985-2005 to accommodate the growth regression. Table 4 Columns (2) and (3) report δ_{1985} and δ_{2005}, instead of δ_{2015} discussed in Section 4.2.

[21] The country sample is selected with valid GDP and correlates data in the starting year. The sample size typically decreases slightly from 1985 to 2005 since some countries vanish in the two decades.

4.4 Shrinking gap between conditional and unconditional convergence

One response to the failure of unconditional convergence was to move to the idea of conditional convergence - convergence conditional upon possible determinants of steady-state income, such as policies and institutions (Barro and Sala-i Martin 1992) - which has been widely supported in the data (Durlauf et al. 2005). This suggests a natural question: does the shift towards unconditional convergence represent a shrinking of the gap between conditional and unconditional convergence, for example due to rapid convergence of correlates, or did conditional convergence itself became faster? Globalization could have resulted in either. For example, international institutions have promoted convergence across many policies, and higher capital mobility has increased capital inflows into some lower income countries, potentially reducing the effect of conditioning on such correlates, while at the same time the spread of technology and of production processes through increased trade may have made convergence conditional on correlates faster.

Univariate While conditional convergence regressions often condition on multiple correlates, our baseline specification conditions on one variable at a time, because of the difficulty in forming a balanced panel with multiple correlates, and to tie our hands in terms of specification search. When conditioning on a single correlate, according to the omitted variable bias formula, the gap between unconditional and conditional convergence can be written as the product of the correlate-income slope δ and the growth-correlate slope λ.

Figure 7 and Table 4 report the changes in this gap from 1985-2005. Correlate-by-correlate, qualitatively the trend in the effect of conditioning is similar to that of the growth regression coefficients: Solow fundamentals have the most stable effect, long-run correlates and culture are intermediate, and short-run institutions have the least stable effect. However, what is harder to see from this figure, but can be seen clearly in A.20, is that the effect on conditioning has on average shrunk to around zero for short-run and long-run correlates since 1980, while for Solow fundamentals and culture it has remained more steady. The same figure also shows that the effect of conditioning on correlates increased substantially between 1960 and 1980, although for a much smaller set of countries and correlates.

Multivariate Many of the classic conditional convergence regressions control for a large set of policies and institutions. In attempting to run such multivariate regressions, there is a harsh trade-off in constructing the country-year sample, between the number of observations and the number of available correlates, which is why we consider the univariate results our main results in this section. However, to attempt to run a multivariate version, we (somewhat arbitrarily) selected a sample of 72 countries and include the following institutional variables: polity 2 score, Freedom House political rights, Freedom House civil liberty, private investment ratio, government spending, inflation, credit provided to the private sector, credit by the financial sector, Barro-Lee educational attainment, and gender gap in schooling years.

Figure 8 plots both the conditional and unconditional convergence coefficients, from 1985 to

2007. We see that, while the unconditional convergence coefficient has trended down, there has been no clear trend in the conditional convergence coefficient, and the gap between the two has closed substantially. Thus, in terms of what has driven the change in unconditional convergence, unconditional convergence has become closer to conditional convergence. We do not find clear trends in conditional convergence itself, although that is not our focus.

Table 5 reports the coefficients for growth in three decades from 1985 to 2015. From 1985 to 1995, correlates explain substantial variation in economic growth and convert absolute divergence to conditional convergence. The ten correlates jointly take down the coefficient from 0.42 (t=1.67) to -0.816 (t=-1.79). In 2005-2015, the unconditional economic growth rate is -0.79% (t=-5.16). Correlates still effectively cut the convergence rate to -1.14% (t=-4.63), however, no sign indicates conditional convergence is faster than two decades ago.

These results suggest an interpretation that is consistent with neoclassical growth models. Conditional convergence has held throughout the period. Absolute convergence did not hold initially, but, as policies, institutions, and human capital have improved in poorer countries, the difference in institutions across countries has shrunk, and their explanatory power with respect to growth and convergence has declined. As a result, the world has converged to absolute convergence because absolute convergence has converged to conditional convergence.

5 Conclusion

We document a trend toward absolute convergence since the late-1980s, resulting in absolute convergence since 2000. This trend is consistent with neoclassical growth models and with models in which catch-up growth is easier than growth at the frontier, and inconsistent with the set of endogenous growth models which predict divergence. While incomes have diverged across countries for centuries (Pritchett 1997), the rapid trend to convergence over the last 20 years suggests something important has changed. Breaking down convergence by income quartiles shows both a growth slowdown at the frontier and a broad increase in the rate of catch-up growth away from the frontier, the breadth of which does not support an explanation in which countries catch up only above a certain income threshold, with more countries recently crossing the threshold, as might be suggested by certain poverty trap models. What could have driven this change: faster catch-up *conditional* on correlates, for example due to the globalization of production, improved communication, faster technology flows, greater access to (international) finance, and migration; or the convergence of correlates themselves, which could also have followed from globalization, but also from the end of the Cold War, trends in democratization, the reduction in conflict, and the adoption of the Washington Consensus, among other reasons?

Most correlates of growth and income - policies, institutions, and culture - have converged during the same period, towards those of rich countries. Some of these changes have been gradual, such as changes in government spending and in fertility, consistent with modernization theory (Inglehart and Baker 2000), and *on average* the size of the changes has been as predicted by income growth, under the cross-country correlate-income relationship. However, other changes have happened remarkably quickly, such as the adoption of VATs, or marriage equality, or the spread of democracy after the fall of the Soviet Union, and these more rapid changes may be better explained with theories of contagion or technology adoption (Dobbin et al. 2007). While some aspects of convergence happened independently of external forces, international institutions played a role in other aspects of convergence, for example the IMF and the World Bank encouraged the adoption of the Washington Consensus (Easterly 2019), and the World Health Organization provides technical guidance and best practice for health policy.

As correlates and growth have changed, so have the relationships between them: the coefficients of growth regressions. All types of correlates considered – Solow fundamentals, other short-run correlates, long-run correlate, and culture – have seen their growth coefficients shrink. Most robust are the Solow fundamentals, for which a regression of the coefficients in 2005 on those of 1985 has a coefficient of 0.74. Long-run correlates and culture were somewhat stable, while short-run correlates' coefficients in 2005 bore little relation to their coefficients in 1985.

As a result of this shrinking in growth regression coefficients, the gap between unconditional and conditional convergence has also shrunk substantially. Absolute convergence has converged towards conditional convergence, a central prediction of neoclassical growth theory which has held throughout the period. In the parlance of club convergence, policies and institutions have (partially) converged, so that now more countries are "in the convergence club".

What drove these changes since the late 1980s? Why was there not also a trend towards convergence in the preceding two decades, when correlates were already converging? And why have growth regression coefficients shrunk since? While faster catch-up *conditional* on correlates may be part of the explanation for the trend in convergence (although, while not our focus, we do not find evidence of it), and the shrinkage in growth regression coefficients may in part be explained by earlier overfitting, we have focused on the convergence of correlates themselves, the potential determinants of steady-state income.

