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Converging to Convergence

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April 2020

Abstract

Neoclassical theory predicts convergence towards steady-state income, determined by policies, institutions, and culture. Empirical tests of convergence in the 1990s found that conditioning on institutions mattered: *unconditionally*, the norm was divergence, if anything. We revisit these tests with 20 years of additional data. While the literature on institutions emphasizes their historical origins and persistence, we find substantial changes. First, there has been a trend towards unconditional convergence since the 1960s, leading to convergence since the early 2000s. Second, policies and institutions have converged substantially, towards development-favored institutions - those associated, across countries, with higher levels of income. Third, the institutional changes are larger, on average, than those predicted by the cross-sectional income-institution slope; while the slope itself has remained stable. Fourth, the growth-institution slope - the coefficients of growth regressions - has decreased substantially, resulting in a shrinking in the gap between conditional and unconditional convergence. We discuss the implications of these new patterns for models of growth.

JEL Code: E02, E13, O43, O47

Keywords: Convergence, Institutions, Growth regressions

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1 Introduction

Cross-country convergence in income per capita was the central prediction of neoclassical growth models of diminishing marginal returns. Yet tests of convergence in the 1990s found, if anything, the opposite: rich countries growing faster than poor, resulting in divergence (Barro 1991a). This empirical failure led to two responses: first, a rejection of the neoclassical model and the development of endogenous growth theory (Romer 1990); second, an emphasis on underlying determinants of steady-state income, such as institutions and human capital, leading to growth regressions and tests of convergence *conditional* on them (Durlauf et al. 2005).

A large strand of development economics has since switched to a more micro approach, prioritizing causal identification. In the case of institutions, for example, researchers have used historical variation in institutions to identify their causal effects on economic outcomes, emphasizing their persistence over time (Dell 2010). Yet, while such causal analysis is central to modern development economics, any understanding of development should match the cross-country patterns of income, growth, and institutions, and keep abreast of changes to them.

To update these stylized facts, we revisit the empirical question of convergence with twenty years of additional data. We consider global trends in income, as well as factors that might be determinants of growth, such as institutions and policies. Far from being static, there have been substantial changes since the 1990s in income trends, institutions, and the relationship between the two. We argue that the updated results suggest a need to rethink the empirical facts which motivated the growth literature.

We begin with absolute convergence – poor countries growing faster than rich, unconditionally – and document *convergence towards convergence*. Except for a decade of regression in the late 1970s and early 1980s, there has been a steady trend towards convergence since the 1960s, when the widespread collection of national income data began. This trend has led to absolute convergence since the early 2000s, precisely when empirical tests of convergence fell out of fashion.

Breaking down this trend towards absolute convergence by subsets of countries provides support for several natural potential explanations for it, although none can explain the change alone. Consistent with a growth slow-down at the frontier, rich countries have experienced lower growth during the last decade. However, the trend towards convergence remains almost as strong once we exclude the richest quintile of countries. Since the mid-nineties, there have been fewer disaster countries – countries that are both poor and experiencing very low or even negative growth. Accounting for them by winsorizing growth rates below, or by excluding countries with prolonged negative growth rates, does dampen the trend towards convergence, but the pattern remains. The trend is also not driven by any one specific region or set of countries. For example, the convergence becomes stronger upon removing Sub-Saharan Africa, and it is not driven by China and India alone, because countries are equal-weighted in the analysis.

We next consider global trends in factors that might be determinants of growth, such as institutions and policies. Far from being static, we find that institutions have undergone large changes

and converged substantially across countries, towards rich-country institutions. We examine 33 variables of five categories of institutions: political institutions, governance quality, fiscal policy, financial institutions, and labor and human capital. 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). We then constrained ourselves to those variables which covered a reasonable number of countries and time periods. Among the 33 variables, we find significant levels of beta-convergence in 29. Only tertiary school enrollment and credit to the private sector have diverged over time. 21 variables are sigma-converging over time, while five variables are sigma-diverging. Democracy, political rights, civil liberty, inflation, civil conflicts, and tariffs all start the sigma-convergence since 1990.

Extensive empirical literature argues that institutions are important for economic development (Glaeser et al. 2004; Acemoglu et al. 2005), raising the question of whether the observed changes in convergence and in institutions are related. Recent literature has used historical variation in institutions to establish their importance for growth causally, emphasizing their persistence over time (Acemoglu et al. 2001; Michalopoulos and Papaioannou 2013; Dell 2010). Prior to this, most analyses focused on stylized facts, either from growth regressions (Barro 1996; Sala-i Martin 1997; Durlauf et al. 2005; Rodrik 2012) or from the observation that rich countries share a common set of "better" institutions: they are more democratic, less corrupt; they have robust financial systems, more effective governance, and better social order, etc. Given the substantial changes in both income convergence and in institutions, we update these stylized empirical facts: the cross-sectional relationships between income and institutions and between growth and institutions. While our analysis is purely descriptive, it is motivated by the question of whether the changes in income convergence and in institutions are linked. In particular, whether the changes are consistent with a causal link from institutions to growth, or a causal link from income to institutions, or both?

The cross-sectional relationships between income and institutions have changed in levels but not in slope. On average, institutions have improved more in the last twenty years than would have been predicted from simply moving along the cross-sectional income-institutions curve - the intercept of the regression lines has, on average, moved up. Yet, in terms of their spreads, the convergence in income and institutions appear to be consistent with their baseline cross-sectional relationships, such that the slope of the cross-country regressions have changed remarkably little. Among 33 institutions, the cross-section relationship with GDP in 2015 is 72% correlated with the cross-section relationship in 1985.

More strikingly, the coefficients on institutions in growth regressions, controlling for income, have reduced substantially. For example, in 1985, one additional score in Freedom House political right predicted a decade of 0.6% extra annual GDP growth. However, the predictive power completely vanishes to zero in the decade 2005-2015. The declining marginal contribution of institutions is a universal pattern, also including polity 2 score, civil liberty, economic freedom score, income tax, credit to the private sector, primary and secondary school enrollment rate.

Together, the flattening of the relationship between income and institutions and the reduction

of the importance of institutions in growth regression has led to a substantial shrinking in the gap between absolute convergence and conditional convergence. Algebraically, the gap can be quantified using the formula for omitted variable bias, which says that its size is the income-institution slope multiplied by the growth regression coefficient. Decomposing the change in this product over time, one institution at a time, we find that most of the change is due to a reduction in growth regression coefficients. Moreover, the trend in absolute convergence can be wholly explained by this shrinking in the gap with conditional convergence – there is no obvious trend in conditional convergence itself.

These results suggest an interpretation that supports neoclassical growth models. Conditional convergence, the natural empirical prediction of the models, has held throughout the period. Absolute convergence did not hold initially, but, as institutions have improved in poorer countries, there has been closure in the gap in institutions across countries, and their explanatory power with respect to growth has declined. As a result, the world has converged to absolute convergence because it has converged to conditional convergence.

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. As noted, this literature was at its apex of popularity 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 1991a; Pritchett 1997), although evidence of convergence within countries (Barro and Sala-i Martin 1992) and across countries conditional on similar institutions. Recently there have been several important additions to these findings. Rodrik (2012) looks specifically at manufacturing and shows that within manufacturing, there has actually been absolute convergence. We are not the first 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. Johnson and Papageorgiou (2020), in contrast, also uses the latest data and concludes that there is still no absolute convergence. The difference results from their considering convergence from a fixed base date (1960), while we consider convergence over a moving time interval. We believe our approach is better suited for quantifying changes in the process of convergence. But, 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. This raises the important question of whether the shift to convergence reflects an underlying, long-term change, or whether it is just transitory due to, for example, higher commodity prices.

The paper also adds to the literature on institutions. Recent papers either instrument for individual institutions (Acemoglu et al. 2001) or use spatial discontinuities (Dell 2010) to identify the effect of institutions on income, generally finding that institutions play a central role. Certain institutions and cultural factors, such as legal systems and trust, have deep historical roots and appear to change very slowly (Michalopoulos and Papaioannou 2013). However, as we show, many

institutions change rapidly. How such rapid changes affect growth remains an open question.[1]

The paper proceeds as follows. In section 2, we present the results on absolute convergence in income per capita and document what we interpret as a trend towards convergence since the 1960s. In section 3, we consider what has happened to institutions across the world and document considerable convergence across multiple dimensions. In section 4, we relate the convergence in income and the convergence in institutions, first considering the implications for the cross-sectional relationship between income and institutions, and then turning to the implications for conditional convergence and growth regressions. Section 5 concludes.

2 Convergence in income per capita

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 1991a). We begin by revisiting these same tests of absolute convergence, with 25 additional years of data. We use the same data sources and focus mainly on β-convergence, defined below.[2]

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. Third, within-country panel datasets, to look at convergence within countries. For example, Barro and Sala-i Martin (1992) examined convergence within the US.

Our goal is to document what has happened to global cross-country convergence since the hey-day 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 full sample from the World Development Indicators, from 1960 to present. 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 later in the period. Section 2.2 shows robustness to using a balanced panel, which make little difference to our results. In the main specification we use GDP per capita measured in constant 2010 US dollars.

[1] Abrupt *worsening* of institutions and policies, such as generating hyperinflation through poor monetary policy, do appear to have abrupt negative effects on income. Whether the opposite is true for positive changes in institutions is less clear.

[2] Parallel results for σ-convergence are in Figure 1 Panel (b) and Appendix Figure A.2 Panel (b) with a fixed country sample

Empirically there are two approaches to testing for convergence: β-convergence and σ-convergence. β-convergence is when poor countries grow faster on average than rich, while σ-convergence is when the variance of (log) income per capita across countries 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, with results on σ-convergence 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):

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

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. $\Delta t = 10$.[3]

2.2 Results: converging to convergence

Figure 1 shows the scatter plot and regression of Section 2.1 for each decade since 1960. Figure A.1, using an alternative approach, plots the average growth by income quintile for each decade. Convergence corresponds to a negative slope, and the shift to convergence since 2000 can clearly be seen in the raw data.

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 -0.48 in the 2000s, and -0.595 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 different in timing is consistent with β-convergence being a function of subsequent 10-year average growth.

The second clear result is that, barring a major reversal which lasted around a decade during the late 1970s and early 1980s, there has been a trend towards β-convergence - converging to convergence - throughout the period. The coefficient started at around 0.5 in 1960 and has

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

trended down towards -0.5 today. Table 1, Column (2), reports the results of our basic absolute convergence regression, Equation 2.1, 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 -0.024. Such a gradual trend is less apparent in the σ-convergence figure, where it would be represented by a gradual decrease in slope. Instead there appears to be a more abrupt change in the early 2000s (although using balanced panels a more gradual change starting in the early 1990s becomes apparent).

There are several natural robustness questions. Is the change driven by panel imbalance, in particular the larger number of poor countries entering the panel over time? Are the results robust to the averaging period? Do they depend on the macroeconomic dataset used?

Balanced panel Since the number of countries in the dataset is growing over time, we do not know whether there was a trend towards convergence during the time period, or whether the change was simply driven by the new countries. 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 5-year average convergence coefficient, from 1970 to present, for the set of countries who are in the dataset since 1970.

Figure A.2 displays the results of these investigations which hold the set of countries fixed over time. It shows that the change in convergence over the time period 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.

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. Figure A.3 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 amount of noise appears large, and the trend which is apparent in 5- and 10-year averages is much less apparent.

Data source and exchange rates Figure A.4 shows that our finding of a trend towards convergence is not specific to using the World Development Indicators data, nor to our choice of the exchange rate of constant 2010 US dollars. We find a similar pattern using the two other commonly used GDP datasets: the Penn World Tables and the Maddison historical data. Likewise, while the data is only available since 1990, we find a trend towards convergence using GDP per capita in Purchasing Power Parity (PPP) terms.

2.3 Which countries have driven the change?

To provide more details on the shift to absolute convergence, and to take a first step towards understanding its causes, we consider robustness to the removal of different groups of countries and also break down results by country wealth.

Faster growth of poor countries or slowing-down of rich country growth? Two very different and popular narratives could each result in the trend to convergence that we observe: the 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 a box plot of the 10-year growth rates over the decades, with one plot per income quintile. Wealth quintile is recalculated each decade. The most striking trend is the slow down in growth in the fourth and fifth quintiles. However, if we remove the top quintile, or indeed the bottom quintile, from our standard test, we still observe a similar trend in convergence (Figure A.5). Since the sample of developing countries is increasing so much during this period, it is harder to draw conclusions about the bottom quartile.

Excluding small population and resource rich countries Could the results be driven by a small set of countries which are somehow different. For example, is the change just driven by the commodity boom and mineral rich countries? Or by India and China? Or by a few outlier countries?

Our main specification is not population-weighted, so the trend cannot be driven by China and India alone. However, the dataset does include some very small countries. Figure A.6 Panel (b) shows that results are robust to excluding all countries with population less than 500,000 in 2010.

With the growth of China as a manufacturing powerhouse, commodity prices have been exceptionally high. Could these high commodity prices have been pushing growth rates up for resource-rich countries, and if so, is the change to convergence simply reflecting the increase in the value of such exports? We consider what happens to the trend in convergence coefficients if we drop all major natural resource countries, in particular those countries for which exports of minerals accounted for at least 20% of GDP in 2010. Figure A.6 Panel (c) shows that excluding major exporters of natural resources has little effect on the trend.

Excluding disasters and growth miracles Figure A.7 presents the trend in coefficients from Equation 2.1 when excluding countries experienced disasters or growth miracles. Panels (c) and (d) show the trend when you remove the bottom and top 5% of growing countries in each period, respectively. In both cases, the trend towards convergence remains robust. Interestingly, the reversion in the 1980s disappears when excluding the bottom 5% of countries. Relatedly, when excluding countries with negative 10-year growth (Panel (b)), the same holds.

3 Convergence in institutions

We next consider global trends in factors that might be determinants of growth, such as institutions and policies, using the same empirical approach used above. While 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, 29 out of the 33 institutions we consider exhibit β-convergence from 1985 to 2015. Moreover, institutions have generally converged in the direction of those of more advanced economies, termed development-favored institutions.

3.1 Institutions and policies considered

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). We then constrained ourselves to those variables which covered a reasonable number of countries and time periods.

Table 2 summarizes the data sources and sample period of the resulting 33 institutions and policies, divided into five broad categories: political institution, governance quality, fiscal policy, financial institution, and labor and human capital. For certain figures in the paper, We pick one representative institution 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), and Barro-Lee education attainment of the age groups from 25 to 29. Equivalent figures with the other variables can be found in the Appendix.

To help interpret the direction of change of institutions, Table 3 Column (3) shows which institutions were development-favored in 1985 (or the earliest available year), defined by their correlation with log GDP in 1985.[4] Institutional variables are defined as high (or low) development-favored if the coefficient from regressing institution 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, a better rule of law, higher GDP spending, more financial credit, and higher education attainment. Five institutions cannot be signed: taxes on goods and services, tax burden score, military expenditure, inflation, and central bank independence.

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),[5] and the political stability score (1996-2018) from Worldwide Governance Indicators (WGI).

Government quality variables - distinct from political institutions - measure whether the public system functions well. We use four variables (1996-2018) from the WGI Project: government

[4]Table A.1 reports institutional change and convergence for an alternative time period 1990-2010. The results are quite comparable with Table 3.

[5]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

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

The labor category includes Barro-Lee average educational attainment of the age groups 25-29 (Barro and Lee 2013), gender inequality in education (male minus female in educational attainment), labor force participation rate, and primary/secondary/tertiary school enrollment rates (as the breakdown of human capital composition). High-income countries have more human capital, less gender inequality, and lower labor force participation.

The following sections examine institutional changes from 1985 to 2015 and convergence β_{Inst} estimated from the following equation:[6] [7]

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

The country sample is time-varying (mostly increasing) as datasets add new countries into the

[6] 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 institutional convergence β_{Inst} in Column (7) is 1996 as well.

[7] In the Appendix, we also plot the standard deviations of the institutional metrics as the σ-convergence for institutions (Figures A.9 - A.13).

sample.

3.2 Political Institutions

Political institutions exhibit pervasive beta convergence and sigma 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.8 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.9 shows the plot of coefficients for beta-convergence in political institutions. Polity 2 score, political rights, and civil liberty yield similar results, including in the coefficient magnitude. The long-run average of coefficients is around -0.2. The deep institutional reforms in the 19990s lead the coefficients to drop below -0.3 in that decade and then gradually move back the historical average -0.2. The beta institutional convergence is statistically significant in any single year's cross-sectional regression. Beta-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 five political institutions. The sigma convergence 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 5 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, drift away from democracy is common as well. Table A.2 summarizes the proportion of countries with improvements and downgrades in democracy scores. After 1980, still, roughly 10% of countries experienced setbacks in democracy in each decade. Suppose we focus on countries with Polity 2 score reduction by at least three in a decade. 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.3 shows logit regressions of increases or decreases in Polity 2 score on an economic development 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.

3.3 Governance Quality

Governance quality measures are taken from the WGI and the Heritage Freedom database. Both data sets indicate that governance quality has not improved on average between 1995 and 2010 and has, if anything, gotten worse. WGI rule of law gets worse in 50% of countries (98 out of 197), and property rights are less secured in 81% of countries (81 out of 100), falling on average by 0.6 standard deviations.

Governance quality measures have converged pervasively: β-convergence holds for almost all variables. Institutional convergence rates are negative and statistically significant at 10% level uniformly for most years (Figure A.10 Panel A). In Panel B, from 1995 to 2015, sigma convergence also happens in seven variables out of nine: rule of law, government effectiveness, regulatory quality, control of corruption, overall economic freedom, government integrity, and investment freedom.

Convergence without first-order improvement implies that better-rated countries are more likely to suffer from governance quality deterioration. Figure 5 Panels B and C plots the changes in rule of law and property rights from 1996 to 2015 against the baseline level in year 1996.[8] Rule of law exhibits a strong path dependence in the very top countries with score above 1.5, for example: Switzerland, Norway, New Zealand. We spot 13 out of 16 countries continue to improve the rule of law. However, rule of law is fragile in countries with score ranging from 0 to 1.5. Among 78 countries in this range, 52 countries (67%) experience drop in the rule of law score. Property right protection appears even harder to maintain. People in Thailand, Argentina, Saudi Arabia, South Korea, Egypt, Mongolia enjoyed decent property right protection (score above 60) in 1996, but compromise a substantially diminishing property right security (a decline more than 20). Convergence in governance quality is strong: Low-income countries catch up in regulatory performance, while some high-rated countries fail to sustain.

