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ECONOMIC GROWTH AND CONVERGENCE, APPLIED ESPECIALLY TO CHINA

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ABSTRACT

From the perspective of conditional convergence, China's GDP growth rate since 1990 has been surprisingly high. However, China cannot deviate forever from the global historical experience, and the per capita growth rate is likely to fall soon from around 8% per year to a range of 3 4%. China can be viewed as a middle-income convergence-success story, grouped with Costa Rica, Indonesia, Peru, Thailand, and Uruguay. Upper-income convergence successes comprise Chile, Hong Kong, Ireland, Malaysia, Poland, Singapore, South Korea, and Taiwan. China's transition from middle- to upper-income status should not be hindered by a middle-income trap, which seems not to exist. The cross-country dispersion of the log of per capita GDP shows no trend since 1870 for 25 countries with long-term data. This group excludes emerging-market countries such as China and India. For 34 countries with data since 1896, there is clear evidence of declining dispersion starting around 1980. This pattern reflects especially the incorporation of China and India into the world market economy.

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My main goal is to assess China's past and prospective economic growth. Appraising a single country in isolation is not possible, and I therefore position China within the context of growth experienced by a large number of countries over long periods. More specifically, I use the well-known framework of conditional convergence applied empirically in the form of cross-country growth regressions.[1]

I. Conditional Convergence and Cross-Country Growth Regressions

My empirical analysis of the determinants of economic growth relies on two data sets. The first applies to 89 countries observed from 1960 to 2010. An important feature of these data is the availability of information not only on real per capita GDP but also on a broad array of explanatory variables—called "X variables"—that help to predict economic growth.

The second data set applies over a much longer period, 1870-2010. For this purpose, I use the long-term data on real per capita GDP constructed recently by Jose Ursúa.[2] These data are particularly useful for the estimation of convergence effects. Specifically, well-known econometric problems[3] in estimating coefficients of lagged dependent variables (central to the gauging of convergence rates) are eased in the presence of long time series. Moreover, it turns out that the 140 years of the second data set is long in this context, whereas the 50 years of the first data set is still too short. Disadvantages of the second data set are the much smaller number of countries with long-term data on real per capita GDP—28 in my context—compared to the 89 in the first data set. In addition, many fewer X variables are available over the long term, even for the countries with information on GDP.

[1]This approach began with Barro (1991).
[2]See Ursúa (2011). These data, available on my website at Harvard University, cover 42 countries with annual data on real per capita GDP starting at least by 1913.
[3]See Hurwicz (1950) and Nickell (1981).

Table 1 reports the basic regression results for the two data sets. Column 1 (which comes from Barro [2015, Table 1, column 3]) is for 89 countries observed over five-year intervals from 1960 to 2010. The dependent variable is the growth rate per year of real per capita GDP.[4] The right-hand side variables include the five-year lag of the log of real per capita GDP. The estimated coefficient of this variable gives the conditional convergence rate—for example, the value -0.017 shown in column 1 of the table implies a conditional convergence rate of 1.7% per year. The conditioning variables (X variables) in this specification are for life expectancy at birth, total fertility rate, indicators of law and order (rule of law) and democracy, ratios to GDP of investment and government consumption, female and male average years of school attainment, the openness ratio (exports plus imports relative to GDP), a measure of changes in the terms-of-trade, and the inflation rate.

The estimation in column 1 uses ordinary least squares and excludes country fixed effects (but has different constant terms for each time period). Barro (2015, section 4) argues that the exclusion of country fixed effects is important for minimizing bias of the Hurwicz (1950)-Nickell (1981) type in the estimated coefficient of the lagged dependent variable. With country fixed effects excluded, the inclusion of the array of X variables is crucial for minimizing omitted-variables bias. The main results, especially for the conditional-convergence rate, are robust to estimating by two-stage least-squares (with lagged values of the X variables used as instruments) and to changes in the list of X variables.

A principal finding in Table 1, column 1, is that the estimated convergence coefficient, -0.0170 (s.e.=0.0021), is significantly negative and indicates convergence at close to the "iron-law" rate of 2% per year. If the other explanatory variables were unchanging, the

[4]For some purposes, it might be better to measure growth per worker rather than per person. However, estimates of work force and employment are subject to large measurement errors in developing countries.

convergence of real per capita GDP would be toward a level implied by the long-run values of the other explanatory variables (adjusted for a worldwide trend).

The other results indicate significantly positive effects on growth (given initial per capita GDP) from initial life expectancy, the law-and-order (rule-of-law) indicator, the investment ratio, international openness, and improvements in the terms of trade. Negative effects relate to the initial fertility rate and the inflation rate. The estimated impact of the democracy indicator is non-linear; positive at low values but eventually becoming negative. The relation with initial years of schooling is surprisingly weak, perhaps because the variable measures years of education rather than the quality of this education. In general, the results for a particular X variable tend to be sensitive to changes in the list of independent variables. However, the general pattern that emerges robustly is a positive impact on growth from changes that can be construed as favorable for the workings of private markets or for productivity.[5]

Table 1, column 2 (which comes from Barro [2015, Table 5, column 4]), shows the results for the long-term panel of 28 countries from 1870 to 2010. Because few X variables are available, the omitted-variables problem would seriously impact the estimation of the coefficient of the lagged dependent variable if country fixed effects were excluded. Fortunately, the inclusion of these effects does not produce a large bias of the Hurwicz (1950)-Nickell (1981) variety when the sample length is 140 years. The main result in column 2 is the estimated coefficient on the lagged dependent variable of -0.0262 (s.e.=0.0041). That is, conditional convergence appears at 2.6% per year.