Our preferred narrative in terms of parsimony, which is admittedly speculative, is as follows. Steady state incomes are determined by a very large number of factors, from the quality of transport infrastructure, to the quality of education systems, to the quality of bankruptcy law. Many of these determinants are correlated with each other, and while some are observable to us, many are not. As such, the regression coefficient on any observable determinant will not just reflect its underlying causal impact, but also patterns of correlation with unobservable determinants. Since the fall of the Soviet Union in 1991 and the adoption of the Washington consensus, there has been rapid convergence in observable policies and institutions (perhaps endogenously as policy makers reacted to the 1990s growth literature), explaining the shrinking gap between absolute and conditional convergence. If they have simultaneously become less correlated with the unobservable determinants, it would also explain the shrinking growth regression coefficients, although then it would also likely predict slower conditional convergence, counterfactually. However, unobserved factors might also be converging, pushing towards faster convergence conditional on observables:

just as international institutions like the world bank and IMF are promoting convergence in economic policy, a host of other international bodies are promoting convergence on policies from civil aviation, to smoking (the World Health Organization), to standardized testing in schools (the Program for International Student Assessment); and the globalization of education and media exposure of elites is likely leading to convergence across many factors. An alternative narrative is that correlates have non-linear effects: policies and institutions used to matter, but now that they have converged, any remaining differences matter less. While we found little evidence for such non-linearities in our exploratory work, we were underpowered, and the hypothesis merits further investigation.

Do these results give cause for optimism or pessimism regarding whether changes in policies and institutions can lead to catch-up up growth? Of course, our results are not causal, so care should be taken here, and further work is needed to assess the causal consequences of the convergence in correlates documented here. Even without taking a causal stance, the results push back on an interpretation of the persistence literature, as indicating that steady-state income is determined only by deep, persistent determinants, which are hard to change. We have shown evidence of convergence in culture, suggesting that even persistent determinants may change relatively rapidly. If we do entertain that our growth regressions at least partially reflect a causal relationship, then our results suggest that malleable policies and institutions did matter for growth in the 1990s, and that when they subsequently (partially) converged there was a shift to income convergence. Yet, malleable policies now seem to have less explanatory power, while long-run correlates (and especially Solow fundamentals) have continued to be correlated with growth.

While we cannot predict whether absolute convergence will continue, we can discuss reasons to believe that it may or may not. On the one hand there are at least two reasons for pessimism. First, both Acemoglu and Molina (2021) and Pande and Enevoldsen (2021) understandably point to recent deteriorations in democracy. This is of concern in its own right, but if democracy is the key correlate, from which others follows, this may undermine the convergence of other correlates. Second, as discussed in Pande and Enevoldsen (2021), the economic costs of climate change are growing and faced disproportionately by developing countries. These costs - both the direct costs and, perhaps more importantly, the indirect costs of induced conflict and emigration - will be a force against convergence going forward. While these are reasons for pessimism, there are also substantial reasons for optimism. Conditional convergence is a robust phenomenon across many settings, and so if the convergence of correlates continues, absolute convergence is a reasonable hypothesis. In the 1960s there were the growing pains from post-colonial independence, in the 1980s there was the breakup of the Soviet Union, both periods in which transitional forces may have eclipsed trends towards convergence. In the more stable, post-colonial world order since the 1980s, we observe rapid convergence of correlates, a shrinking of the gap between unconditional convergence and conditional convergence, and ultimately, unconditional convergence.

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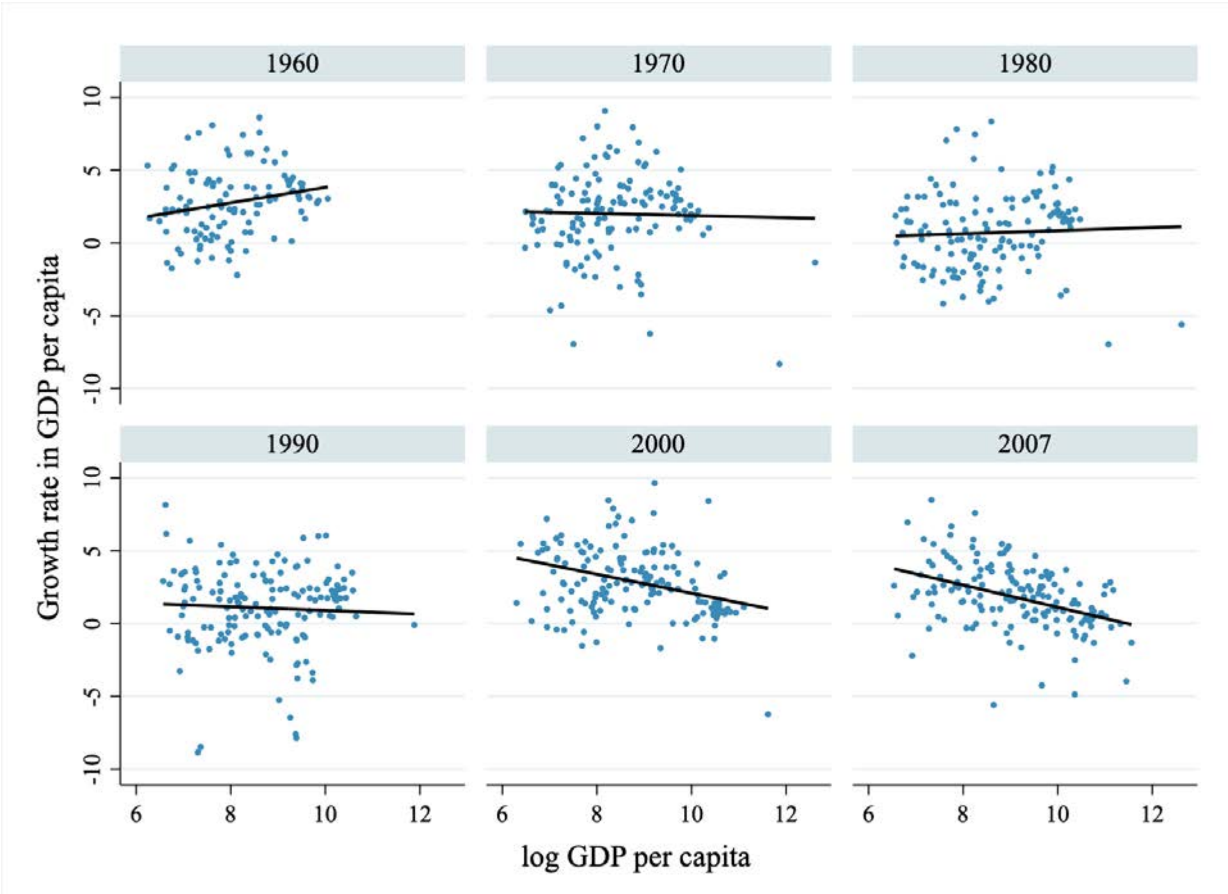
Figures

Figure 1: Income convergence by decade

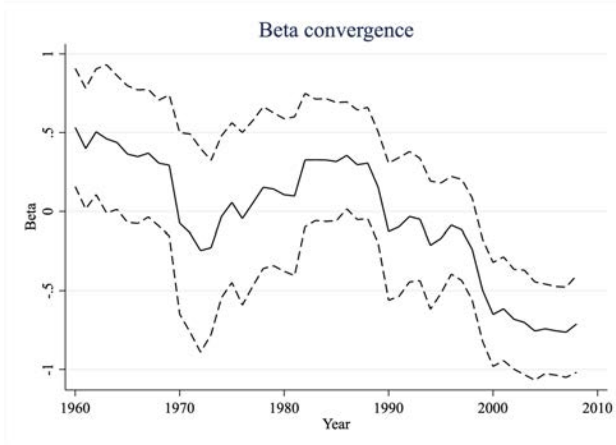


Notes: This figure plots, by decade, the raw scatter plots for the decade's β-convergence regression, as well as the regression line itself.