3.4 Fiscal Policy

Fiscal policy requires a different analysis from political institutions and governance quality. It is harder to define development-favored fiscal policy: government spending which is either too high or too low is likely to be detrimental. Government spending is important to provide a sound public health system, road network, public education, national security and other public services. Meanwhile, government spending must be paid for. Excessive government spending might crowd out private investment or squeeze the space of private business operation through an excessive tax burden. Indeed, optimal government spending trades off these considerations and may be country-specific.

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

[8] 1996 is the first year where WGI database provides extensive data.

statistically significant beta convergence in government spending: one percent higher spending in 1990 predicts a subsequent 0.53% decline. Figure 5 Panel D exhibits a strong mean-reverting: one percent higher in government spending in 1996 predicts 0.53 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 common for all fiscal policy variables. The convergence β ranges from -0.36 (Private investment as %GDP) to -0.98 (taxes on goods and services as % tax revenue) with significant at 1% level.

One policy on which economists largely agree is reducing barriers to international trade. A large empirical literature documents lower policy-induced barriers to trade induces faster economic growth (Frankel and Romer, 1999). Greenaway, Morgan, and Wright (2002) argue that even uni-lateral trade liberalisation benefits developing countries. We document a significant trade liberalization from 1990 to 2010 — equal-weighted tariff drops from 10.3% to 5.38%; similarly value-weighted tariff drops from 8.88% to 3.73% — more than 50% tariff cut on average. Beta-convergence coefficient fluctuates around -0.6 but gradually moves to -0.4 in the recent decades. The magnitude is notably large compared with other institutional variables. The convergence is large in both equal-weighted and value-weighted tariff data. Figure A.11 Panels B4 indicates 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. d

3.5 Financial Institutions

Extensive evidence shows bank credit (Rajan and Zingales 1998) relaxes borrowing constraints and allows firms to grow. However, recent literature argues that rapid credit expansion can increase financial fragility and contribute to potential sand-pile crises (Mian and Sufi 2009,Baron and Xiong 2017).

We see mixed evidence regarding financial credit convergence: modest convergence happens when countries are equal-weighted, while there is also substantial credit growth in a few large highly-leveraged developed economies.[9] New Keynesian economic thinking redirects the focus of macroeconomic policy from money neutrality to utilizing money supply to stimulate the economy and lower unemployment. Credit is development-favored, according to our definition, and we do observe substantial credit expansion from 47.9% of GDP in 1990 to 61.7% of GDP in 2010, which translates into 0.42 standard deviations in 1990. One percent higher credit in 1990 corresponding to a 0.128% (t=-1.99) decrease per decade. However, the convergence pattern is less persistent over time — Figure 4 Panel D shows the convergence particularly concentrates in 80s and 90s.

Figure 5 Panel E implies that convergence happens in both directions. Under-leveraged economies, such as Denmark, Iceland, and South Korea, expanded their financial sector. At the same time, many countries de-leveraged: out of 123 countries in our sample, 40 shrank the scale of credit. Highly-leveraged economies were more likely to contract credit, potentially to manage

[9]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.

the risk of recessions. In total, twelve countries hold credit-to-GDP ratio above 100% in 1990, reduced credit by 23% on average after two decades.[10] At the other extreme, seventeen countries with credit below 15% of GDP expand the credit by 21% till 2010.

Financial stability also significantly improves, for example, inflation becomes much more manageable. Figure A.12 Panels A1 and B1 report the convergence pattern for inflation. We don't find robust convergence until 1980, when episodes of very high inflation were still widespread. The beta-convergence coefficients stay negative with a narrow confidence interval since 1980. Sigma convergence happens since 1990: the standard deviation runs from the peak above 30 to the trough below 5 in 2010. Healthier monetary policy reduces the occurrence of hyper-inflation, and contribute to the convergence in inflation. Figure 6 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 leaves inflation above 50% while less than 10% countries bears inflation above 15%.

3.6 Labor and Human Capital

Human capital is a robust predictor of income growth, as emphasized in the seminal literature Lucas Jr (1988), Barro (1991b), Mankiw et al. (1992), Sala-I-Martin (1997), Barro and Lee (1994).[11] Education augments labor productivity (Lucas Jr (1988)), facilitates technological progress (Romer (1990)), and industrializes economy (Squicciarini and Voigtländer (2015)).[12]

We measure time-varying human capital with the Barro-Lee average schooling years of population age 25-29.[13] Figure 4 Panel E reports the beta 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 particular, people benefit from the broader availability of primary and secondary schools.[14] In addition, education levels in some well-educated populations have stagnated or even declined. In Figure 5 Panel F, Russia, Australia, New Zealand, and Denmark experienced approximately one year education reduction from 1990 to 2010. The

[10] Three developed economies - US, UK, and Japan - are notable exceptions: highly leveraged economies continue to expand bank credit even more. 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 another approximate 100%. Similarly, both countries lowered interest rates near zero after the 2008 financial crisis and the 2020 Covid-19 induced recession. The unprecedented low-interest rates fuel outstanding credits further.

[11] Government cannot directly manage human capital, but many policies can significantly influence educational attainment, such as budgetary decisions, school-building campaigns, curriculum, and minimum school leaving age.

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

[13] We pick education attainments of five age cohorts to maximize time variation in human capital at the country level. At 25, most people have completed their education. Thus, our variable captures the human capital of young labor.

[14] Figure A.13 Panels A4 and B4 show the uniform beta and sigma convergence pattern in primary school education. The standard deviation of primary school enrollment rate persistently drops from 33 in 1975 to 13 in 2015. Beta convergence of secondary school enrollment rate holds since 1990, and Sigma convergence starts from 1995.

data implies that 13 average years of education appears to be a soft cap for many countries.[15] We also observe a meaningful shrinkage in education attainment inequality across gender. The education advantage of male is expected to decline by 14.3% per decade.

Contrary to the convergence in basic education, tertiary education strongly diverges in our study period. In the 1970s, overall tertiary education enrollment was low, but tertiary education has since expanded substantially in rich and high-education countries, while low-income countries mainly caught up in basic education and literacy. In Figure A.13 Panel A6, the beta convergence coefficient has the historical average of 0.2 and statistically significant before 2000, and the divergence slows down after 2000. In Figure A.13 Panel B6, the standard deviation keeps rising from 9 in 1975 to a peak of 27 in 2012 and modestly declines afterward.

Finally, to test convergence of all of our institution variables jointly, table A.4 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.[16] For both decades, we confidently reject (p-value $< 10^{-14}$) the hypothesis that institutional convergence does not exist.

4 Connecting convergence in income with converging institutions

The link between income and institutions is a foundational question of development economics. In one direction, it is argued, better institutions lead to higher growth and, thus, to higher income. In the other direction, higher income may lead to better institutions. Recent work has made progress on establishing the link causally, showing that institutions indeed can have a large causal effect of growth (Dell 2010). Earlier work often provided evidence in the form of cross-sectional relationships between income and institutions. We revisit these cross-sectional relationships, detailing how they have changed and linking these changes to the rising absolute convergence in the past two decades. First, we consider what has happened to the relationship between income levels and institutions. Then, we turn to what has happened to the relationship between income growth and institutions – growth regressions. Finally, combining the two, we turn to the question of conditional convergence - the true prediction of neoclassical growth models – and anatomy of the gap between unconditional and conditional convergence.

4.1 Simple empirical framework

For our simple empirical investigation of the link between income, institutions, and growth, we consider two basic cross-country regressions. First, the cross-country relationship between income

[15] 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.

[16] The joint significance holds for any decade in 1996-2017.

and institutions:

$$Inst_{i,t} = \nu_t + \delta_t log(GDP_{i,t}) + \epsilon_{i,t} \tag{1}$$

where δ_t is the slope of the relationship and ν_t is the institutional level in year t.

Second, the relationship between institutions and growth, controlling for income. The classic growth regression:

$$\Delta log(GDP_{i,t}) = \alpha_t + \beta_t^* log(GDP_{i,t}) + \lambda_t Inst_{i,t} + \epsilon_{i,t} \tag{2}$$

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

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

$$\beta_t - \beta_t^* = \delta_t \times \lambda_t$$

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 [17] as follows:

$$\beta_{t_2} - \beta_{t_1} = \beta_{t_2}^* - \beta_{t_1}^* + \delta_{t_1} \times (\lambda_{t_2} - \lambda_{t_1}) + \lambda_{t_1}(\delta_{t_2} - \delta_{t_1}) + (\lambda_{t_2} - \lambda_{t_1}) \times (\delta_{t_2} - \delta_{t_1}) \tag{3}$$

4.2 Cross-country relationship between income and institutions

Richer countries are associated with certain types of institutions. 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 institutions have converged substantially. Are these changes related? Did countries simply shift along the lines in the cross-country relationship between income and institutions, or did the lines themselves change?

Figure 7 investigates this, plotting whether changes in institutions are the scale as would be expected from changes in income, given the baseline cross-country relationship between the two. Overall, we see that actual changes are more aggressive than the one predicted from income growth.[18] Overall, the institutional quality levels have increased: for a given level of income,

[17] 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 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.

[18] The solid fitted line is steeper than the 45-degree line.

institutions are typically now better than they were thirty years ago.

However, actual institutional changes are often quite far from those predicted by baseline relationships. Education and financial development are much ahead, compared to simultaneous income growth. Countries endeavor to provide more education at all levels, and the gender gap in education becomes significantly smaller. Many "best practices" of financial institutions have been broadly chased as well: well-managed inflation, central bank independence, credit expansion as a crucial part of the economic stimulus package, lower tariff to embrace globalization. Figure 7 also reveals a lot of variation. Political institutions improve almost as much as predicted. Meanwhile, governance quality stagnates or even recess: property right protection, investment freedom, business freedom, and political stability experience sizable decline from 1985 to 2015.

So have the relationships themselves, between income and institutions, changed? Figure 8, which normalizes by the standard deviation of institutions in 1985[19], shows the slopes of these income-institution regressions, the δ_ts in Equation (1) , 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) rises to 87.5% if three outliers (financial credit, credit to private sector, and tertiary education) are excluded. The other 30 institutions scatter precisely along the 45-degree line.

4.3 Institution-Growth relationship in growth regressions

Turning to what has changed in growth regressions, the most striking finding is that the coefficients on institutions, the λ_ts in Equation (2), have reduced substantially. Table 4 Columns (3) and (6) report λ_{1985} and λ_{2005}.[20] Thirteen institutions in 1985 predict additional growth in the next decade at 20% significance level (t-stat of λ above 1.282). Figure 9 plots λ_{2005} re-estimated with the same country sample[21] two decades later 2005-2015. Overall, institution-growth relationship have pervasively shrunk towards zero — the slope of fitted line in Figure 9 is only 0.23 (t=1.62), implying λ shrinks by 77% on average.[22]

In the decade 1985-1995, political institutions are strong predictors for growth: Polity 2 democracy, civil liberty, and political right. Twenty years later, political institutions lose its power in forecasting growth both economically and statistically, even media freedom score negatively correlates with growth. The diminishing λ might come from two possibilities. First, the phenomenal improvement and convergence in the political institution since 1990 make countries are not that different from each other. The democratic reform wave makes it hard to sort countries into high

[19] In Figure A.14, we normalize standard deviations of institutions in 1985 and 2015, respectively. The fitted line coincides with the 45-degree line, and the R-squared is as high as 92%.

[20] Our time horizon shrinks to 1985-2005 to accommodate the growth regression. Table 4 Columns (2) and (4) 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 institution data in the starting year. The sample size typically decreases from 1985 to 2005 since some countries vanish in the two decades.

[22] Figure A.15 plots growth-institution relationship of all 33 institutions in 1985 and 2005. The slope of the fitted line is 0.21 (t=0.84). The magnitude is quite close to the slope derived from the 13 institutions with a 20% significance level.

or low growth by democracy level. Another possibility is that countries stay with low scores in political institutions manage to find a way to generate sufficient economic growth, and thus, the existing institutions remain in place.

One s.d. increase in credit to private sector forecasts 0.76% percent higher annualized economic growth. Credit expansion can increase the firm's productivity with lower borrowing cost, and also indirectly boost household demand (Mian et al. 2019). However, the Lucas critique applies here. Credit expansion generates much smaller — 0.19% additional growth two decades later. Similarly, the λ coefficient of financial credit supply also decreases from 0.35% to 0.21%, and loses statistical significance.[23]

Education still, also the only category, predicts stronger economic growth powerfully at surprising similar magnitude in decades 1985-1995 and 2005-2015. One s.d. increase in educational attainment predicts 0.67% annualized GDP growth in 1985-1995, and the number rises to 0.85%. Countries grow faster when female can get more equal access to education resources: one s.d. reduction in gender gap (in schooling years) predicts 0.59% higher GDP growth in 1985-1995, and 0.50% in 2005-2015. Fighting gender inequality increases the productivity of young female labor force and proves to generate sustainable additional economic growth. Primary and secondary school enrollment rates remain crucial for growth: One s.d. enrollment rate in primary and secondary schools corresponds to 0.50% and 1.09% growth in 1985, and 0.63% and 0.54% growth in 2005, respectively.

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 institutions and policies (Barro and Sala-i Martin 1992). Conditional convergence has been widely supported in the data (Durlauf et al. 2005).

This leads to the natural question of whether the shift towards unconditional convergence represents a reduction of the importance of conditioning – a shrinking of the gap between conditional and unconditional convergence. Or has conditional convergence itself become faster?

We first look at convergence β conditional on the income percentile in the baseline. Conditional on income, to some extent, provides a proxy to conditional on overall institutional quality. 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 conditional convergence. We revisit this result and show convergence among the rich diminishes and shifts to the global convergence.

Figure 10 plots the convergence coefficients in the country sub-sample with income above X

[23] A rapid credit expansion elevates financial risk; for example, Baron and Xiong 2017 and Mian and Sufi 2009 show that credit supply explains the economic downturn and financial crisis in 2008-2009. The credit supply tools are no longer as efficient as they were to stimulate economic growth.

percentile.[24] Three decades from 1965 to 1995 yield a similar pattern - a strong convergence pattern among high-income countries (above 60 percentile) while the overall absolute convergence was not in place. This pattern captures a lot of existing knowledge - conditional convergence holds (say, in OECD countries) but not absolute convergence. However, this pattern starts to be overturned in the period from 1995 to 2005. In the most recent decade, the convergence pattern consistently holds for samples including countries with income in bottom 60% while the convergence stopped in top 40% rich countries. Developing countries finally start to catch up with rich countries.

We obtain conditional convergence coefficients by controlling a fixed set of institutions. The country sample is a trade-off between number of observations and being able to condition on a sizeable number of institutional variables. Finally, our baseline coefficients are based on a sample of 72 countries, and includes 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 11 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, it is not that conditional convergence has gotten faster, but instead, that unconditional convergence has become closer to conditional convergence.

Table 5 reports the coefficients for growth in three decades from 1985 to 2015. From 1985 to 1995, institutions explain substantial variation in economic growth and convert absolute divergence to conditional convergence. The ten institutional co-variates jointly take down the coefficient from 0.31 (t=1.51) to -1.27 (t=-3.03). In 2005-2015, the unconditional economic growth rate is 0.32% (t=-2.37). Institutions still effectively cut the convergence rate to -0.82% (t=-2.61), however, no sign indicates conditional convergence is faster than two decades ago. We include more extensive list of institutions but shrinks the sample size to 56 in Table A.5, and expand sample size to 85 in Table A.6 by limiting to only four institutions. In both alternative specifications, the conditional convergence coefficients do not decline and cannot explain the new pattern in absolute convergence.

This observation, in turn, asks the question, what led to the fact that absolute convergence converges to conditional convergence? Under the omitted variable framework, the gap can be written as the product of income-institution δ and the institution-growth λ. The gap shrinkage either comes from the decline in δ or λ. When conditioning on a single variable, the change in absolute convergence can be quantitatively decomposed into the changes in conditional convergence, cross-section income-institution relationship, and growth-institution relationship in growth regressions.

We first identify institutions that can generate a sufficiently large gap between the conditional

[24] $X = 0$ 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.

and absolute convergence. Seven institutional variables drive down the convergence rate by more than 0.15% (see Table 6 Column (4)) in 1985: Polity 2, political rights, civil liberty, credit to the private sector, educational attainment, gender inequality, and secondary school enrollment rate. The political institutions appear to matter most for the gap shrinkage, where Polity 2 score change accounts for 47% $(1 - \frac{\Delta\beta^*}{\Delta\beta})$[25], political rights change accounts for 65%, and civil liberty change explains for 64% of the change in the absolute convergence ($\Delta\beta$). Credit to the private sector contributes modestly by 28%. Education variables, although converge significantly as well, have little importance in the gap shrinkage as conditional convergence declines as much as the absolute convergence.

As argues above, changes in the slopes in the institution-income relationship have been small, whereas changes in growth regression coefficients have been larger. Table 6 Column (6)-(8) report the gap between absolute convergence and conditional convergence in 1985 and 2005, one institution at a time, and does the decomposition in Equation (3) for the two-decade period. On average, more than 30% of the shrinking of the gap between conditional and unconditional convergence coefficients have come from the shrinking importance of institutions in growth regressions (λ-Change). The change in income-institution relationship does not contribute the *convergence to convergence*.[26]

Variable-wisely, polity 2 score, political rights, and civil liberty dominantly contribute, 20.5%, 46.4%, and 45.3% respectively, through the λ — these three variables fail forecast additional growth conditional on the income level. λ-reduction of credit to the private sector massively cuts the gap by 75.1%, but δ-increase expands the gap by 10.5% conversely. The convergence in education has limited explanatory power in the gap shrinkage, as human capital remains a robust predictor for future economic growth.

5 Conclusion

This paper documents absolute convergence rate turns negative since 1995 and converges to the conditional convergence rate. With a fixed sample of 72 countries, the gap between conditional and absolute convergence rates was as high as 1.58% in the decade 1985-1995 and declines to 0.50% in the decade 2005-2015. We propose a dynamic view of institutions — similar policies and institutions are widely adopted, essentially homogenize countries, and enable us to discover economic convergence in *unconditional* growth regressions.