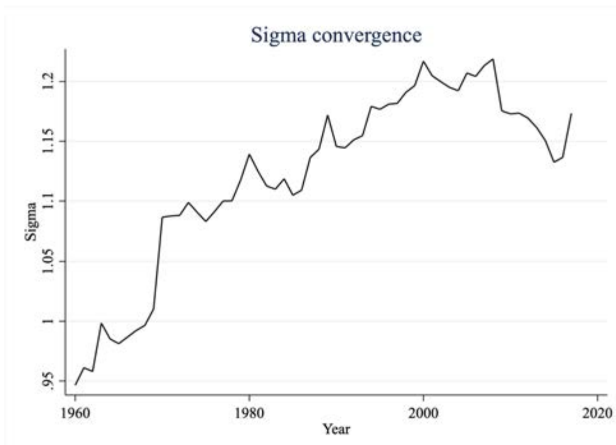
$$100\frac{log(GDPpc)_{i,t+10} - log(GDPpc)_{i,t}}{10} = \alpha_t + \beta_t log(GDPpc)_{i,t} + \epsilon_{i,t}$$

The income measure is income per capita, adjusted for PPP, from the Penn World Tables v10.0. The sample is all countries for which data is available, excluding those with a population less than 200,000 or for whom natural resources account for $> 75\%$ of their GDP. Data availability means that the number of countries is growing over time. For 2007, the period considered in 2007-2017.

Figure 2: Trend in income convergence, 1960-2007



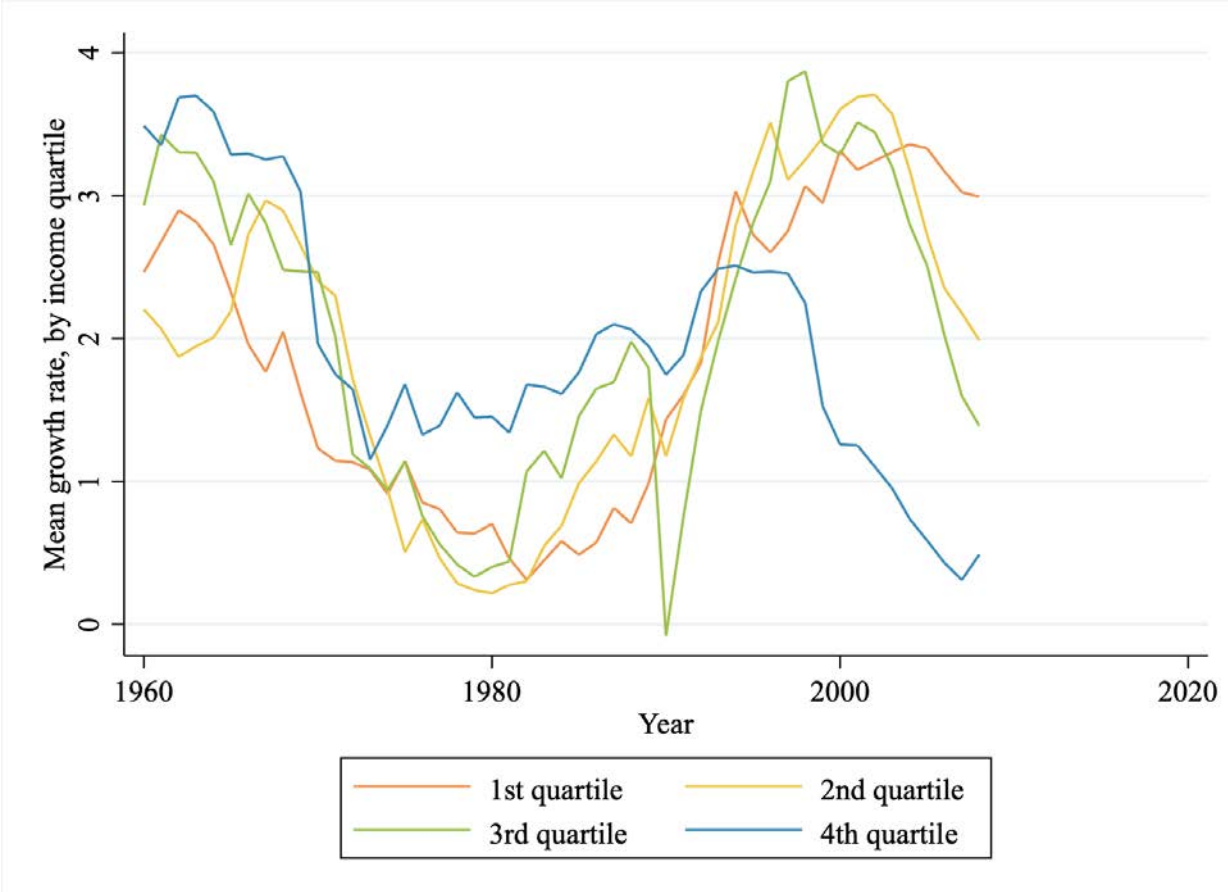
(a) $\beta-$convergence.



(b) $\sigma-$convergence.

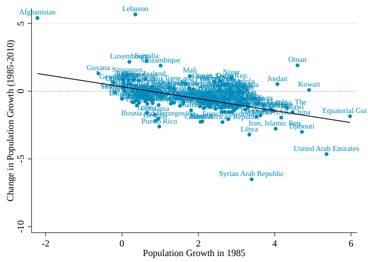
Notes: These figures show the trend in convergence from 1960 to 2007. Figure a) plots the β-convergence coefficient, for growth in the subsequent decade, over time. It is the coefficient from Equation 1 - regressing, across countries, the average growth in GDP per capita in the next decade (in %) on the log of GDP per capita, with year fixed effects, and with standard errors clustered by country. Income per capita is adjusted for PPP and comes from the Penn World Tables, v10.0. The sample is growing over time, and excludes countries with a population less than 200,000 or for whom natural resources account for $> 75\%$ of their GDP, as in Figure 1 (neither exclusion has a meaningful effect on the trend). Figure b) plots the evolution over time of the cross-country standard deviation in GDP per capita. *sigma*-convergence corresponds to a negative slope. Equivalent panels using balanced panels are in Figure A.5.

Figure 3: Trend in income growth by income quartile, 1960-2007



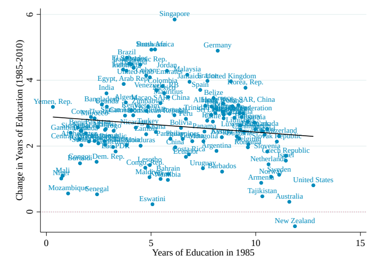
Notes: The plots show the average annual growth in GDP per capita, PPP, for the subsequent decade, averaged by income per capita quartile. Income per capita quartile is classified based on GDP per capita in that year, with the first quartile being the lowest income and the fourth quartile the highest.

Figure 4: Convergence in growth correlates: level in 1985 versus change 1985-2015

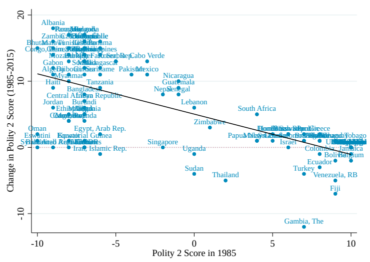


A: Population Growth

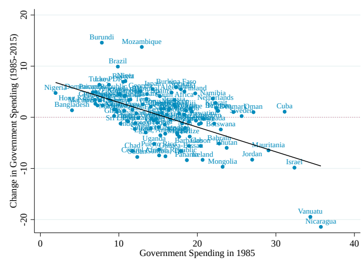
B: Investment



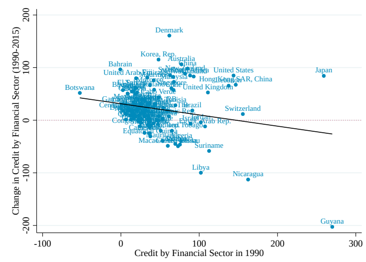
C: Barro-Lee Years of Education



D: Polity 2



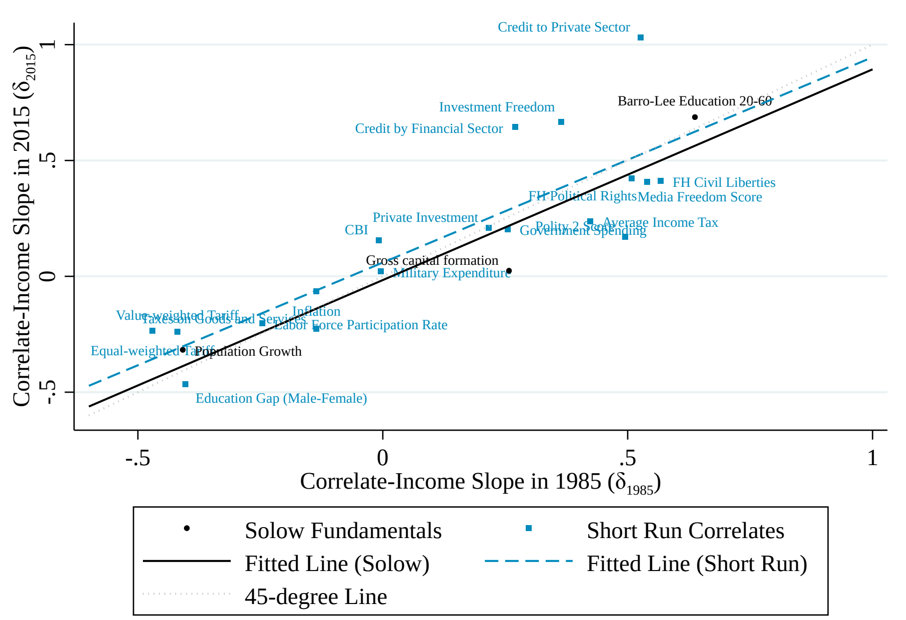
E: Government Spending



F: Credit

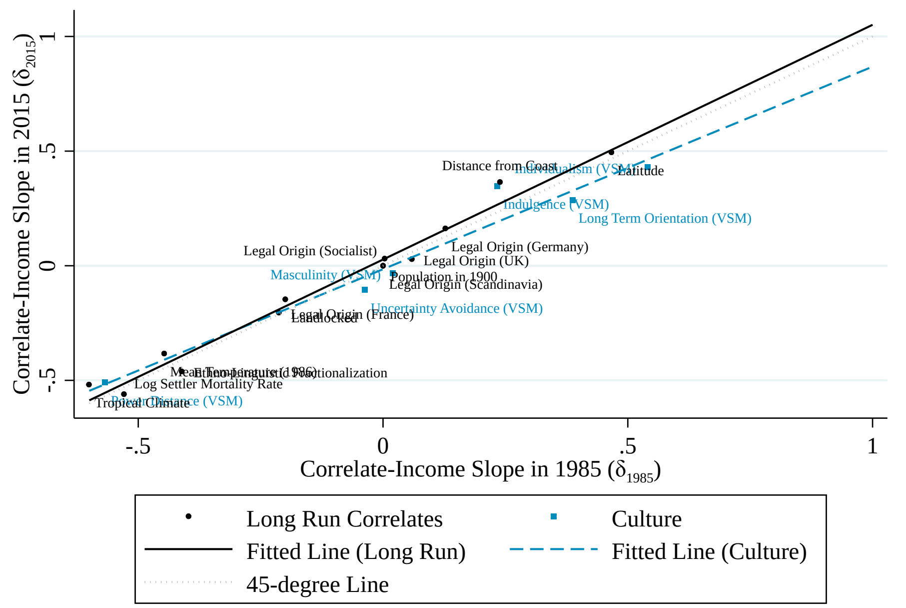
Notes: This figure plots β-convergence for growth six representative correlates (potential determinants of steady-state income) from 1985 (or the earliest available year) to 2015 against the baseline correlate level in 1985. We include six of the correlates which are comparable over time, for illustration: Population growth rate (%), Investment rate (% of GDP), Barro-Lee average years of education among 20-60-year-olds, Polity 2 score, government spending (% of GDP), credit by the financial sector. The sample for each figure is the complete set of countries for which the relevant data is available in 1985 and 2015.

Figure 5: Correlate of growth-income slopes, 1985 vs. 2005



Slopes of fitted lines: Solow = 0.897; Short-Run = 0.886

Panel A: Enhanced Solow fundamentals and short-run growth correlates



Slopes of fitted lines: Long-Run = 1.024; Culture = 0.884

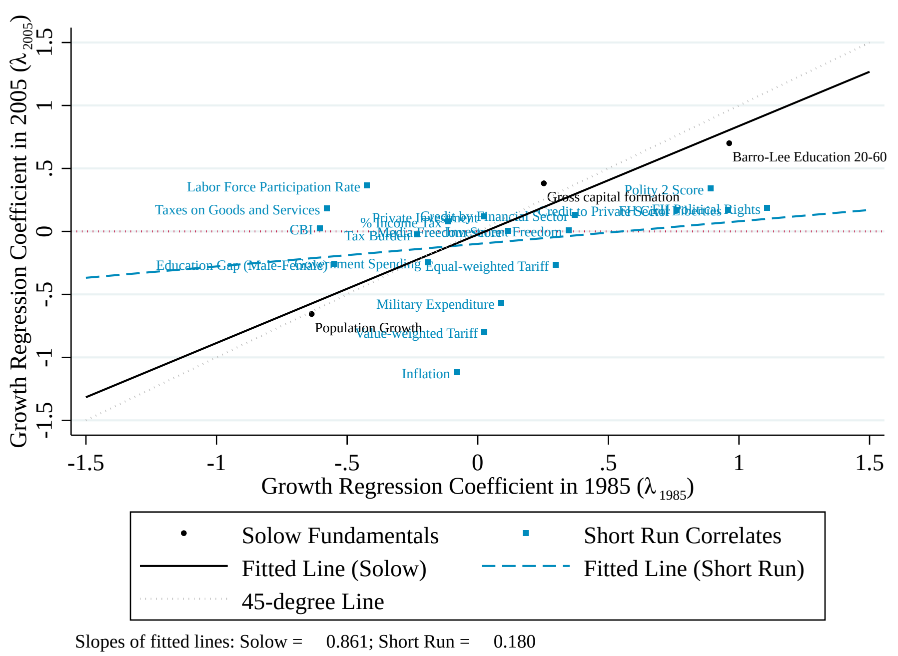
Panel B: Long-run growth correlates and culture

Notes: This figure is a scatter plot of the coefficients from regressing correlates on (log) income per capita, plotting the coefficient in 1985 vs. 2015. The correlates are normalized by their standard deviation in 1985. Namely, the y-axis is δ_{2015}, and the x-axis δ_{1985}, from Equation 3, which is the following regression:

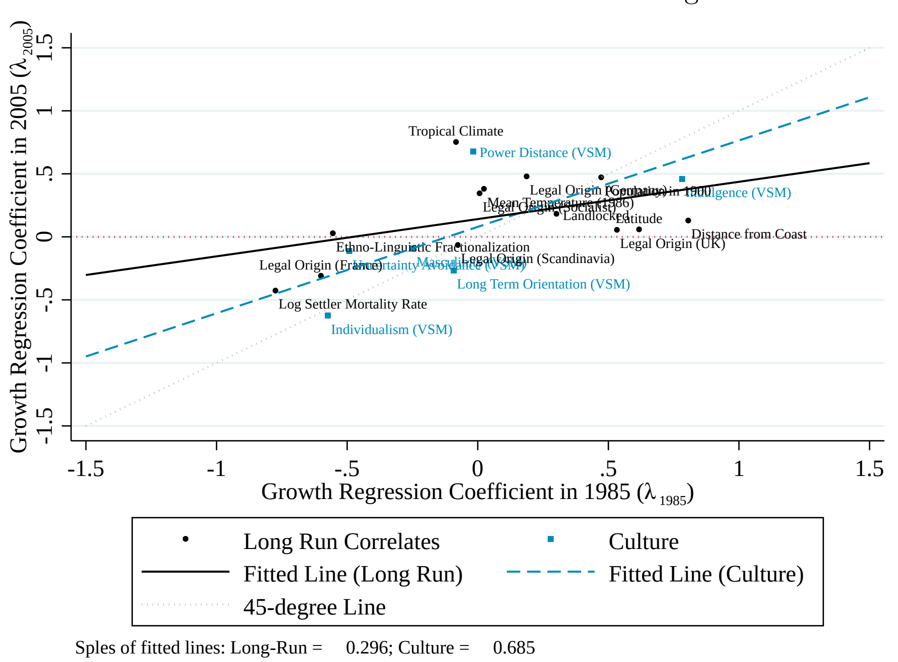
$$\frac{Inst_{i,t}}{SD(Inst_{1985})} = \delta_t log(GDPpc)_{i,t} + \nu_t + \epsilon_{t,i}$$

δ_{1985} and δ_{1985} are estimated using a balanced panel, balanced separately for each correlate. The solid lines are the fitted lines of the scatter plot; the numbers beneath the plots refer to their slopes. The dashed lines are the 45-degree line, as a benchmark. Panel A presents results for Solow fundamentals and short-run correlates; Panel B presents results for long-run correlates and culture. We exclude those correlates which are normalized each period, and hence are not comparable over time.

Figure 6: Growth-correlate of growth slopes, 1985 vs. 2005



Panel A: Enhanced Solow fundamentals and short-run growth correlates



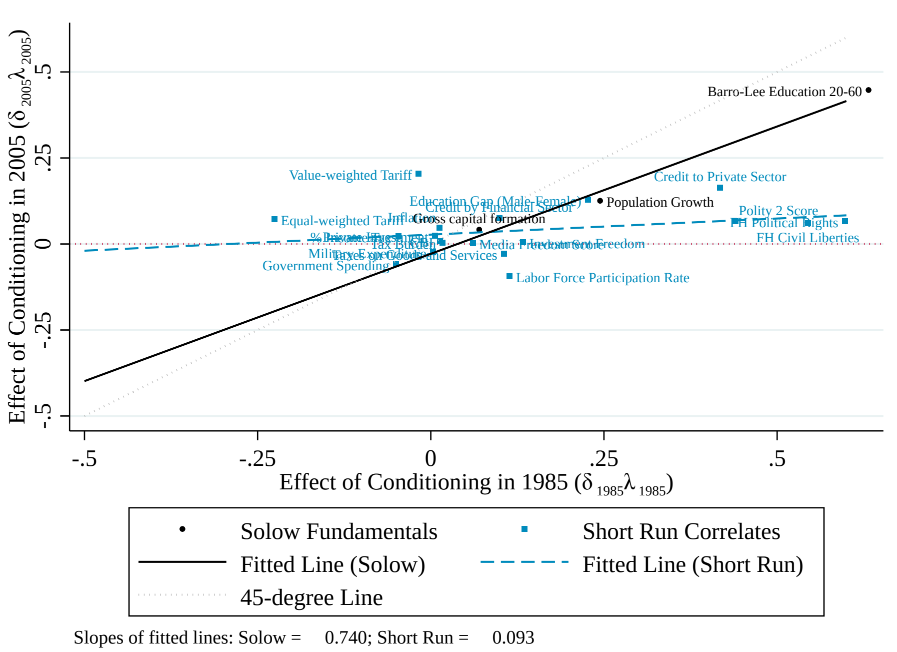
Panel B: Long-run growth correlates and culture

Notes: This figure is a scatter plot of the growth regression coefficients for different correlates, in 1985 vs. 2015. I.e. the coefficients from regressions of average growth in (log) income per capita in the next decade, on correlates, controlling for baseline (log) income per capita. Namely, the y-axis is λ_{2005}, and the x-axis λ_{1985}, from Equation 4, which is the following regression:

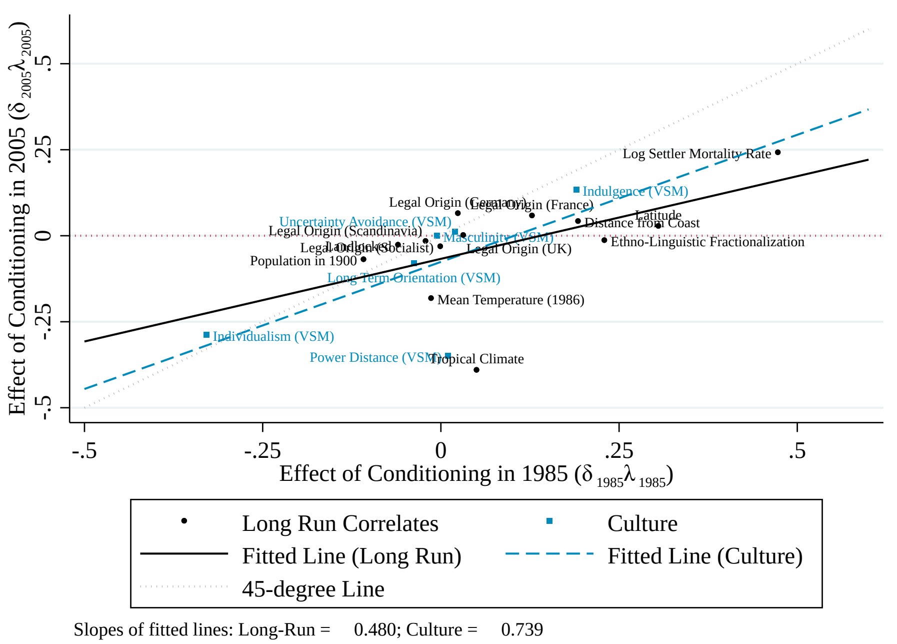
$$100\frac{log(GDPpc)_{i,t+10} - log(GDPpc)_{i,t}}{10} = \beta_t log(GDPpc)_{i,t} + \lambda_t \frac{Inst_{i,t}}{SD(Inst_{1985})} + \alpha_t + \epsilon_{i,t}$$

λ_{1985} and λ_{2005} are estimated using a balanced panel, balanced separately for each correlate. The solid lines are the fitted lines of the scatter plot; the numbers beneath the plots refer to their slopes. The dashed lines are the 45-degree line, as a benchmark. Panel A presents results for Solow fundamentals and short-run correlates; Panel B presents results for long-run correlates and culture. We exclude those correlates which are normalized each period, and hence are not comparable over time.