Over decades, many best practices have been established — democracy, globalization, controlled inflation, more available financial credit, accessible education. We indeed observe global institutional change towards these paradigms for most institutional variables we consider. Moreover, the institutional convergence is even more robust: 29 institutions, out of 33 in total, exhibit β-convergence from 1985 to 2015.

[25] $\frac{\Delta\beta^*}{\Delta\beta}$ is reported in Table 6 Column (6).

[26] Table 6 Column (7) reports the δ-change explains the convergence rate gap by -2.06%.

We further relate institutional convergence to the decline in the convergence rate. The institutional homogenization drives the absolute convergence rate towards the conditional convergence rate, mainly through its weakened predictive power in future economic growth. It becomes less critical to condition on institutions; thus, the true prediction of neoclassical theory can be revealed with unconditional growth regression.

Institutions by no means evolve in a single direction and backfire put established institutions at risk. Substantial convergence in governance quality without first-moment improvement implies that some deterioration occurs in countries with decent governance. Property rights, political stability, business freedom, and investment freedom even retreat over the period from 1990 to 2010. Brexit and trade wars under Trump's administration are monuments for de-globalization, and the Covid-19 pandemic might accelerate it.

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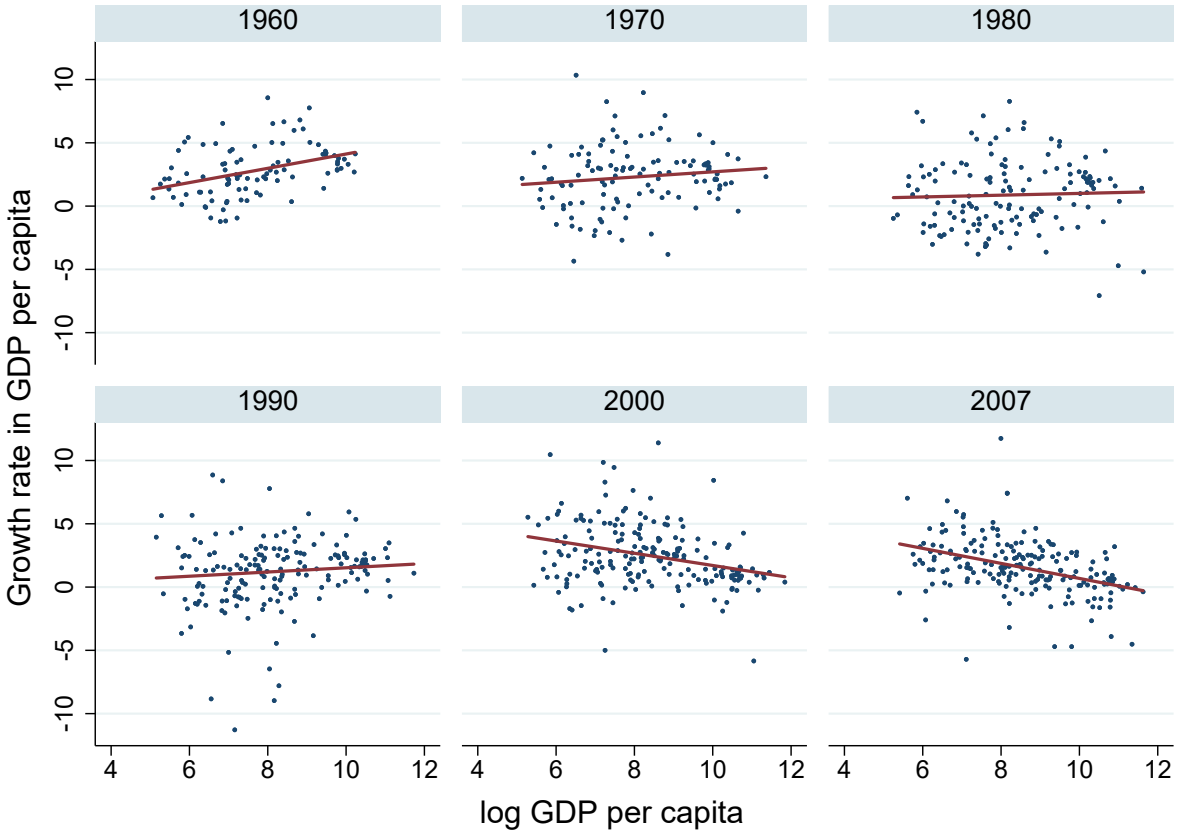
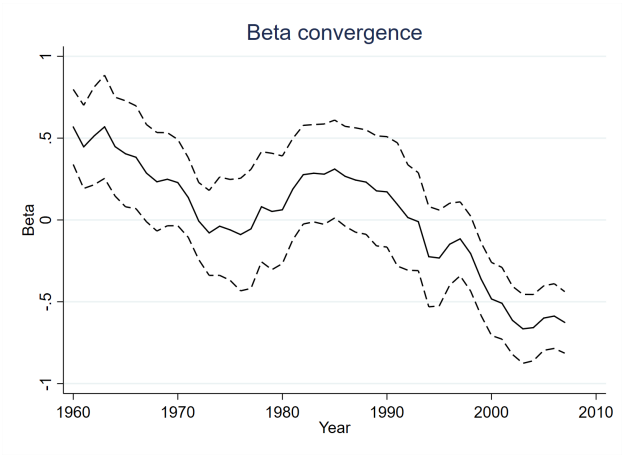
Figures

Figure 1: Scatterplot of growth vs income ($\beta-$convergence), split by decade.

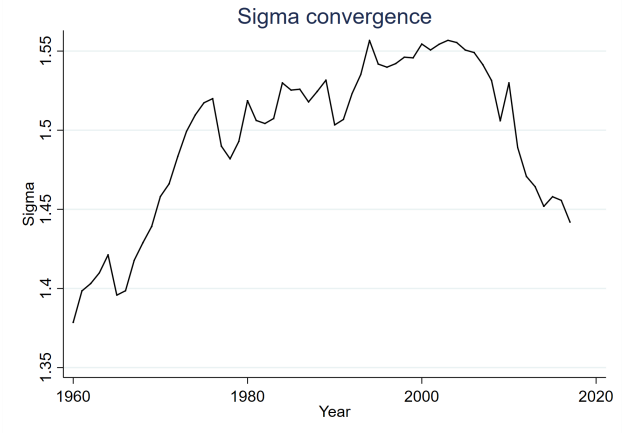


Notes: This figure plots, by decade, the raw scatter plots for the decade's β-convergence regression, as well as the regression line itself. For 2007, the period considered in 2007-2017.

Figure 2: Converging to convergence. Trend in convergence, 1960-2007



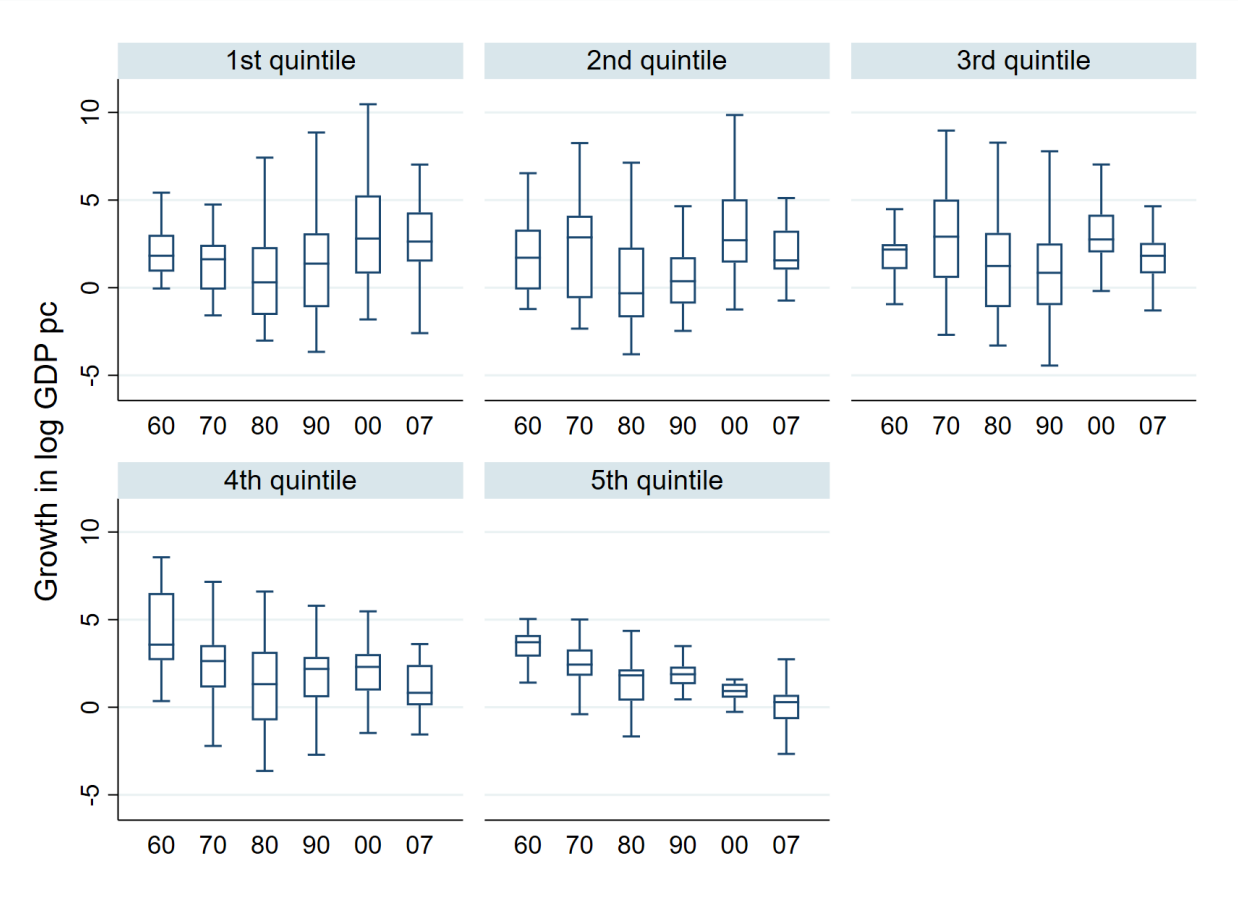
(a) $\beta-$convergence.



(b) $\sigma-$convergence.

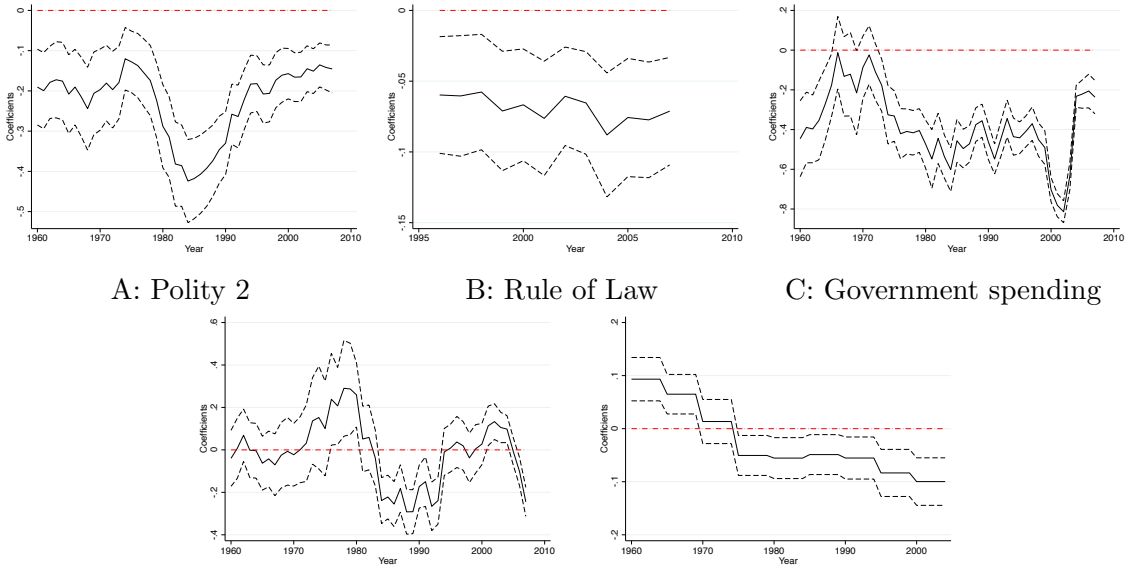
Notes: These figures show the trend in convergence from 1960 to 2007. Figure a) plots the β-convergence coefficient, for growth in the subsequent decade, over time. It is the coefficient from regressing, across countries, the average growth in GDP per capita in the next decade on the log of GDP per capita. Figure b) plots *sigma*-convergence: the evolution over time of the cross-country standard deviation in GDP per capita.

Figure 3: Boxplot showing trend in growth over time, split by income quintiles



Notes: These are boxplots of country's average growth in GDP per capita for a decade. Each facet shows one quintile of countries, based on baseline GDP per capita. Within a facet, the plot shows how decade average growth for that quintile varied over time. The top of the box is the 75th percentile of average growth in that quintile, the center is the median (the 50th percentile), and the bottom is the 25th percentile. The extended top and bottom lines represent the upper and lower extremes.

Figure 4: Convergence in institutions



A: Polity 2 B: Rule of Law C: Government spending

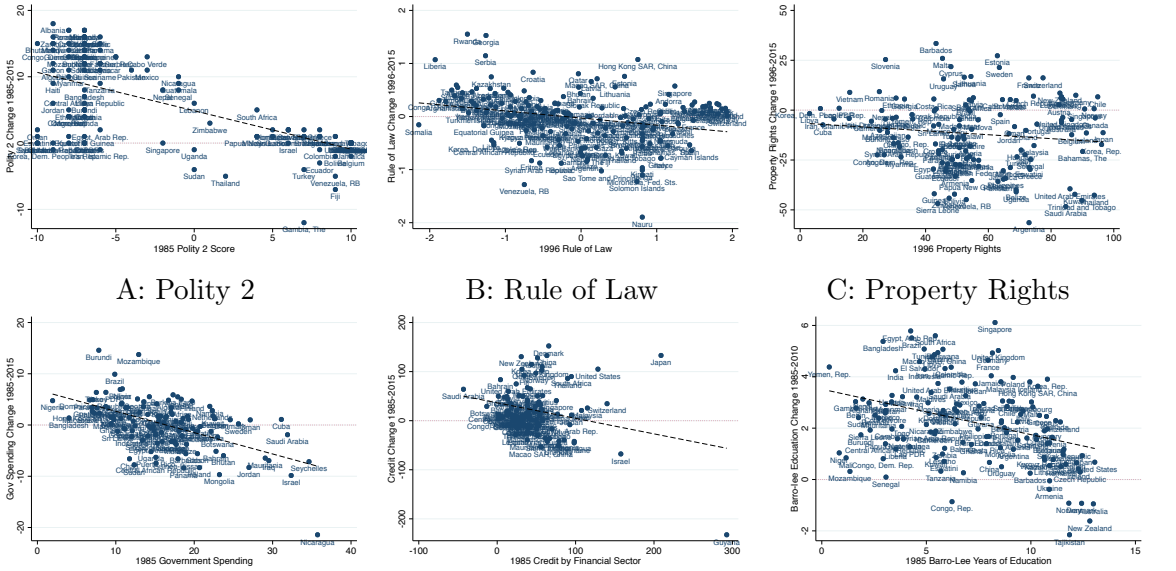
D: Credit by Financial Sector E: Barro-Lee Years of Education

Notes: This figure plots the institutional convergence β_t as a function of year t estimated from regressing the institutional change in the next decade (from year t to $t+10$) on the current institution (in year t):

$$\Delta Inst_{t \longrightarrow t+10,i} = \beta_t Inst_{t,i} + \mu_t + \epsilon_{t,i}$$

Five institutions are included: polity 2 score, rule of law (WGI), government spending (% GDP), credit provided by the financial sector, and Barro-Lee education attainment of age cohorts from 25 to 29. The dashed horizontal red lines are benchmark $\beta_t = 0$

Figure 5: 1985 Institution and Institutional Change 1985-2015

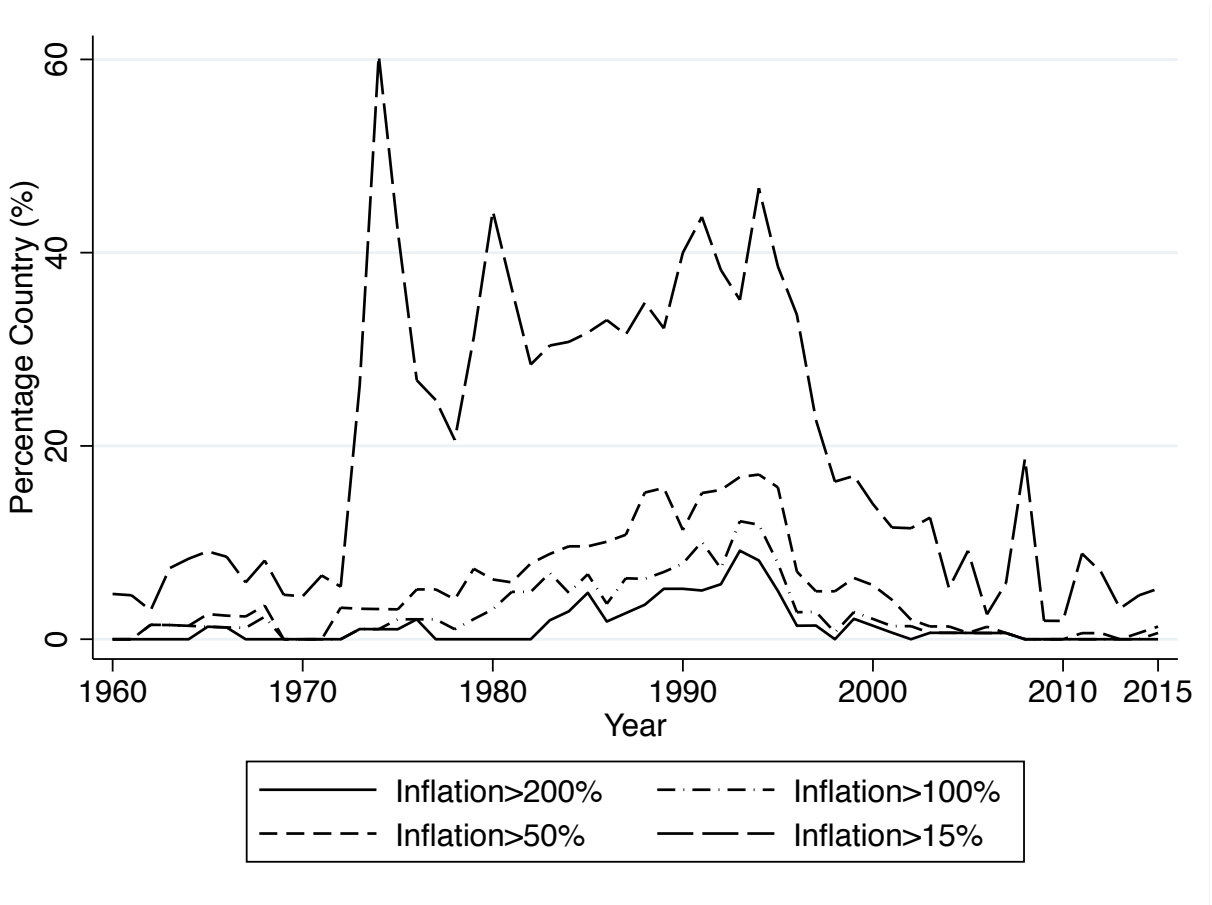


A: Polity 2 B: Rule of Law C: Property Rights

D: Government Spending E: Credit F: Barro-Lee Years of Education

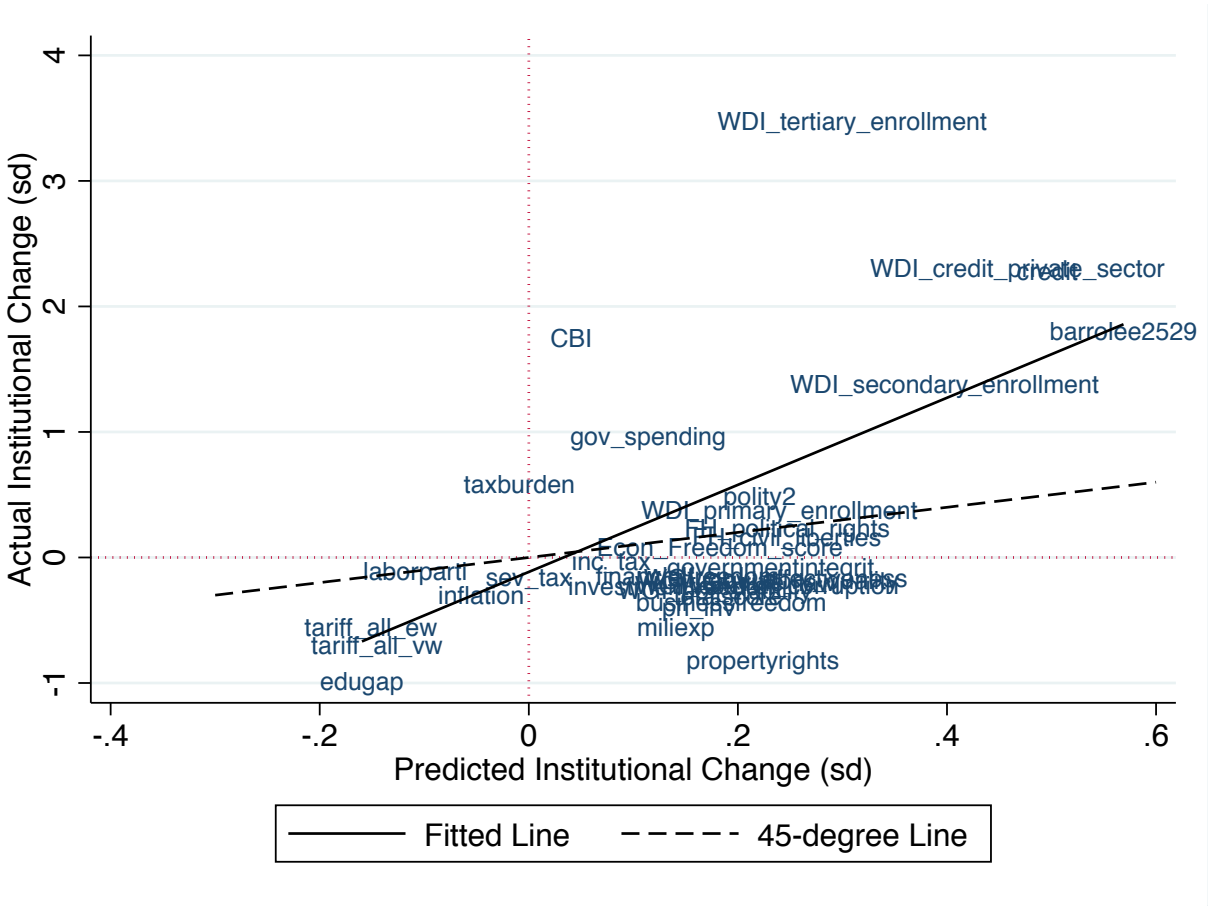
Notes: This figure plots the institutional change from 1985 (or the earliest available year) to 2015 against the baseline institution level. We include six institutional variables: Polity 2 score, rule of law, property rights, government spending, credit by financial sector, and Barro-Lee years of education.

Figure 6: Hyper-inflation over time



Notes: This figure plots four series of the percentage of countries experience inflation above 200%, 100%, 50%, and 15%.

Figure 7: Actual and Predicted Institutional Change from 1985 to 2015

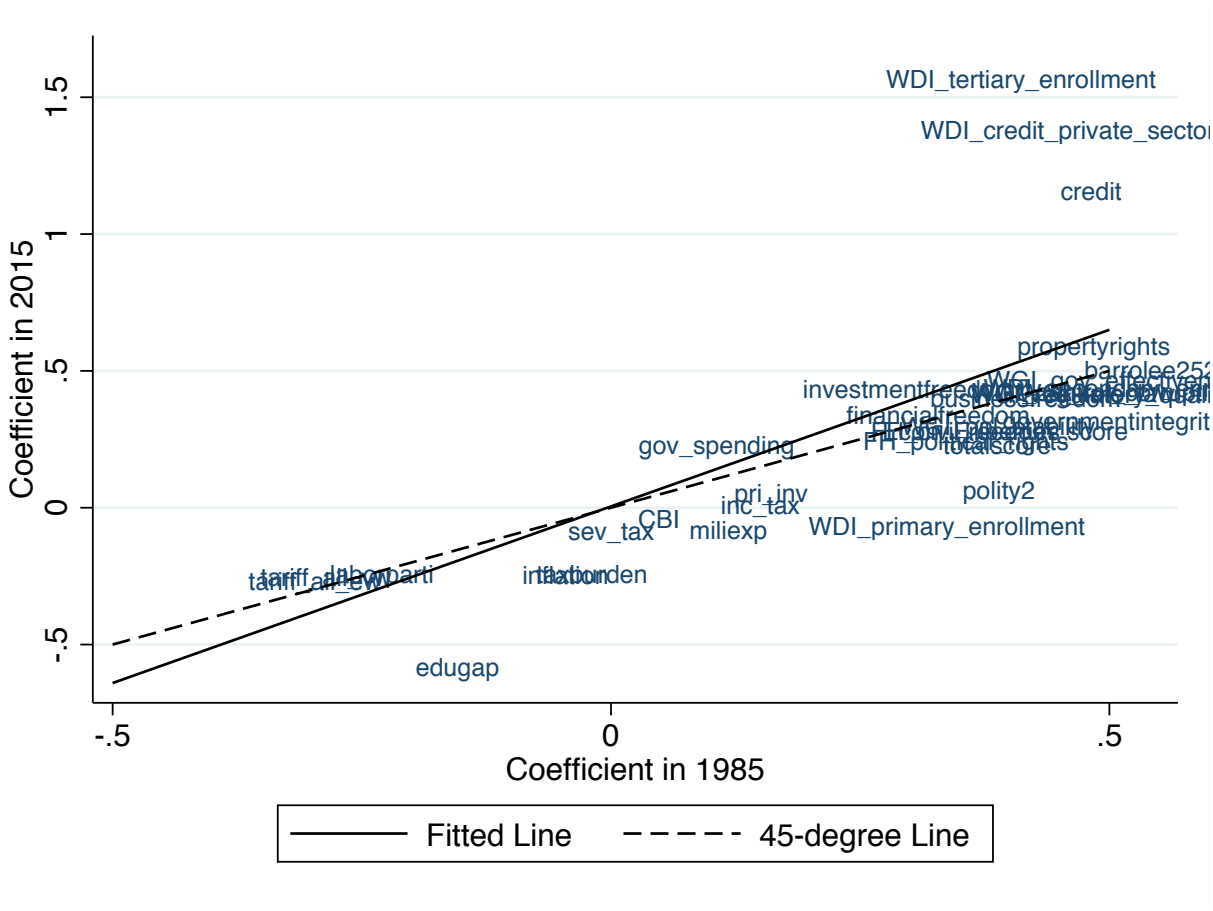


Notes: This figure plots the actual average institutional change from 1985 to 2015 versus the predicted average institutional change with the GDP-income relationship in 1985 estimated from the following regression:

$$\frac{Inst_{i,1985}}{SD(Inst_{1985})} = \delta_{1985} Log(GDP_{i,1985}) + \nu_{1985} + \epsilon_{i,1985}$$

The predicted institutional change (on X-axis) is defined as $\delta_{1985}\text{mean}_i(Log(GDP_{i,2015}) - Log(GDP_{i,1985}))$. The actual institutional change (on Y-axis) is defined as $\text{mean}_i\left(\frac{Inst_{i,2015} - Inst_{i,1985}}{SD(Inst_{1985})}\right)$. The solid line is the fitted line of all 33 institutions. The dashed line is the 45-degree degree line as a benchmark. The vertical and horizontal dotted lines are the benchmark of zeros.

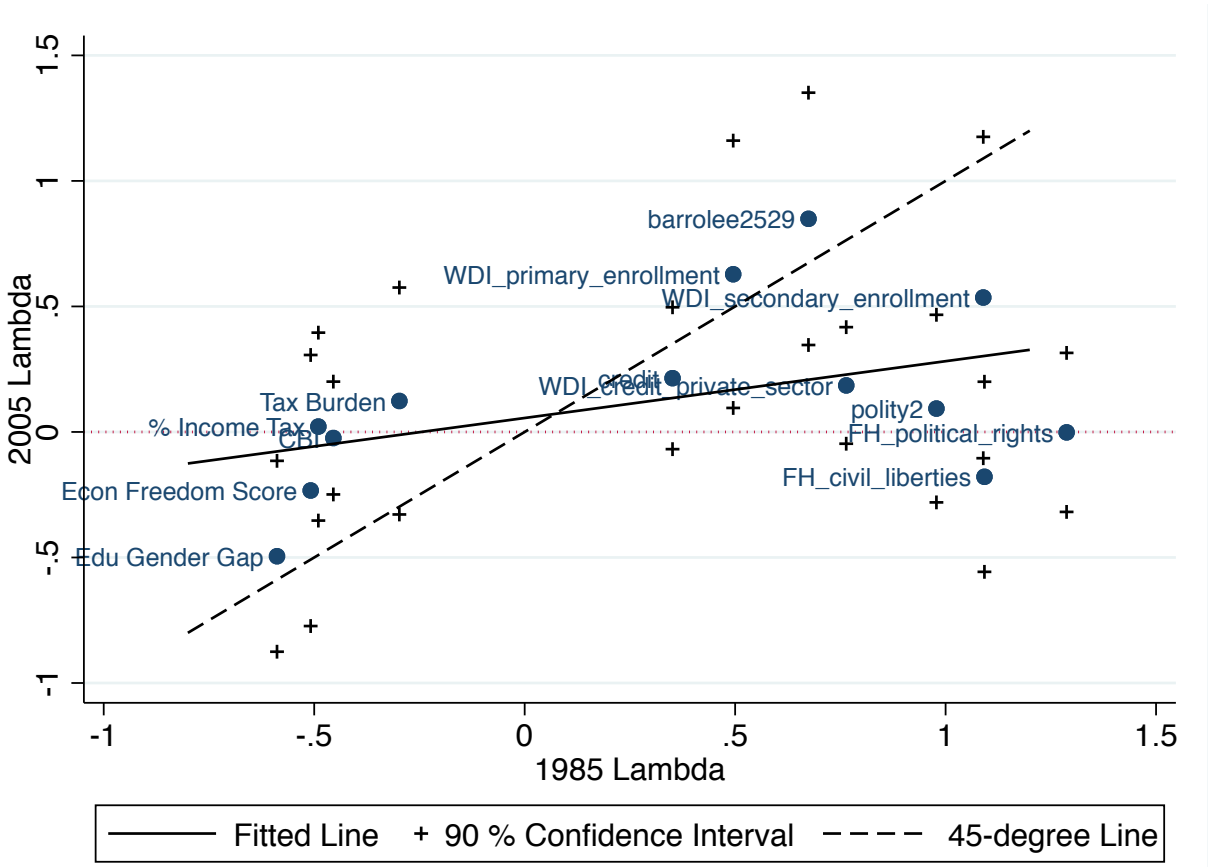
Figure 8: Institution-Income Relationship Dynamic 1985-2005



Notes: This figure plots the coefficient from regressing the normalized institution on the log(GDP) in 1985 and 2015 for all 33 institutions. The solid line is the fitted line of the scatter plot. The dashed line refers to the 45-degree line as a benchmark.

$$\frac{Inst_{i,t}}{SD(Inst_{1985})} = \delta_t Log(GDP_{i,t}) + \nu_t + \epsilon_{t,i}$$

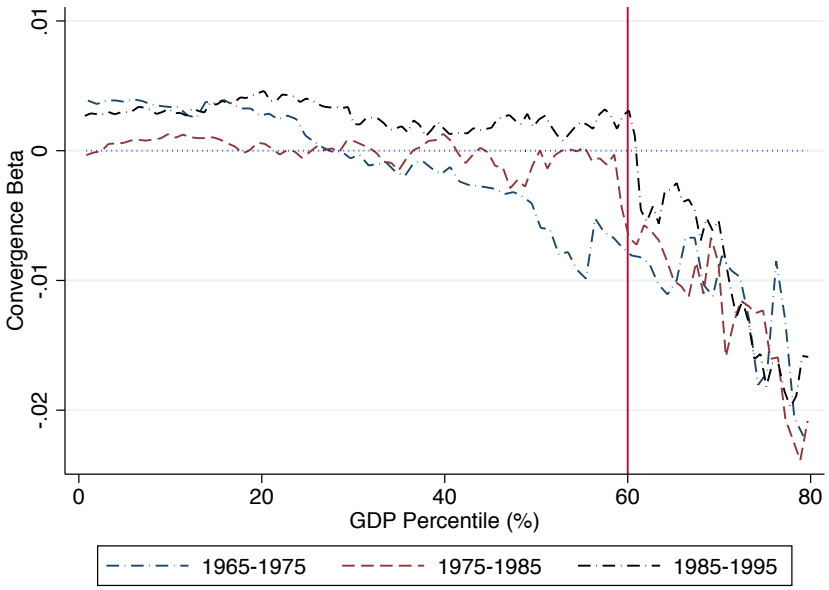
Figure 9: Institution-Growth Relationship Dynamic 1985-2005



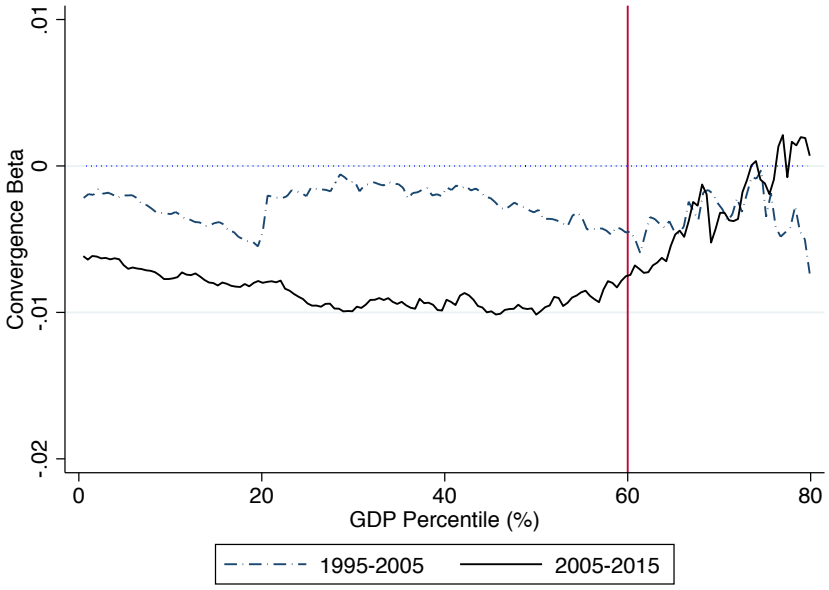
Notes: This figure plots the λ_{1985} and λ_{2005}. Institutions included in the plot are the ones with t-stats for λ_{1985} both above 1.282 (significant at 20% level). 1985λ and 2005λ are estimated from the following regressions with the GDP growth in sample periods 1985-1995 (or the earliest available decade) and 2005-2015, respectively, corresponding to Table 5. The red dotted line is the benchmark that institutions have zero marginal effect on GDP growth conditional on GDP development.