Figure 7: Gap between unconditional and conditional convergence (univariate), 1985 vs. 2005



Panel A: Enhanced Solow fundamentals and short-run growth correlates



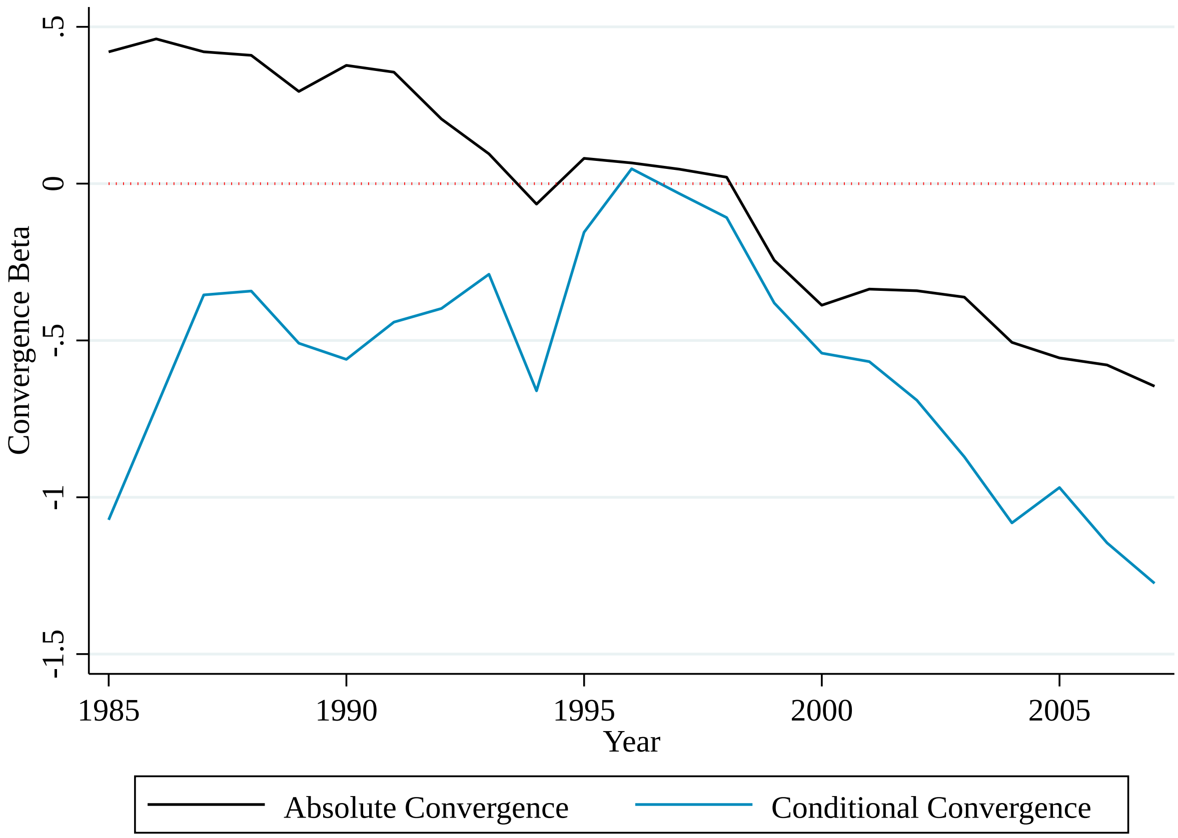
Panel B: Long-run growth correlates and culture

Notes: This figure plots the gap between unconditional and (univariate) conditional convergence, in 1985 vs 2005, across different correlates. In particular it plots $\delta_{1985}\lambda_{1985}$ and $\delta_{2005}\lambda_{2005}$, which link together unconditional and conditional convergence through the omitted variable bias formula, Equation 5:

$$\beta_t = \beta_t^* + \delta_t\lambda_t$$

Coefficients are estimated using a balanced panel, balanced separately for each correlate. The solid lines are the fitted lines of the scatter plot; the numbers beneath the plots refer to their slopes. The dashed lines are the 45-degree line, as a benchmark. Panel A presents results for Solow fundamentals and short-run correlates; Panel B presents results for long-run correlates and culture. We include those correlates which are normalized each period, since the normalization does not affect the effect the size of the gap (it has opposite effects on δ and λ which cancel each other out).

Figure 8: Absolute convergence converging to conditional convergence (multivariate)



Notes: The black line represents the absolute convergence β-coefficient and the blue line represents the conditional convergence β^*-coefficient, using one particular set of correlates to condition on. Choosing the set of correlates is a trade-off between sample size and number of correlates, which leaves a lot of choice to the researcher - one of the reasons we view the univariate results as our main specification. The particular choice here gives a sample of 72 countries, using the following set of correlates: polity2 score, Freedom House political rights, Freedom House civil liberty, private investment ratio, government spending, inflation, credit provided to private sector, credit by financial sector, Barro-Lee education attainment, and education gender gap. Minor imputations apply: missing values in institutions are imputed with the latest available data point. The red dotted line is the benchmark of no convergence

Tables

Table 1: Converging to convergence. Absolute convergence 1960-2017

	Average annual growth in next decade		
	(1)	(2)	(3)
log(GDPpc)	-0.270**	0.449**	
	[0.118]	[0.224]	
log(GDPpc) * (Year-1960)		-0.025***	
		[0.006]	
log(GDPpc) * 1960s			0.532***
			[0.191]
log(GDPpc) * 1970s			-0.075
			[0.293]
log(GDPpc) * 1980s			0.106
			[0.246]
log(GDPpc) * 1990s			-0.127
			[0.221]
log(GDPpc) * 2000s			-0.651***
			[0.168]
log(GDPpc) * 2007s			-0.764***
			[0.146]
Year FE	Y	Y	Y
Observations	863	863	863

Notes: This table reports absolute convergence regressions, Equation 1. The independent variable is the average annualized GDP growth (%) for the subsequent decade, in PPP (from the Penn World Tables v10.0), and the sample contains the data for the first year of each decade since 1960, with 2007 replacing 2010. We exclude countries with population $<$ 200,000, and for which natural resources account for $>$ 75% of GDP. Specification (1) pools the data since 1960. Specification (2) includes a time trend of absolute convergence β. Specification (3) estimates the absolute convergence β by decade. Year fixed effects are included in all three specifications. Standard errors, clustered at the country-level, are reported in the parentheses. * $p < 0.05$, **$p < 0.01$, *** $p < 0.001$

Table 2: List of Solow fundamentals, growth correlates, and cultural variables

Category	Variable	Data Source	Data Period
Enhanced Solow Fundamentals	**Gross capital formation (% GDP)**	WDI	1960-2017
	Population growth rate	WDI	1960-2017
	Barro-Lee Years of Education Age 25-29	Barro-Lee Data	1950-2010
Labor Force	Education Gap (Male-Female)	Barro-Lee Data	1950-2010
	Labor Force Participation Rate	WDI	1960-2017
Political Institutions	**Polity 2 Score**	Polity IV Project	1960-2018
	Freedom House Political Rights	Freedom House	1973-2018
	Freedom House Civil Liberty	Freedom House	1973-2018
	Media Freedom Score	Freedom House	1979-2018
	WGI Political Stability	WGI	1996-2018
Governance Quality	**WGI Rule of Law**	WGI	1996-2018
	WGI Government Effectiveness	WGI	1996-2018
	WGI Regulatory Quality	WGI	1996-2018
	WGI Control of Corruption	WGI	1996-2018
	Overall economic freedom index	Heritage Freedom	1995-2019
	Government Integrity	Heritage Freedom	1995-2019
	Business Freedom	Heritage Freedom	1995-2019
	Property Rights	Heritage Freedom	1995-2019
Fiscal Policies	Taxes on income & cap. gains (% of revenue)	WDI	1972-2017
	Taxes on goods and services (% of revenue)	WDI	1972-2017
	Equal-weighted Tariff	WDI	1988-2017
	Value-weighted Tariff	WDI	1988-2017
	Tax Burden Score	Heritage Freedom	1995-2019
	Private Investment (% Total Investment)	IMF	1960-2015
	Government Spending (% GDP)	WDI	1960-2017
	Military Expenditure (%GDP)	WDI	1960-2017
Financial Institutions	Inflation	WDI	1960-2017
	Central Bank Independence (Weighted)	Garriga (2019)	1970-2012
	Credit to private sector	WDI	1960-2017
	Credit by financial sector	WDI	1960-2017
	Financial Freedom	Heritage Freedom	1995-2019
	Investment Freedom	Heritage Freedom	1995-2019
Culture	Power Distance	Hofstede VSM	-
	Individualism	Hofstede VSM	-
	Masculinity	Hofstede VSM	-
	Uncertainty Avoidance	Hofstede VSM	-
	Indulgence vs. Restraint	Hofstede VSM	-
	Long Term Orientation	Hofstede VSM	-
	Population in 1900	Maddison Project	-
	Legal Origin (UK)	LaPorta et al. (2008)	-
	Legal Origin (France)	LaPorta et al. (2008)	-