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

Figure 10: Conditional convergence by income



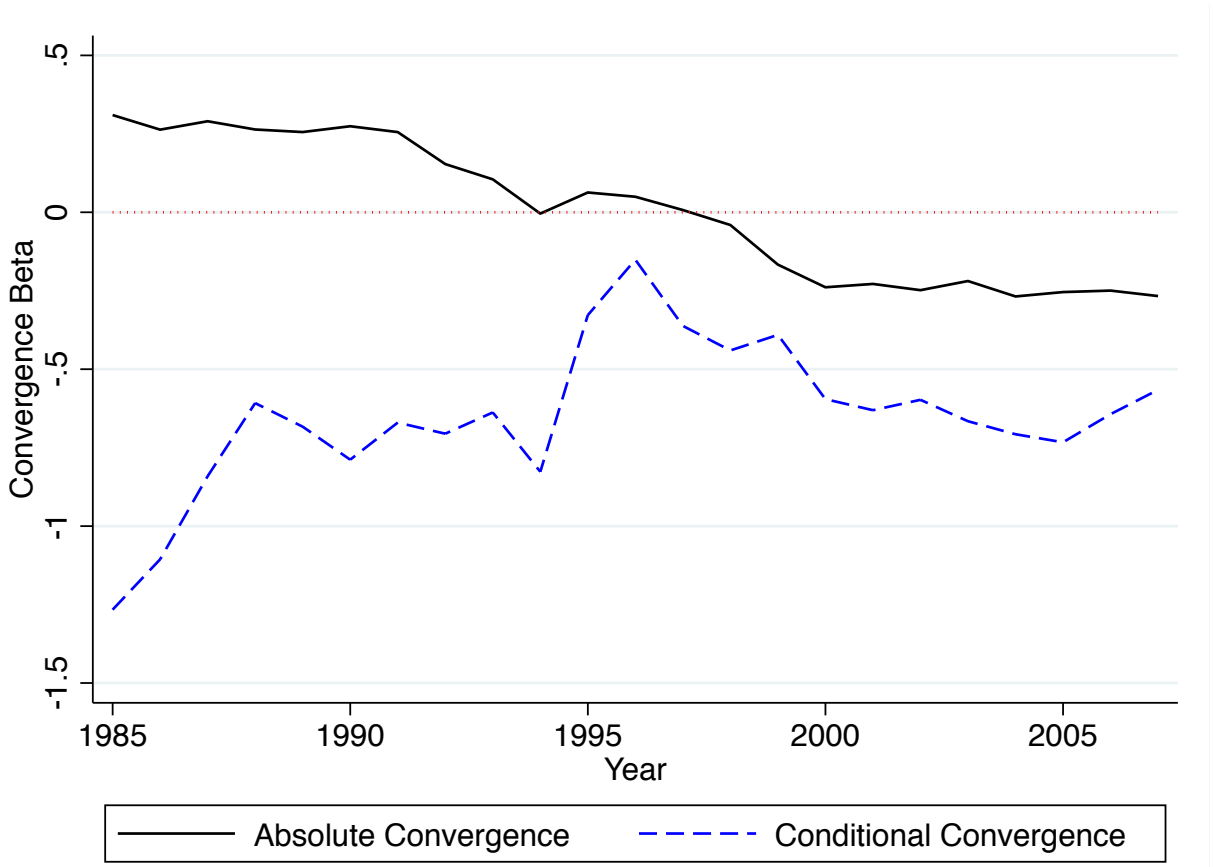
Panel A: Conditional convergence in decades from 1965 to 1995



Panel B: Conditional convergence in decades 1995 to 2005

Notes: This figure plots the convergence β conditional on the rank of GDP per capita ($> X\%$), from absolute convergence β ($X = 0$) to β conditional in top 20% income percentile ($X = 80$). Panel A reports the convergence β conditional on income for the three decades in the pre-convergence era: 1965-1975, 1975-1985, and 1985-1995. Panel B reports the β for the two decades in the post-convergence era: 1995-2005 and 2005-2015. The red vertical lines imply the cutoff for country sub-sample in the top 40% income percentile. The blue dotted lines are the benchmark of no convergence.

Figure 11: Absolute and Conditional Convergence Beta



Notes: The country sample contains 72 countries with sufficient institutional variables in 1985. The solid line represents the absolute convergence β-coefficient and the dashed line represents the conditional convergence β-coefficient. The institutional co-variates include 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: Absolute convergence 1960-2017

	(1)	(2)	(3)
logGDP	-0.124**	0.581***	
	[0.056]	[0.099]	
logGDP*(Year-1960)		-0.024***	
		[0.003]	
logGDP*1960s			0.565***
			[0.114]
logGDP*1970s			0.205
			[0.126]
logGDP*1980s			0.070
			[0.154]
logGDP*1990s			0.167
			[0.165]
logGDP*2000s			-0.483***
			[0.109]
logGDP*2007s			-0.594***
			[0.094]
Year FE	Y	Y	Y
Observations	925	925	925

Notes: This table reports absolute convergence regressions. The independent variable is the annualized GDP growth in percentage. The specification (1) is the pooling regression since 1960. The specification (2) includes a time trend for the absolute convergence β. The specification (3) estimates the absolute convergence β by decade. The year fixed effects are included in all three specifications. Standard errors are reported in the parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: List of institutions

Category	Variable	Data Source	Data Period
Political Institution	**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
	Investment Freedom	Heritage Freedom	1995-2019
	Property Rights	Heritage Freedom	1995-2019
Fiscal Policy	Taxes on income & cap. gains (% of revenue)	WDI	1972-2017
	Taxes on goods and services (% of revenue)	WDI	1972-2017
	Tax Burden Score	Heritage Freedom	1995-2019
	Equal-weighted Tariff	WDI	1988-2017
	Value-weighted Tariff	WDI	1988-2017
	Private Investment (% Total Investment)	IMF	1960-2015
	Government Spending(% GDP)	WDI	1960-2017
	Military Expenditure (%GDP)	WDI	1960-2017
Financial Institution	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
Labor	**Barro-Lee Years of Education Age 25-29**	Barro-Lee Data	1950-2010
	Education Gap (Male-Female)	Barro-Lee Data	1950-2010
	Labor Force Participation Rate	WDI	1960-2017
	Primary School Enrollment Rate (WDI)	WDI	1970-2017
	Secondary School Enrollment Rate (WDI)	WDI	1970-2017
	Tertiary School Enrollment Rate (WDI)	WDI	1970-2017

Notes: This table summarizes all 33 institutions of five categories: Political institution, governance quality, and fiscal policy, financial institution, and labor. Columns 3 and 4 report the data source and data period for each variable. The variables in bold are the representative institutions reported in Figure 7 and Figure 8.

Table 3: Institutional Changes and Convergence from 1985 to 2015

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	Dev-Favored	1985 Mean	2015 Mean	Change (in σ_{1985})	t-stat	Convergence β
Polity 2 Score	High	-1.16	4.38	0.73	9.55	-0.193***
Freedom House Political Rights	High	5.92	6.60	0.30	4.62	-0.129***
Freedom House Civil Liberty	High	5.80	6.62	0.39	6.82	-0.122***
Media Freedom Score	High	52.50	49.91	-0.11	-2.38	-0.085***
WGI Political Stability	High	-0.01	-0.10	-0.10	-1.94	-0.118***
WGI Rule of Law	High	-0.01	-0.04	-0.02	-0.69	-0.0691***
WGI Government Effective	High	-0.01	0.00	0.01	0.26	-0.0545**
WGI Regulatory Quality	High	-0.02	-0.01	0.01	0.16	-0.063**
WGI Control of Corruption	High	-0.01	-0.05	-0.04	-1.26	-0.0426*
Overall economic freedom index	High	57.27	60.48	0.32	3.84	-0.129***
Government Integrity	High	38.69	41.51	0.11	1.55	-0.247***
Business Freedom	High	68.03	64.19	-0.26	-2.88	-0.163***
Property Rights	High	55.82	43.01	-0.70	-7.76	-0.0365
Taxes on income & capital gain	High	25.20	27.41	0.18	1.66	-0.177***
Taxes on goods and services	N/A	46.66	31.67	-1.22	-0.73	-0.394***
Tax Burden Score	N/A	63.19	76.29	0.89	8.61	-0.302***
Equal-weighted Tariff	Low	10.43	5.02	-0.57	-4.01	-0.396***
Value-weighted Tariff	Low	8.90	3.37	-0.74	-5.28	-0.407***
Private Investment	High	0.63	0.63	-0.03	-0.43	-0.154***
Government Spending (% GDP)	High	16.32	16.24	-0.01	-0.17	-0.154***
Military Expenditure (%GDP)	N/A	3.68	1.98	-0.71	-5.96	-0.227***
Inflation	Low	14.60	1.83	-0.64	-6.62	-0.304***
Central Bank Independence	N/A	0.39	0.60	1.59	10.77	-0.265***
Credit to private sector	High	30.79	55.55	1.29	8.23	0.0836*
Credit by financial sector	High	47.78	68.5	0.73	4.37	-0.106**
Financial Freedom	High	52.04	51.43	-0.04	-0.37	-0.181***
Investment Freedom	High	57.47	55.81	-0.12	-0.9	-0.0695
Barro-Lee Education Age 25-29	High	7.16	9.41	0.71	16.92	-0.0821***
Education Gap (Male-Female)	Low	0.78	0.00	-0.67	-7.70	-0.143***
Labor Force Participation Rate	Low	62.35	62.58	0.02	0.55	-0.0573**
Primary School Enrollment Rate	High	93.82	104.44	0.47	5.09	-0.390***
Secondary School Enrollment Rate	High	56.44	84.34	0.89	14.96	-0.133***
Tertiary School Enrollment Rate	High	14.08	42.74	2.54	13.08	0.161*

Notes: This table presents average institution in 1985 (or the earliest available year) and 2015 (or the latest available year), and convergence rate over the three decades. Column (2) reports the development-favored institutions determined by the correlation between institution in 1985 (or the earliest available year) and the GDP per capita in the corresponding year. "N/A" refers to the institutions we do not have sufficient statistical power to sign the direction, where t-stat of δ_{1985} (regressing normalized 1985 institution on Log GDP). Columns (3) and (4) report the raw mean of institutional variables in 1985 (or the earliest available year) and 2015 correspondingly. Columns (5) and (6) report the institutional change normalized by the standard deviation in 1985 and corresponding t-statistics. Column (7) is the institutional convergence β by regressing the decade-average institutional change from 1985 (or the earliest available year) to 2015 on the institution in 1985.

Table 4: Institution-Income and Institution-Growth Relationship

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Institution	1985 δ	1985 λ	1985 Obs	2005 δ	2005 λ	2005 Obs
Polity 2 Score	0.39***	0.98***	119	0.18***	0.09	117
Freedom House Political Rights	0.4***	1.29***	135	0.28***	0	134
Freedom House Civil Liberty	0.41***	1.09***	135	0.28***	-0.18	134
Media Freedom Score	0.4***	0.01	158	0.35***	-0.39**	156
WGI Political Stability	0.4***	0.26	175	0.41***	-0.01	172
WGI Rule of Law	0.49***	-0.22	182	0.5***	-0.25	179
WGI Government Effective	0.51***	0.12	170	0.53***	0.18	167
WGI Regulatory Quality	0.51***	-0.26	171	0.52***	-0.15	168
WGI Control of Corruption	0.5***	-0.16	173	0.52***	-0.23	170
Overall economic freedom index	0.42***	-0.51*	98	0.35***	-0.23	94
Government Integrity	0.49***	-0.09	98	0.44***	-0.07	94
Business Freedom	0.46***	0.01	98	0.38***	$-0.47^{\#}$	94
Property Rights	0.48***	-0.09	98	0.59***	-0.12	94
Taxes on income & capital gain	0.2***	-0.49*	68	0.23***	0.02	60
Taxes on goods and services	-0.08	0.03	68	0	3.27	58
Tax Burden Score	0	$-0.30^{\#}$	98	-0.14***	0.12	94
Equal-weighted Tariff	-0.41***	0.1	56	-0.23***	-0.83	55
Value-weighted Tariff	-0.41***	0.22	56	-0.21***	-1.24*	55
Private Investment	0.17***	0.22	131	0.18***	0.04	130
Government Spending (% GDP)	0.17***	-0.36	119	0.17***	-0.04	116
Military Expenditure (%GDP)	0.06	0.14	106	0.03	-0.27	105
Inflation	-0.11**	0.04	146	-0.04**	-0.43	144
Central Bank Independence	0	-0.45*	102	0.28***	-0.02	101
Credit to private sector	0.4***	0.76**	111	0.78***	0.19#	110
Credit by financial sector	0.2***	$0.35^{\#}$	109	0.48***	0.21	108
Financial Freedom	0.38***	-0.09	98	0.39***	-0.14	94
Investment Freedom	0.31***	0.24	98	0.39***	0.06	94
Barro-Lee Education Age 25-29	0.48***	$0.67^{\#}$	116	0.48***	0.85***	115
Education Gap (Male-Female)	-0.31***	-0.59*	116	-0.33***	-0.5**	115
Labor Force Participation Rate	-0.25***	-0.38	154	-0.2***	0.2	153
Primary School Enrollment Rate	0.25***	0.5*	122	0.03	0.63*	104
Secondary School Enrollment Rate	0.51***	1.09**	105	0.54***	0.54	83
Tertiary School Enrollment Rate	0.42***	-0.06	95	1.05***	0.09	67

Notes: This table reports the marginal institutional contribution in growth and institution-income cross-section relationship 1985 (or the earliest available year) to 2005 (or the latest available year). The coefficients δ and λ are estimated from the following regressions:

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

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

Columns (2) and (5) report the cross-section relationship δ estimated estimated in 1985 and 2005. Columns (3) and (6) report institutional marginal effect in GDP growth in the next decade, 1985-1995 and 2005-2015. Columns (4) and (7) reports the number of observations in both specifications respectively. The sample only includes countries with non-missing institutional variables in 1985. $\#p < 0.2$ * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Table 5: Absolute and Conditional Convergence from 1985 to 2005 - Selected Institutions

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP Growth					
	1985-1995		1995-2005		2005-2015	
Log(GDP)	0.310	-1.266**	0.0471	-0.228	-0.321*	-0.823*
	(1.51)	(-3.03)	(0.37)	(-0.91)	(-2.37)	(-2.61)
Polity 2 Score		-0.942		-0.497		0.291
		(-1.32)		(-1.08)		(0.51)
FH Civil Liberties		-0.986		-0.112		-1.244
		(-1.31)		(-0.19)		(-1.50)
FH Political Rights		2.378**		0.604		0.763
		(2.69)		(1.08)		(1.12)
Private Investment		-0.128		-0.363		0.0995
		(-0.39)		(-1.42)		(0.30)
Government spending		0.0034		-0.401		-0.293
		(0.01)		(-1.45)		(-0.77)
Inflation		0.068		0.237		-1.198
		(0.27)		(0.93)		(-1.13)
Credit to private sector		1.247*		0.535		0.213
		(2.19)		(1.59)		(0.53)
Credit by financial sector		-0.863		-0.514		-0.413
		(-1.46)		(-1.17)		(-0.85)
Barro-Lee Education 25-29		1.498**		0.487		1.047*
		(2.82)		(1.19)		(2.57)
Education Gender Gap		-0.649*		-0.019		-0.241
		(-2.03)		(-0.07)		(-0.74)
Constant	-1.105	4.947	1.414	2.912	4.861***	8.906***
	(-0.66)	(1.63)	(1.36)	(1.49)	(4.27)	(3.66)
N	72	72	72	72	72	72

Notes: This table reports the regressions with full institutional variables that allow a decent sample size of 72 in 1985. The institutional co-variates include 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. Columns (1), (3) and (5) report absolute convergence regressions for decades 1985-1995, 1995-2005, and 2005-2015. Columns (2), (4) and (6) report conditional convergence regressions correspondingly. t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Absolute Convergence Decomposition from 1985 to 2005 - Uni-variate Approach

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Institution	Baseline Year	$\Delta\beta$	$\beta - \beta^*$ (1985)	$\beta - \beta^*$ (2005)	$\frac{\Delta\beta^*}{\Delta\beta}$	δ-Change $(\frac{\lambda\Delta\delta}{\Delta\beta})$	λ-Change $(\frac{\delta\Delta\lambda}{\Delta\beta})$
Polity 2 Score	1985	-0.77%	0.383	0.017	52.55%	2.56%	20.52%
Freedom House Political Rights	1985	-0.79%	0.51	0	35.03%	-0.02%	46.4%
Freedom House Civil Liberty	1985	-0.79%	0.45	-0.05	36.24%	-3%	45.34%
Credit to private sector	1985	-0.62%	0.312	0.133	71%	-10.49%	75.1%
Barro-Lee Education Age 25-29	1985	-0.87%	0.325	0.316	99.07%	-0.2%	1.13%
Education Gap (Male-Female)	1985	-0.87%	0.18	0.166	98.42%	-0.69%	2.36%
Secondary School Enrollment	1985	-0.77%	0.535	0.414	84.23%	-2.6%	22.74%
Average	N/A	-0.78%	0.385%	0.142%	68.08%	-2.06%	30.51%

Notes: This table reports the decomposition of absolute convergence from 1985 (or the earliest available year) to 2005 into three components: conditional convergence, change in GDP-Institution relation, change in marginal effect of an institution in growth:

$$\underbrace{\Delta_{1985\longrightarrow 2005}\beta}_{\text{Column (3)}} = \underbrace{\Delta_{1985\longrightarrow 2005}\beta^*}_{\text{Column (6)}} + \underbrace{\delta_{1985}\Delta_{1985\longrightarrow 2005}\lambda}_{\text{Column (7)}} + \underbrace{\lambda_{1985}\Delta_{1985\longrightarrow 2005}\delta}_{Column(8)} + \Delta_{1985\longrightarrow 2005}\lambda\Delta_{1985\longrightarrow 2005}\delta$$

The coefficients are estimated from the following regressions:

$$\Delta log(GDP_{i,t}) = \beta_t log(GDP_{i,t}) + \mu_t + \epsilon_{i,t}$$

$$\Delta log(GDP_{i,t}) = \beta_t^* log(GDP_{i,t}) + \lambda_t Inst_{i,t} + \alpha_t + \epsilon_{i,t}$$

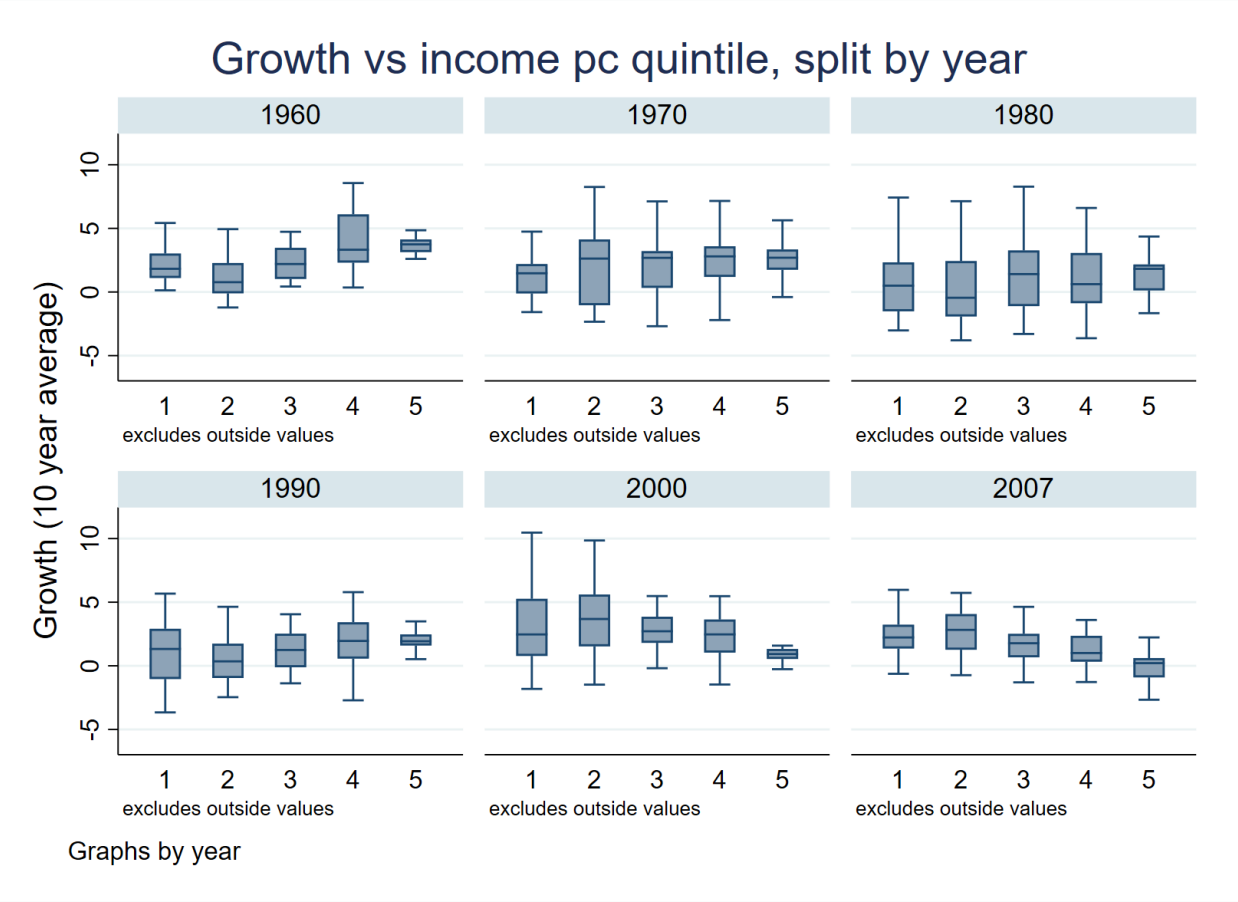
$$Inst_{i,t} = \delta_t log(GDP_{i,t}) + \nu_t + \epsilon_{i,t}$$

Column (2) reports the baseline year of absolute convergence β. Column (3) reports the change in β from the baseline year to 2005. Columns (4) and (5) report convergence coefficient differences: absolute minus conditional convergence, for decades 1985-1995 and 2005-2015. Columns (6), (7), and (8) report the percentage contribution to the change in absolute convergence $\Delta\beta$ (reported in Column (3)). Seven institutions are included in this table if and only if$\beta - \beta^*$ is above 0.15 (explain the convergence rate gap in 1985).

A For Online Publication: Appendix figures and tables

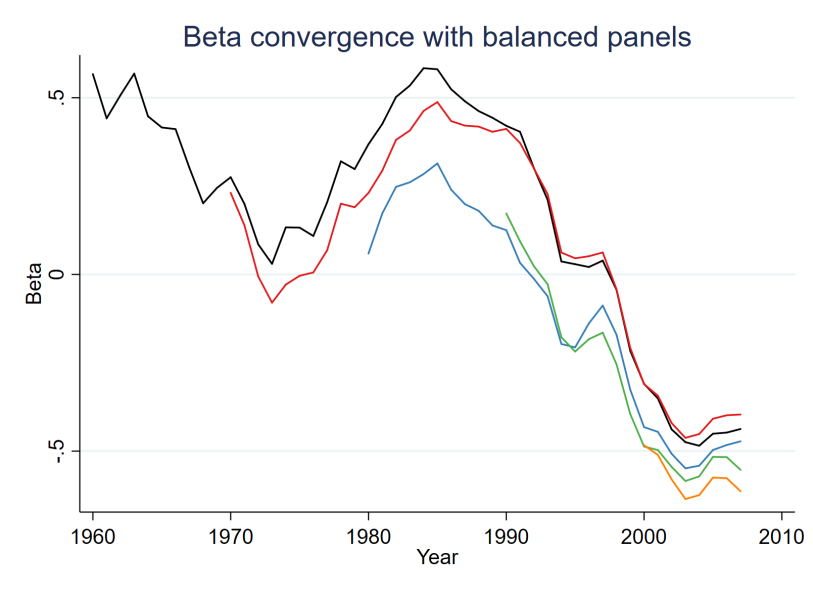
A.1 Income

Figure A.1: Boxplot of growth vs. country quintile, split by decade.

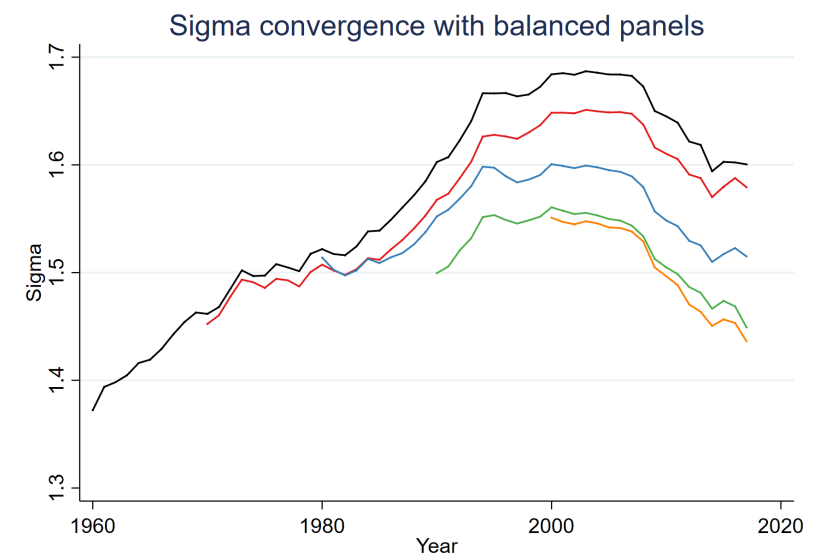


Notes: These are boxplots of country's average growth in GDP per capita for a decade. Each facet shows one decade. Within a facet, the plot shows how decade average growth varied by quintile of baseline GDP per capita. The top of the box is the 75th percentile of average growth in that quintile, the center is the median (teh 50th percentile), and the bottom is the 25th percentile. The whiskers represent the corresponding maximum and minimum. The last decade starts in 2007, since our data runs to 2017.

Figure A.2: Robustness of convergence coefficients to balanced panel.



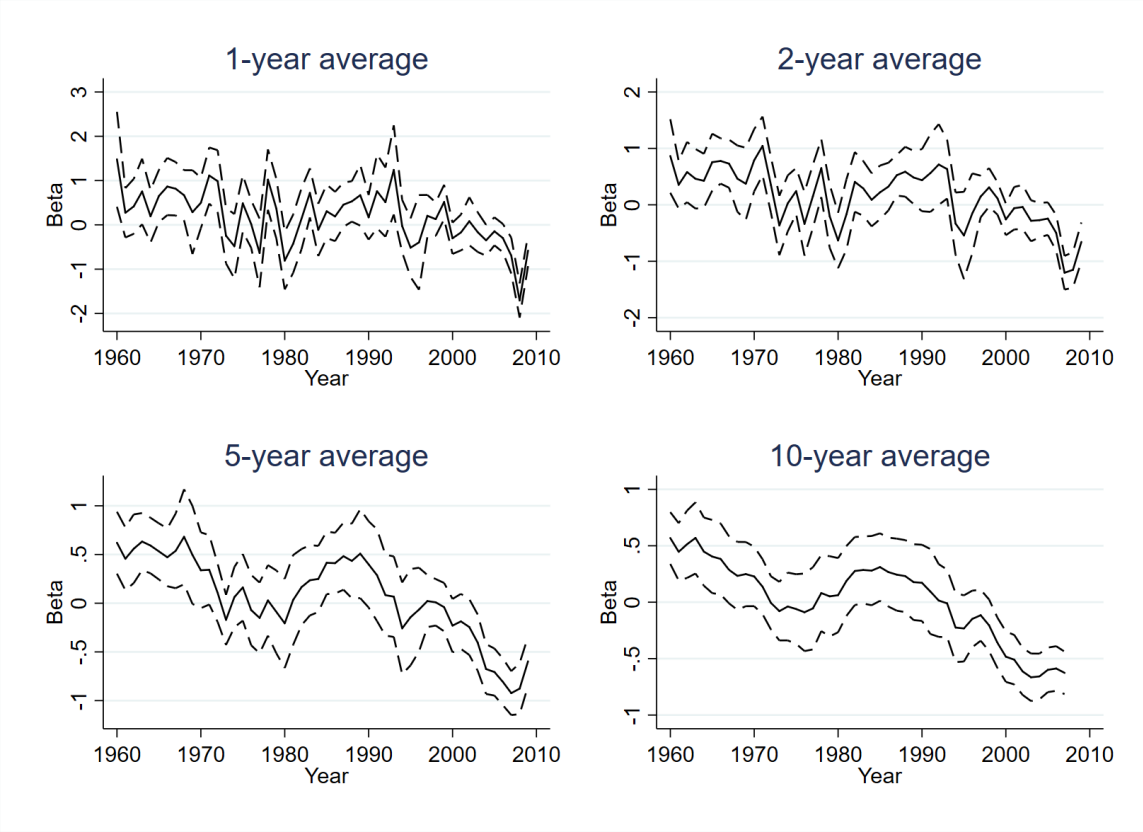
(a) Robustness of $\beta-$convergence.



(b) Robustness of $\sigma-$convergence.

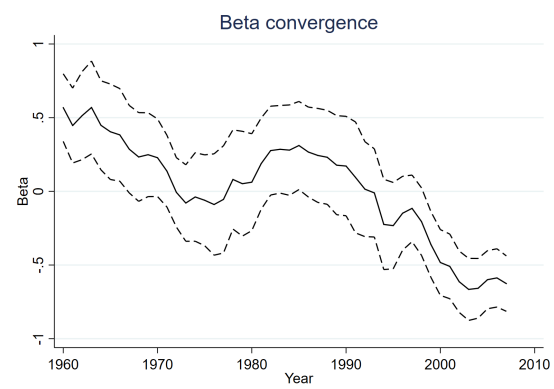
Notes: This figure shows robustness of the convergence coefficients to using balanced panels. Since countries are joining our dataset over time, we plot 5 different curves, one starting at the beginning of each decade. A given decades curve shows the evolution of the convergence coefficients going forward from the start of that decade, based upon the constant set of countries who were in the dataset at the start of that decade.

Figure A.3: Robustness of $\beta-$convergence coefficient to averaging period.

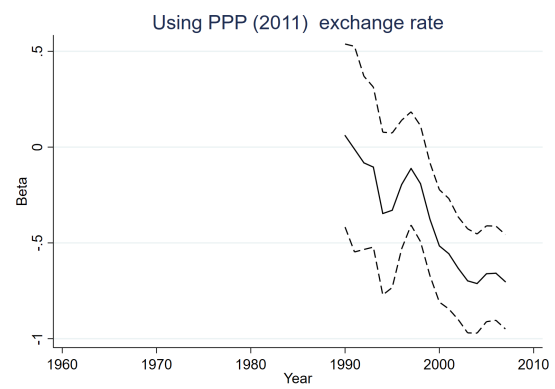


Notes: This figure shows robustness to the averaging period used for β-convergence. In particular, the plots show the β-convergence coefficients using subsequent 1, 2, 5, and 10 year average growth rates.

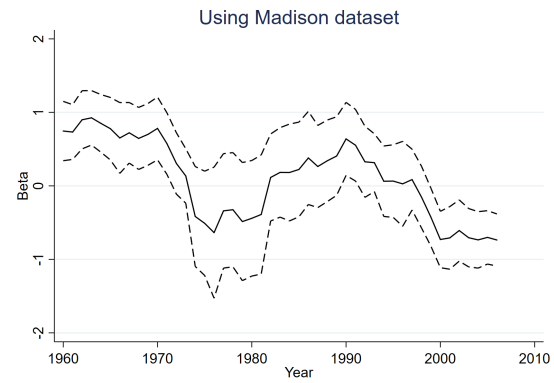
Figure A.4: Robustness of $\beta-$convergence coefficient to changing the measure of GDP per capita



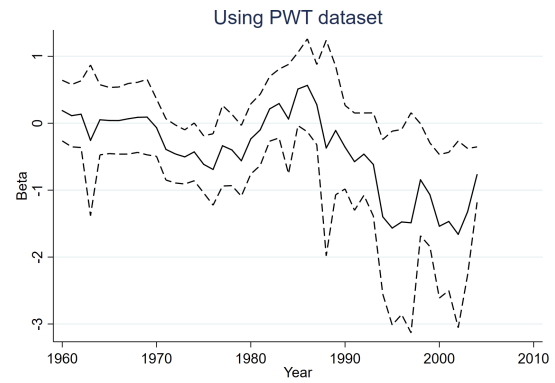
(a) Main specification.



(b) Using Purchasing Power Parity exchange rate.



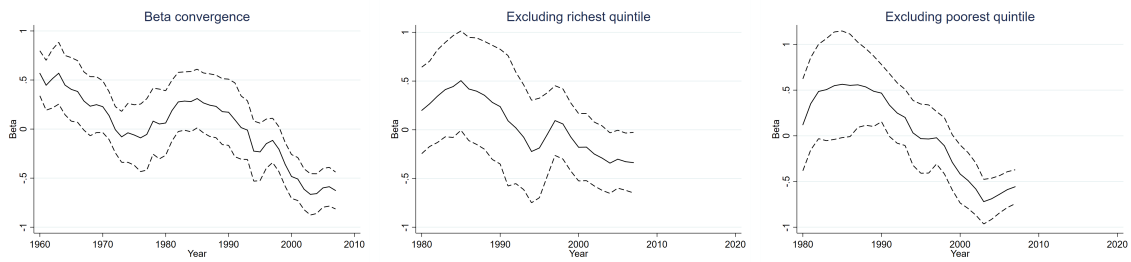
(c) Using the Maddison dataset.



(d) Using the Penn World Tables. (TO CHECK)

Notes: These graphs show robustness of the β-convergence plot to natural changes in the measure of GDP per capita used. a) is the original, main specification. b) Uses a Purchasing Power Parity exchange rate, in 2011 international dollars. The data is only available starting 1990. c) Uses the Maddison Project data. d) Uses Penn World Table data.

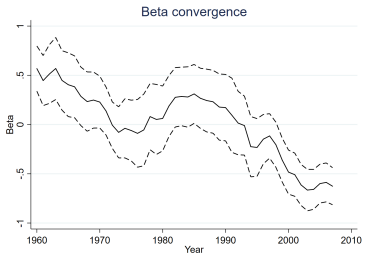
Figure A.5: Catch-up of the poor or slow-down of the rich? $\beta-$convergence coefficients when excluding countries in top and bottom quintiles of per capita income.



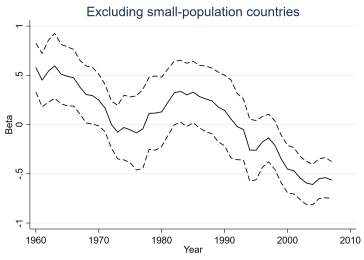
(a) Main specification. (b) Excluding richest quintile. (c) Excluding poorest quintile.

Notes: This figure checks the sensitivity to the richest and poorest countries. Panel (a) is the main specification. Panel (b) is the absolute convergence β after excluding countries in the richest quintile. Panel (c) is the absolute convergence β after excluding countries in the poorest quintile.

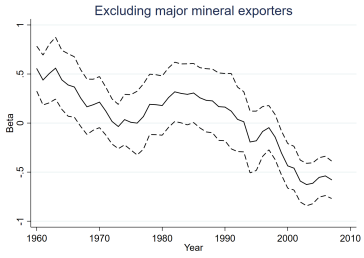
Figure A.6: Robustness of $\beta-$convergence coefficient to excluding small countries and major mineral exporters.



(a) Main specification.



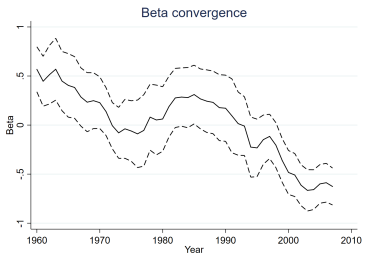
(b) Excluding small population countries.



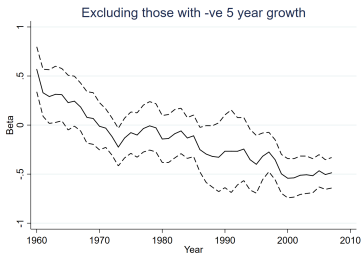
(c) Excluding major mineral exporters.

Notes: These graphs show robustness of the β-convergence plot to natural changes in the set of countries. a) is the original, main specification. b) Excludes countries for whom exports of minerals accounted for $> 20\%$ of their GDP in 2010. c) Excludes countries whose population was less than 500,000 in 2010.

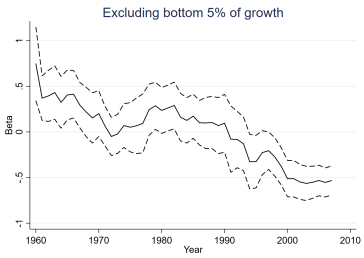
Figure A.7: Disasters, growth miracles, and stagnation. $\beta-$convergence coefficients when excluding outlying growth rates.



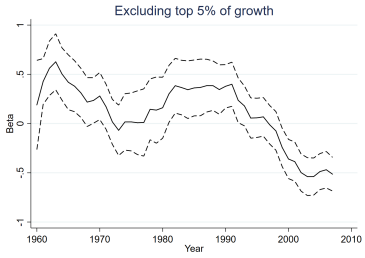
(a) Baseline specification.