Long-Run Variables	Legal Origin (Germany)	LaPorta et al. (2008)	-
	Legal Origin (Scandinavia)	LaPorta et al. (2008)	-
	Legal Origin (Socialist)	LaPorta et al. (2008)	-
	Log Settler Mortality Rate	Acemoglu et al. (2001)	-
	Mean Temperature	Acemoglu et al. (2001)	-
	100km of the Coastline	Acemoglu et al. (2001)	-
	Ethno-Linguistic Fractionalization	Acemoglu et al. (2001)	-
	Landlocked	Acemoglu et al. (2001)	-
	Absolute Latitude	Acemoglu et al. (2001)	-
	Tropical Climate	Sachs and Warner (1997a)	-

This table summarizes all enhanced Solow fundamentals, growth coorelates, and cultural variables considered in the analysis, which we divide into four broad groups: enhanced Solow fundamentals, short-run correlates (comprising political institutions, governance, fiscal policy, financial institutions), long-run correlates, and culture. Columns 3 and 4 report the data source and data period for each variable. The variables in bold are the representative correlates reported in Figure A.14 and Figure 4. Some of the correlates are not directly comparable across time, for example the WGI indicators are standardized each year. In subsequent analysis we only consider such variables for conditional versus absolute convergence, where such standardization does not matter.

Table 3: Change and convergence in enhanced Solow fundamentals and growth correlates from 1985* to 2015*

	Dev-Favored	**Mean in 1985**	**Mean in 2015**	**Change (in σ_{1985})**		**Convergence β**
				Estimate	p-val	
Gross capital formation (% of GDP)	High	22.07	24.18	0.23	0.06	-2.98***
Population growth (annual %)	Low	1.99	1.42	-0.43	0.00	-1.53***
Barro-Lee Education Age 20-60	High	6.19	8.80	0.86	0.00	-0.16
Average of Solow Fundamentals						-1.56
Education Gap (Male-Female)	Low	0.97	0.33	-0.66	0.00	-0.81***
Labor Force Participation Rate	Low	62.48	62.61	0.01	0.79	-0.66***
Polity 2 Score	High	-0.87	4.69	0.73	0.00	-2.03***
Freedom House Political Rights	High	5.86	6.53	0.30	0.00	-1.39***
Freedom House Civil Liberty	High	5.72	6.56	0.41	0.00	-1.36***
Media Freedom Score	High	52.63	49.93	-0.12	0.02	-0.88***
WGI Political Stability	High	-	-	-	-	-
WGI Government Effective	High	-	-	-	-	-
WGI Regulatory Quality	High	-	-	-	-	-
WGI Rule of Law	High	-	-	-	-	-
WGI Control of Corruption	High	-	-	-	-	-
Overall Economic Freedom Index	High	-	-	-	-	-
Government Integrity	High	-	-	-	-	-
Property Rights	High	-	-	-	-	-
Business Freedom	High	-	-	-	-	-
Equal-weighted Tariff	Low	9.46	4.36	-0.47	0.00	-3.46***
Value-weighted Tariff	Low	8.11	3.09	-0.70	0.00	-3.38***
Taxes on Income & Capital Gain	High	25.54	28.79	0.20	0.06	-1.61***
Government Spending (%GDP)	High	15.90	15.96	0.01	0.90	-1.61***
Taxes on Goods and Services	N/A	28.47	31.38	0.21	0.17	-2.51***
Tax Burden Score	N/A	-	-	-	-	-
Private Investment	High	0.63	0.63	0.00	0.99	-1.60***
Military Expenditure (%GDP)	N/A	3.38	1.89	-0.47	0.00	-2.10***
Inflation	Low	16.19	2.25	-0.54	0.00	-3.07***
Central Bank Independence	N/A	0.38	0.60	1.77	0.00	-2.56***
Credit to Private Sector	High	31.46	55.60	0.95	0.00	0.89**
Credit by Financial Sector	High	49.42	69.15	0.47	0.00	-0.98
Financial Freedom	High	-	-	-	-	-
Investment Freedom	High	-	-	-	-	-

Average of Short Run Correlates	-1.66

Notes: This table presents the average correlate in 1985 (or the earliest available year, denoted 1985*) and 2015 (or the latest available year, denoted 2015*), and convergence rate over the three decades. Column (2) reports the development-favored correlates determined by their correlation with GDP per capita in 1985. "N/A" refers to the potential correlates which are not significantly correlated with income in our base year 1985, i.e. where δ_{1985} is insignificant. Columns (3) and (4) report the raw mean of correlates in 1985* and 2015* respectively. Columns (5) and (6) report the change in the correlates between 1985* and 2015*, normalized by the standard deviation in 1985* and corresponding t-statistics. Column (7) is the correlate convergence β, obtained by regressing the decade-average correlate change from 1985* to 2015* on the correlate in 1985*. Missing entries correspond to correlates which are not directly comparable across time, for example if they are standardized each year. Results for culture are in Table A.6.