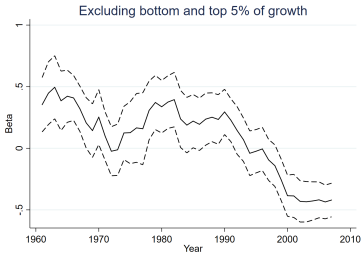
(b) Excluding countries with negative average growth.



(c) Excluding bottom 5% of growth.



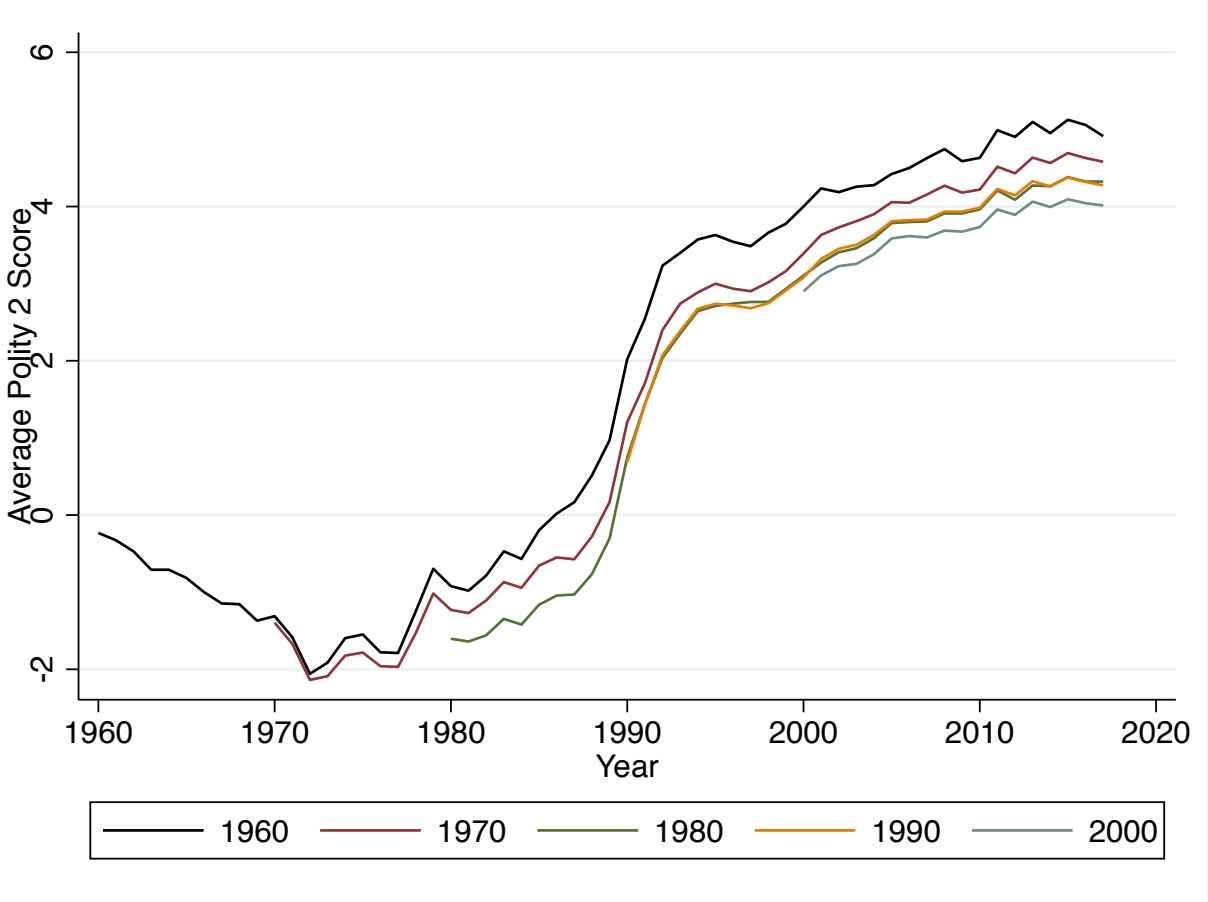
(d) Excluding top 5% of growth.



(e) Excluding bottom and top 5% of growth.

Notes: This figure verifies the declining absolute convergence β. Panel (a) is the baseline specification; Panel (b) excludes countries with negative growth in the coming decade; Panel (c) excludes bottom 5% of countries with the lowest growth; Panel (d) excludes top 5% of countries with the highest growth; Panel (e) winsorizes both top 5% and bottom 5% of countries.

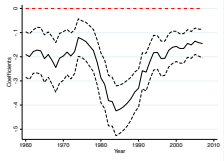
Figure A.8: Polity 2 score with fixed country samples



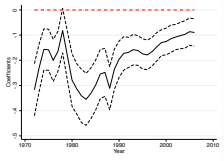
Notes: Average Polity 2 score with the country samples available in 1960, 1970, 1980, 1990, and 2000.

Figure A.9: Convergence in Political Institutions

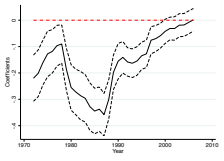
Panel A: Beta-Convergence



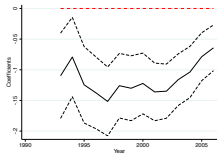
Panel A1: Polity 2



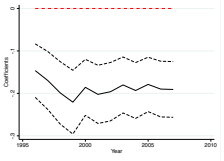
Panel B1: Political Rights



Panel C1: Civil Liberty

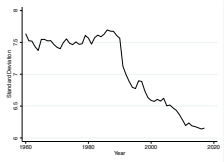


Panel D1: Media Freedom

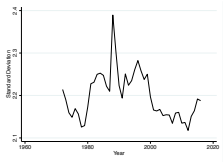


Panel E1: WGI Political Stability

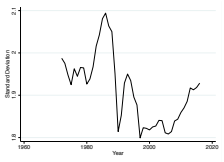
Panel B: Sigma-Convergence



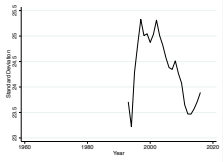
Panel B1: Polity 2



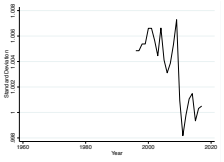
Panel B2: Political Rights



Panel B3: Civil Liberty



Panel B4: Media Freedom

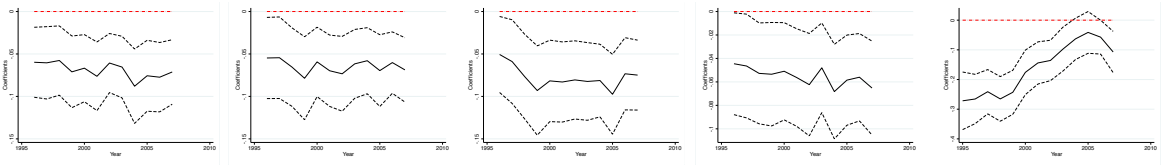


Panel B5: WGI Political Stability

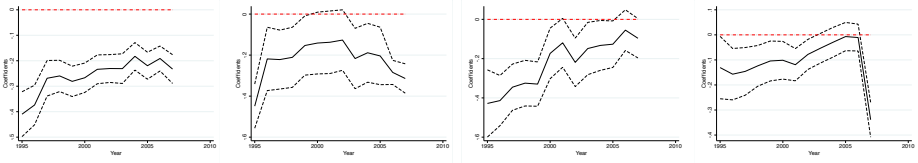
Notes: Political institution measures include Polity 2 score from Center of Systematic Peace (1960-2015), Freedom House political rights score (1973- 2015), Freedom House civil liberty score (1973-2015), Press Freedom score (1995-2015), and WGI political stability. The top panels (A1-A5) report results of Beta convergence. The bottom panels (B1-B5) report results of Sigma convergence.

Figure A.10: Convergence of Governance Quality

Panel A: Beta-Convergence

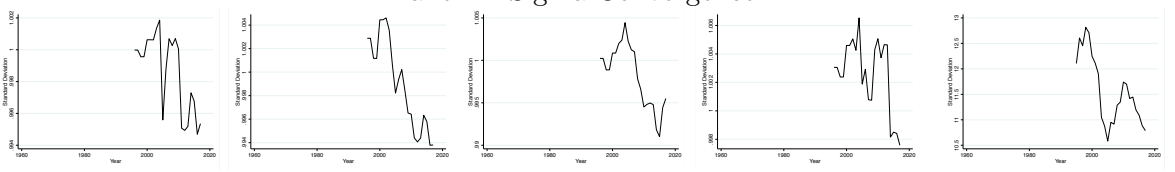


A1: Rule of Law A2: Gov Effectiveness A3: Regulatory Quality A4: Control of Corruption A5:Economic Freedom Score

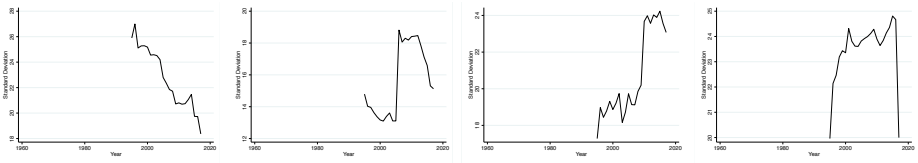


A6: Government Integrity A7: Business Freedom A8: Investment Freedom A9: Property Rights

Panel B: Sigma-Convergence



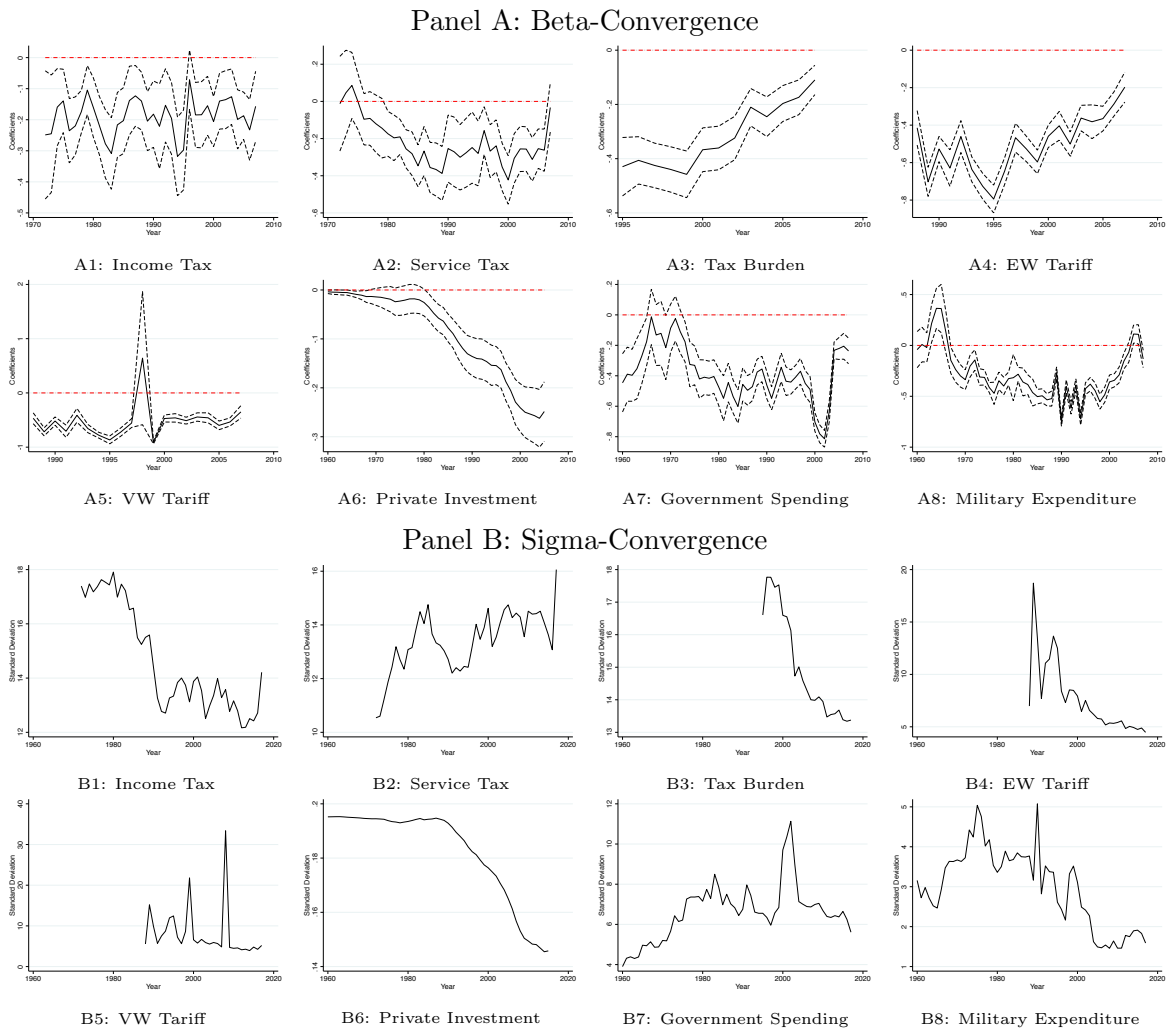
B1: Rule of Law B2: Gov Effectiveness B3: Regulatory Quality B4: Control of Corruption B5: Economic Freedom Score



B6: Government Integrity B7: Business Freedom B8: Investment Freedom B9: Property Rights

Notes: Governance quality measures include rule of law, government effectiveness, regulatory quality, control of corruption, overall economic freedom score, government integrity, business freedom, investment freedom, and property rights. The top panels (A1-A9) report results of Beta convergence. The bottom panels (B1-B9) report results of Sigma convergence.

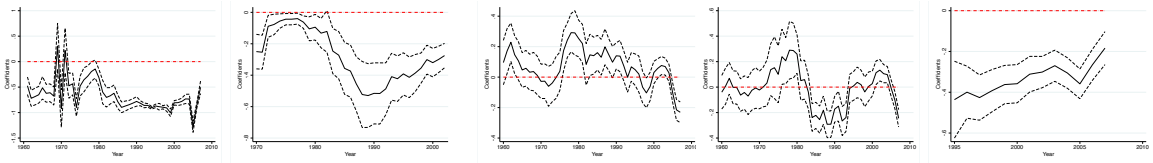
Figure A.11: Convergence in Fiscal Policy



Notes: Fiscal policy measures include tax on income and capital gain (% tax revenue),tax on goods and service (% tax revenue), tax burden score, equal-weighted tariff rate, value-weighted tariff rate, private investment (% total investment), government spending (% GDP), and military expenditure (% GDP). The tax burden is a quadratic decreasing function with of tax as a portion of GDP. See https://www.heritage.org/index/fiscal-freedom for more explanation. The top panels (A1-A8) report results of Beta convergence. The bottom panels (B1-B8) report results of Sigma convergence.

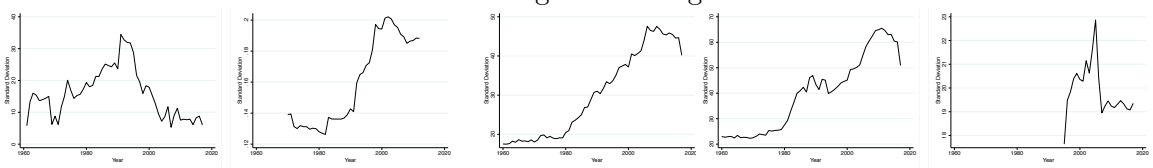
Figure A.12: Convergence in Financial Institution

Panel A: Beta-Convergence



A1: Winsorized Inflation A2: CBI A3: Credit to Private Sector A4: Bank Credit A5: Financial Freedom

Panel B: Sigma-Convergence

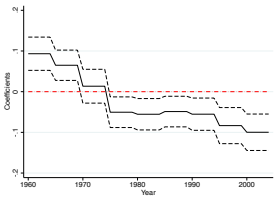


B1: Winsorized Inflation B2: CBI B3: Credit to Private Sector B4: Bank Credit B5: Financial Freedom

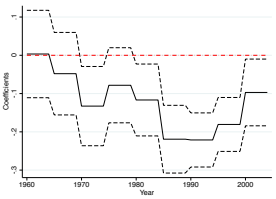
Notes: Financial institution measures include winsorized inflation, central bank independence, credit to private sector, credit by financial sector (bank credit), and financial freedom score. The annual inflation data is winsorized by 100% to reduce the impact of outliers. The top panels (A1-A5) report results of Beta convergence. The bottom panels (B1-B5) report results of Sigma convergence.