* $p < 0.05$, **$p < 0.01$, *** $p < 0.001$

Table 4: Correlate-income and growth-correlate relationships

	δ_{1985}	δ_{2005}	λ_{1985}	λ_{2005}	$\delta\lambda_{1985}$	$\delta\lambda_{2005}$	N
Gross capital formation (% of GDP)	0.276***	0.109 *	0.253	0.382*	0.070	0.042	115
Population growth (annual %)	-0.384***	-0.192***	-0.636***	-0.656***	0.244	0.126	136
Barro-Lee Education Age 20-60	0.656***	0.639***	0.963 **	0.700**	0.632	0.447	118
Average of Solow Fundamentals					0.32	0.20	
Education Gap (Male-Female)	-0.412***	-0.501***	-0.550 **	-0.257	0.227	0.129	118
Labor Force Participation Rate	-0.268***	-0.257***	-0.424	0.367**	0.114	-0.094	160
Polity 2 Score	0.494***	0.197***	0.891***	0.340	0.440	0.067	124
Freedom House Political Rights	0.540***	0.353***	1.107***	0.189	0.598	0.067	132
Freedom House Civil Liberty	0.568***	0.351***	0.959***	0.173	0.544	0.061	132
Media Freedom Score	0.517***	0.468***	0.117	0.004	0.061	0.002	152
WGI Political Stability	-	-	-	-	0.069	0.069	159
WGI Government Effective	-	-	-	-	-0.115	0.262	158
WGI Regulatory Quality	-	-	-	-	-0.270	0.044	159
WGI Rule of Law	-	-	-	-	-0.175	0.075	159
WGI Control of Corruption	-	-	-	-	-0.173	-0.032	159
Overall Economic Freedom Index	-	-	-	-	-0.267	-0.150	97
Government Integrity	-	-	-	-	-0.113	-0.042	97
Property Rights	-	-	-	-	-0.106	-0.125	97
Business Freedom	-	-	-	-	-0.012	-0.120	97
Equal-weighted Tariff	-0.758***	-0.271***	0.298	-0.265	-0.226	0.072	45
Value-weighted Tariff	-0.696***	-0.256***	0.026	-0.799	-0.018	0.205	45
Taxes on Income & Capital Gain	0.416***	0.280 **	-0.113	0.082	-0.047	0.023	48
Government Spending (%GDP)	0.262***	0.237***	-0.192	-0.245	-0.050	-0.058	111
Taxes on Goods and Services	-0.182	-0.155	-0.579 *	0.185	0.106	-0.029	49
Tax Burden Score	-	-	-	-	0.017	0.004	97
Private Investment	0.234***	0.195***	0.026	0.121	0.006	0.024	133
Military Expenditure (%GDP)	0.034	0.044	0.089	-0.565	0.003	-0.025	110
Inflation	-0.156 *	-0.043 *	-0.081	-1.117**	0.013	0.048	124
Central Bank Independence	-0.022	0.339***	-0.606 **	0.023	0.013	0.008	100
Credit to Private Sector	0.549***	0.963***	0.761 **	0.170	0.418	0.164	104
Credit by Financial Sector	0.267***	0.574***	0.371	0.132	0.099	0.076	104
Financial Freedom	-	-	-	-	-0.059	-0.069	97
Investment Freedom	-	-	-	-	0.133	0.005	97
Average of Short Run Correlates					0.04	0.03	
Population in 1900	-0.230 *	-0.145	0.472	0.472**	-0.109	-0.068	58
Legal Origin (UK)	0.059	0.039	0.533 **	0.056	0.031	0.002	136
Legal Origin (France)	-0.213***	-0.191***	-0.600***	-0.308*	0.128	0.059	136
Legal Origin (Germany)	0.127 **	0.137 **	0.187	0.480**	0.024	0.066	136
Legal Origin (Scandinavia)	0.283***	0.234***	-0.076	-0.065	-0.022	-0.015	136
Legal Origin (Socialist)	-0.132	-0.089	0.007	0.345**	-0.001	-0.031	136
Log Settler Mortality Rate	-0.610***	-0.569***	-0.774 **	-0.426	0.473	0.243	84

Mean Temperature (1986)	-0.583***	-0.476***	0.024	0.381	-0.014	-0.181	60
Distance from Coast	0.239 *	0.329***	0.806 **	0.130	0.192	0.043	61
Ethno-Linguistic Fractionalization	-0.413***	-0.441***	-0.555 **	0.029	0.229	-0.013	124
Landlocked	-0.200***	-0.142 **	0.301	0.183	-0.060	-0.026	129
Latitude	0.494***	0.481***	0.618 **	0.059	0.305	0.029	129
Tropical Climate	-0.601***	-0.518***	-0.083	0.752***	0.050	-0.390	89
Average of Long Run Correlates					0.09	-0.02	
Power Distance	-0.588***	-0.513***	-0.017	0.679***	0.010	-0.348	60
Individualism	0.573***	0.459***	-0.574 *	-0.626***	-0.329	-0.287	60
Masculinity	0.023	-0.006	-0.247	-0.092	-0.006	0.001	60
Uncertainty Avoidance	-0.040	-0.105	-0.492 *	-0.114	0.020	0.012	60
Indulgence	0.242 **	0.292***	0.783***	0.458**	0.190	0.134	69
Long Term Orientation	0.412***	0.297***	-0.092	-0.268	-0.038	-0.080	70
Average of Culture Determinants					-0.03	-0.09	

This table reports the coefficients of the cross-sectional regressions of correlates on income and of (ten year average) growth on correlates, in 1985* to 2005*. In particular, the coefficients δ and λ are estimated from the following regressions:

$$\Delta log(GDPpc)_{i,t} = \beta_t log(GDPpc)_{i,t} + \lambda_t \frac{Inst_{i,t}}{SD(Inst_{1985})} + \alpha_t + \epsilon_{i,t}$$

$$\frac{Inst_{i,t}}{SD(Inst_{1985})} = \delta_t log(GDPpc)_{i,t} + \nu_t + \epsilon_{i,t}$$

Columns (2) and (3) report the cross-section relationship δ estimated estimated in 1985* and 2005*. Columns (4) and (5) report regressions of income growth in the next decade on correlates, controlling for income at the start of the decade, in 1985*-1995 and 2005*-2015. Columns (6) and (7) report the difference between absolute converge and conditional convergence constructed using the standard omitted variable bias formula by constructing the product $\lambda\delta$. Column (8) reports the number of observations in the specifications, respectively. The sample only includes countries with non-missing correlate variables in 1985. Missing entries correspond to correlates which are standardized each year: the standardization makes comparisons over time of λ and δ difficult to interpret, but cancel out for the product $\lambda\delta$.

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Table 5: Absolute and conditional convergence in 1985 and 2005

	Annual Growth in GDPpc (1985-1995)				**Annual Growth in GDPpc (2005-2015)**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log GDP PC	0.420*	-0.447	-0.435	-0.816	-0.794***	-1.215***	-0.791***	-1.139***
	(0.252)	(0.661)	(0.457)	(0.619)	(0.154)	(0.205)	(0.233)	(0.246)
Investment		0.298		-0.0469		0.384		0.416
		(0.377)		(0.478)		(0.319)		(0.300)
Population growth		-1.034		-1.024		-0.392***		-0.415***
		(0.626)		(0.661)		(0.129)		(0.148)
Barro-Lee Education 20-60		0.428		0.492		0.463*		0.535**
		(0.525)		(0.619)		(0.270)		(0.267)
Polity 2 Score			-0.558	-0.916			0.693*	0.0514
			(0.704)	(0.728)			(0.378)	(0.400)
FH Political Rights			1.304	1.567*			-0.193	0.378
			(0.989)	(0.931)			(0.464)	(0.428)
Private Investment			-0.184	-0.267			0.223	0.143
			(0.332)	(0.329)			(0.394)	(0.344)
Government Spending			-0.0168	0.0773			-0.551**	-0.764***
			(0.386)	(0.415)			(0.275)	(0.256)
Inflation			-0.0994	-0.0284			-1.438*	-1.273*
			(0.235)	(0.243)			(0.772)	(0.722)
FH Civil Liberties			0.0958	-0.481			-0.0784	-0.333
			(0.647)	(0.749)			(0.782)	(0.724)
Credit to Private Sector			0.915*	0.875			0.483	0.494*
			(0.467)	(0.531)			(0.313)	(0.291)
Credit by Financial Sector			-0.394	-0.546			-0.733*	-0.798**
			(0.507)	(0.573)			(0.376)	(0.368)
Constant	-2.172	5.546	1.213	6.644	9.387***	11.42***	10.90***	12.31***
	(2.230)	(5.458)	(3.313)	(4.687)	(1.471)	(1.732)	(2.277)	(2.306)
Observations	73	73	73	73	113	113	113	113
R-Squared	0.0283	0.155	0.152	0.228	0.214	0.333	0.306	0.417

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: This table reports absolute and conditional convergence regressions, for 1985*-1995 and 2005*-2015, for the fullest list of Solow and short-run correlates which allow a reasonable sample size of 72 in 1985. The covariates include Investment, Population growth, Barro-lee education attainment, polity2 score, Freedom House political rights, Freedom House civil liberty, private investment ratio, government spending, inflation, credit provided to private sector, credit by financial sector, and education gender gap. Columns (1-4) report regressions for 1985-1995, and columns (5-8) for 2005-2015. Column (1) is the absolute convergence regression. Column (2) conditions on the enhanced Solow fundamentals - the fundamental determinants of steady state income in the Solow model. Column (3) conditions on other policies and institutions and column (4) conditions on both. Robust standard errors are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$