Figure A.13: Convergence in Labor

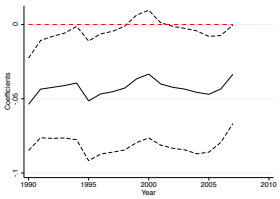
Panel A: Beta-Convergence



A1: Barro-Lee Age 25-29



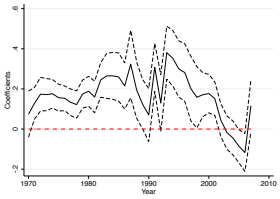
A2: Education Gap by Gender



A3: Labor Participation

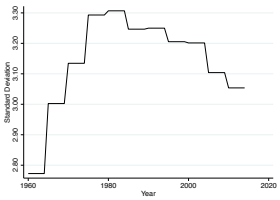
A4: Primary Enrollment

A5: Secondary Enrollment

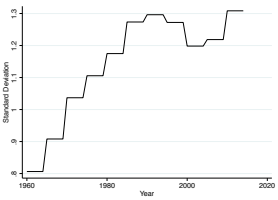


A6: Tertiary Enrollment

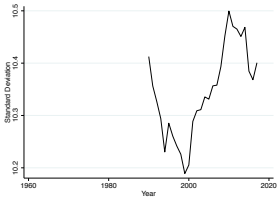
Panel B: Sigma-Convergence



B1: Barro-Lee Age 25-29

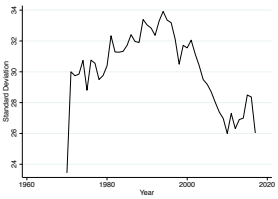


B2: Education Gap by Gender

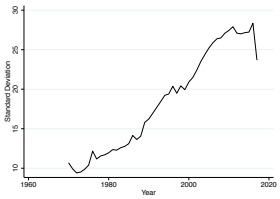


B3: Labor Participation

B4: Primary Enrollment



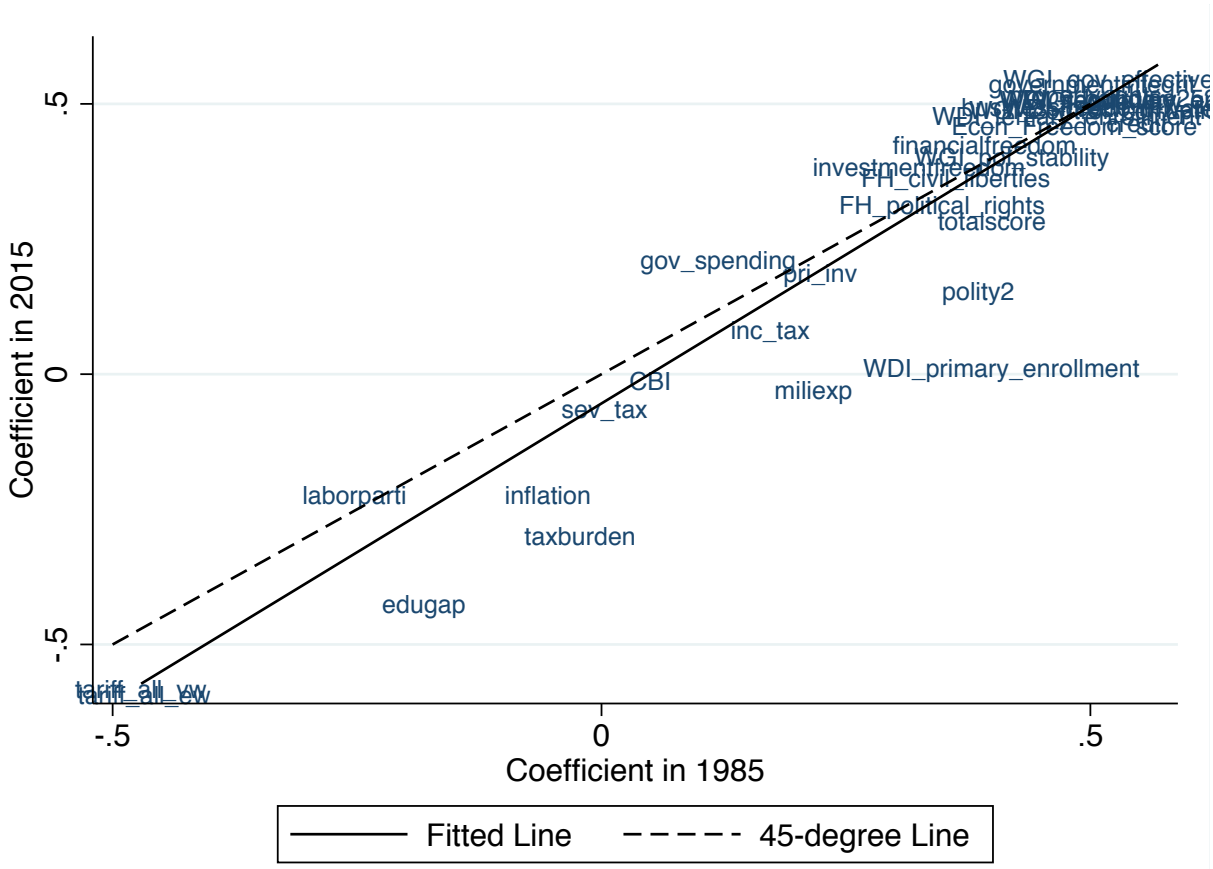
B5: Secondary Enrollment



B6: Tertiary Enrollment

Notes: Labor measures include the quinquennial Barro-Lee educational attainment of Age group 25-29 (1970-2015), gender gap in educational attainment (male minus female), labor force participation rate, primary school enrollment rate, secondary school enrollment rate, tertiary school enrollment rate. The top panels (A1-A6) report results of Beta convergence. The bottom panels (B1-B6) report results of Sigma convergence.

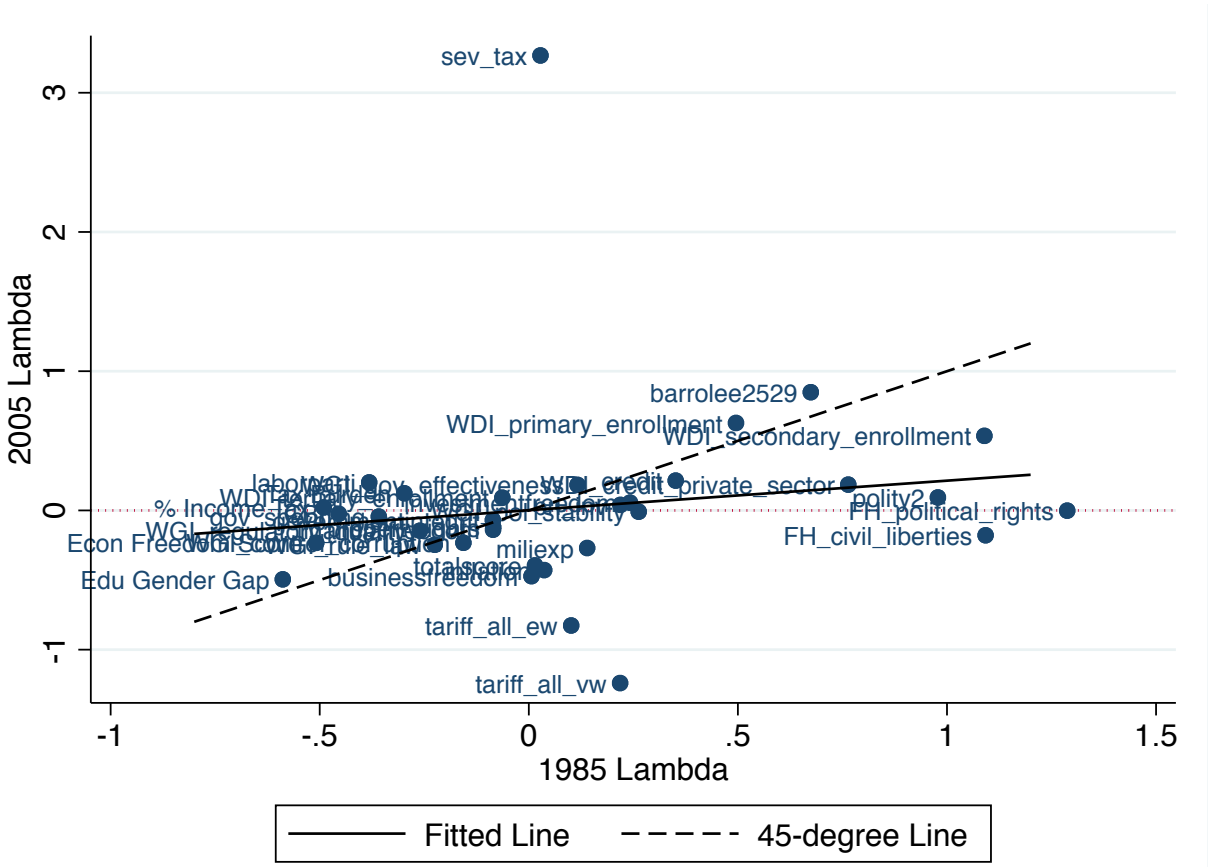
Figure A.14: Institution-Income Relationship Dynamic - Robustness



Notes: This figure plots the coefficient from regressing the normalized institution on the log(GDP) in 1990 and 2010 for all 33 institutions. The solid line is the fitted line of the scatter plot. The dashed line refers to the 45-degree line as a benchmark. R-squared is 92%.

$$\frac{Inst_{i,t}}{SD_t(Inst_t)} = \gamma_t Log(GDP_{i,t}) + \epsilon_{t,i}$$

Figure A.15: Institution-Growth Relationship Dynamic - All 33 Institutions



Notes: This figure plots the λ_{1985} and λ_{2005} for all 33 institutions. 1985λ and 2005λ are estimated from the following regressions with the GDP growth in sample periods 1985-1995 (or the earliest available decade) and 2005-2015, respectively, corresponding to Table 4. The red dotted line is the benchmark that institutions have zero marginal effect on GDP growth conditional on GDP development.

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

Table A.1: Institutional Changes and Convergence from 1990 to 2010

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable	Dev-Favored	1990 Mean	2010 Mean	Change (in σ_{1990})	t-stat	Convergence β
Polity 2 Score	High	0.74	3.99	0.43	7.09	-0.212***
Freedom House Political Rights	High	6.28	6.57	0.13	2.69	-0.123***
Freedom House Civil Liberty	High	6.34	6.68	0.19	4.12	-0.083***
Media Freedom Score	High	52.5	51.16	-0.06	-1.27	-0.097***
WGI Political Stability	High	-0.01	-0.12	-0.12	-2.63	-0.139***
WGI Rule of Law	High	-0.01	-0.05	-0.04	-1.28	-0.061**
WGI Government Effective	High	-0.01	-0.01	0	-0.03	-0.054*
WGI Regulatory Quality	High	-0.02	0	0.02	0.43	-0.072**
WGI Control of Corruption	High	-0.01	-0.05	-0.03	-1.15	-0.035
Overall economic freedom index	High	57.27	60.04	0.27	3.4	-0.139**
Government Integrity	High	38.78	40.46	0.06	0.99	-0.283***
Business Freedom	High	68.01	65.11	-0.2	-2.03	-0.178**
Property Rights	High	55.82	44.9	-0.6	-6.82	-0.078
Taxes on income & capital gain	High	25.58	26.81	0.1	0.95	-0.221***
Taxes on goods and services	N/A	47.64	31.92	-1.27	-0.75	-0.491***
Tax Burden Score	N/A	63.49	74.57	0.77	7.85	-0.346***
Equal-weighted Tariff	Low	11.32	4.37	-0.9	-3.9	-0.445***
Value-weighted Tariff	Low	8.98	3.2	-0.86	-4.52	-0.465***
Private Investment	High	0.62	0.64	0.06	1.3	-0.178***
Government Spending (% GDP)	High	15.91	15.63	-0.05	-0.59	-0.267***
Military Expenditure (%GDP)	N/A	3.79	1.92	-0.74	-4.29	-0.427***
Inflation	N/A	16.63	6.78	-0.53	-5.8	-0.447***
Central Bank Independence	N/A	0.4	0.59	1.42	10.47	-0.326***
Credit to private sector	High	33.73	51.95	0.81	7.11	0.094*
Credit by financial sector	High	48.72	63.14	0.42	3.15	-0.128*
Financial Freedom	High	52.04	51.33	-0.04	-0.43	-0.264***
Investment Freedom	High	57.76	51.63	-0.44	-3.32	-0.141*
Barro-Lee Education Age 25-29	High	7.72	9.41	0.54	13.48	-0.082***
Education Gap (Male-Female)	Low	0.71	0	-0.61	-8.47	-0.143***
Labor Force Participation Rate	Low	62.46	62.49	0	0.07	-0.057**
Primary School Enrollment Rate	High	93.63	104.73	0.52	5.97	-0.390***
Secondary School Enrollment Rate	High	64.66	82.85	0.57	11.87	-0.133***
Tertiary School Enrollment Rate	High	18.28	41.69	1.76	11.75	0.161*

Notes: This table presents average institution in 1990 and 2010, and convergence rate over the two decades. Column (2) reports the development-favored institutions determined by the correlation between institution in 1990 (or the earliest available year) and the GDP per capita in the corresponding year. "N/A" refers to the institutions we do not have sufficient statistical power to sign the direction, where t-stat of δ_{1990} (regressing 1990 institution on Log(GDP) with 10%statistical significance). Columns (3) and (4) report the raw mean of institutional variables in 1990 (or the earliest available year) and 2010 correspondingly. Columns (5) and (6) report the institutional change normalized by the standard deviation in 1990 and corresponding t-statistics. Column (7) is the institutional convergence β by regressing the decade-average institutional change from 1990 (or the earliest available year) to 2010 on the institution in 1990.

Table A.2: Polity 2 Score Change by Decade

Decade	Increase in Polity 2	Decrease in Polity 2	Unchanged Polity 2	Obs
1960-1970	19.4%	30.1%	50.5%	103
1970-1980	23.8%	25.4%	50.8%	122
1980-1990	37.3%	9.7%	53.0%	134
1990-2000	52.9%	10.1%	37.0%	134
2000-2010	31.6%	13.3%	55.1%	158
2010-2015	19.3%	6.8%	73.9%	161

Notes: This table reports the portion of countries with an increase, decrease, and unchanged Polity 2 score for each decade: 1960-1970, 1970-1980, 1980-1990, 1990-2000, 2000-2010, and 2010-2015.

Table A.3: Democratization and Income by Decade

	(1)	(2)	(3)	(4)	(5)	(6)
	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-2015
	Panel A: Dummy {Increase in Polity 2 Score}					
Log(GDP)	-0.403**	0.0575	0.0707	-0.468***	-0.137	-0.0173
	(-2.36)	(0.44)	(0.63)	(-3.99)	(-1.46)	(-0.18)
Obs	91	114	137	169	193	203
	Panel B: Dummy {Decrease in Polity 2 Score}					
Log(GDP)	-0.328*	-0.690***	-0.438*	-0.0895	-0.292*	-0.280
	(-1.68)	(-3.32)	(-1.81)	(-0.47)	(-1.79)	(-1.22)
Obs	68	96	114	127	154	158

Notes: This table reports the logit regressions of dummies of Polity 2 score increase or decrease on log(GDP). The dependent variable in Panel A is the indicator dummy of the increase in Polity 2 score, and the sample excludes the countries with perfect democracy (where the score increase is not possible). The dependent variable in Panel B is the indicator dummy of the decrease in Polity 2 score, and the sample excludes the countries with perfect dictatorship (where the score decrease is not possible).t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.4: Institutional convergence: joint tests

	Chi-squared	P-value	Number of Institutions
		Panel A: 1996-2006	
Political Institution	155.10	1.09×10^{-31}	5
Governance Quality	317.97	0.00	9
Fiscal Policy	460.23	0.00	8
Financial Institution	122.43	9.61×10^{-25}	5
Labor	124.23	2.11×10^{-24}	6
		Panel B: 2006-2016	
Political Institution	98.29	1.21×10^{-19}	5
Governance Quality	207.81	0.00	9
Fiscal Policy	170.41.75	1.06×10^{-32}	8
Financial Institution	698.09	0.00	5
Labor	74.53	4.80×10^{-14}	6

Notes: This table reports the joint significance test for two decades 1996-2006 and 2006-2016. The null hypothesis is that institutional convergence does not exist in all policy variables (all βs are zeros). 1996 is the first year, we have a full data for all institutional variables. Barro-Lee education and private investment are extended to 2016 with the latest value available in our data (2010 and 2014 respectively).

Table A.5: Absolute convergence Decomposition from 1985 to 2015 - Full set of institutions

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP Growth					
	1985-1995		1995-2005		2005-2015	
Log(GDP)	0.143	-1.069*	0.0353	-0.0764	-0.481***	-0.507*
	(0.69)	(-2.49)	(0.28)	(-0.27)	(-3.96)	(-2.15)
Polity 2 Score		-0.0425		-0.304		1.063*
		(-0.05)		(-0.61)		(2.37)
FH Political Rights		0.743		0.738		0.0151
		(0.68)		(1.21)		(0.03)
FH Civil Liberty		-0.0842		0.121		-0.254
		(-0.10)		(0.15)		(-0.38)
Private Investment		-0.117		0.0162		0.496
		(-0.33)		(0.05)		(1.76)
Government Spending		-0.784		-0.433		-0.782*
		(-1.68)		(-1.20)		(-2.65)
Military Expenditure		1.458*		0.526		1.102*
		(2.69)		(0.88)		(2.12)
Inflation		-0.200		0.0891		0.496
		(-0.72)		(0.30)		(0.61)
Central Bank Independence		-0.786*		-0.185		-0.128
		(-2.57)		(-1.00)		(-0.92)
Credit to private sector		0.660		0.416		-0.376
		(1.16)		(1.00)		(-1.29)
Credit by financial sector		-0.640		-0.682		0.0820
		(-1.05)		(-1.31)		(0.24)
Barro-Lee Education 25-29		1.053		0.117		1.110***
		(1.98)		(0.29)		(3.93)
Education Gap		-0.700		0.124		0.596*
		(-2.01)		(0.40)		(2.33)
Constant	0.425	9.623*	1.570	0.865	6.226***	3.858
	(0.25)	(2.70)	(1.48)	(0.34)	(5.93)	(1.84)
N	56	56	53	53	56	56

t statistics in parentheses

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

Notes: This table reports the absolute convergence and conditional convergence with full set of institutional variables in the periods 1985-1995, 1995-2005, and 2005-2015. The country sample is fixed in 1985. Columns (1), (3) and (5) report the absolute convergence β, and Columns (2), (4), and (6) report the conditional convergence β.

Table A.6: Absolute and Conditional Convergence from 1985 to 2005 - Short-listed Institutions

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP Growth					
	1985-1995		1995-2005		2005-2015	
Log(GDP)	0.269	-0.973**	0.00203	-0.524*	-0.376**	-0.915***
	(1.34)	(-3.16)	(0.01)	(-2.00)	(-2.90)	(-3.54)
Polity 2 Score	-0.838		-0.644		-0.0579	
		(-1.29)		(-1.33)		(-0.11)
Freedom House Political Rights		1.645*		0.614		0.200
		(2.23)		(1.31)		(0.41)
Barro-Lee Education 25-29		1.286**		0.630		0.993*
		(2.66)		(1.37)		(2.45)
Credit to private sector		0.677*		0.251		-0.00709
		(2.27)		(1.43)		(-0.04)
Constant	-1.019	0.894	1.748	2.655	5.348***	6.689***
	(-0.63)	(0.38)	(1.50)	(1.65)	(4.95)	(4.39)
N	85	85	84	84	84	84

Notes: This table reports the regressions with selected institutional co-variates: polity2 score, Freedom House political rights, credit by financial sector, and Barro-lee education attainment. Columns (1), (3) and (5) report absolute convergence regressions for decades 1985-1995, 1995-2005, and 2005-2015. Columns (2), (4) and (6) report conditional convergence regressions correspondingly. t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$