[5]The results do not depend much on the observation interval, taken to be five years in Table 1. The main findings, particularly on the conditional convergence rate, are similar with the variables observed at ten- or one-year intervals. However, an annual regression is problematic because many of the right-hand-side variables are not really observed at an annual frequency.

Barro (2015, section 6) argues that the true coefficient on the lagged dependent variable is likely bracketed by the value -0.017 in column 1 (1960-2010) and -0.026 in column 2 (1870-2010). The reasoning is that the column-1 estimate likely reflects some remaining omitted-variables bias (which tends to lower the magnitude of the estimated coefficient), whereas the column-2 estimate likely retains some Hurwicz-Nickell bias (which tends to raise the magnitude of the estimated coefficient). The iron-law convergence rate of 2% per year falls into the interval between the two point estimates.

II. Applying the Global History to China's Economic Growth

Table 3 uses the results from Table 1, column 1, to assess actual and model-estimated economic growth for China from 1960 to 2010. In the early parts of the sample, the actual growth rate of real per capita GDP was well below the model-implied value. That is, convergence was occurring at a rate well below the typical cross-country experience. To put it another way, because China was so poor in this period, economic growth should have been more rapid, even after taking into account the generally unfavorable nature of the X variables.

In contrast, Table 3 shows that the Chinese growth rate tended to exceed the model-implied value since 1990—the residual is substantially positive in three of the last four five-year periods. Notably, for 2005-2010, the actual per capita growth rate of 8.9% per year was sharply above the fitted value of 4.2%. In other words, if one takes the measured GDP numbers at face value, China has been converging over the last two decades toward middle- and upper-income status at a rate far greater than anticipated from the global historical experience (given the values of China's X variables).

Of course, it would be great to attenuate the residuals shown in Table 3 by incorporating more explanatory variables, some possibly specific to China. One idea, possibly not already

fully reflected in the X variables included in the panel regression, is that China was largely closed to private enterprise and international markets in the early part of the sample, especially until around 1980, and then became much more pro-market (or capitalist?). The challenge would be to model these forces in a consistent way across countries and over time. That is, the suggested route amounts to measuring additional X variables and incorporating them into the regression system. I readily agree that other researchers may do better in this respect that the panel regression reported in Table 1, column 1.

It is also possible to use the results from Table 1, column 1, to project China's economic growth into the future. For this purpose, I use the values of China's explanatory variables for the most recent year available.[6] The result is a projected per capita growth rate as of 2015 by 3.5% per year (with subsequent growth rates declining in accordance with a typical convergence process). This projection is sharply below official five-year forecasts of real GDP growth of around 6-7% per year (which should be adjusted downward by about 0.5% per year to account for population growth). Of course, consistent with the model's under-estimation of Chinese economic growth in the 2000s (as shown in Table 3), the model may be under-predicting growth from 2015 on. But it is unlikely that China's growth rate can deviate in the long run from the results predicted by international experience within a conditional-convergence framework. In particular, it is not possible for China's per capita GDP growth rate to exceed 6% per year in the long run.

[6]Values for 2014 were real per capita GDP of 12609 (2011 international dollars), life expectancy at birth of 75.4 years (for 2013), total fertility rate of 1.7 (for 2013), law-and-order (rule-of-law) indicator of 0.58 (0-1 scale), political rights indicator of 0 (0-1 scale), investment ratio of 0.37, government consumption ratio of 0.15, openness ratio of 0.42, years of female schooling of 8.2, years of male schooling of 9.2, inflation rate of 0.020 per year. The future change in the terms of trade was assumed to be zero.

III. Convergence Success Stories across the World

China through 2014 can be viewed as a convergence success story, in the sense that the strong economic growth over a sustained period led to a level of real per capita GDP that can be characterized as middle income. To put the Chinese accomplishment into international perspective, I calculated all the convergence success stories in the world based on reasonable, though somewhat arbitrary, criteria. Specifically, I propose that one criterion for a convergence success is a doubling or more of real per capita GDP from 1990 to 2014 (implying average per capita growth by at least 2.9% per year). Secondly, I define a middle-income success as attainment of a level of real per capita GDP in 2014 of at least $10000 (on a purchasing-power-parity basis in 2011 international dollars[7]). An upper-income success requires a level of real per capita GDP in 2014 at least twice as high; that is, at least $20000.

Table 4 shows the cases of middle- and upper-income successes. Aside from China, the middle-income successes comprise Indonesia, Peru, Thailand, and Uruguay. (Uruguay was a surprise; a possible explanation is the extensive migration of high human-capital people away from Argentina, which has been following strikingly anti-market policies.) One additional country that almost made this list is Costa Rica (average per capita growth rate since 1990 of 2.8% per year).

The upper-income successes comprise seven economies: Chile, Ireland, Malaysia, Poland, Singapore, South Korea, and Taiwan. Hong Kong almost made this list (average per capita growth rate since 1990 of 2.8% per year). Some of these upper-income successes—Singapore, Hong Kong, and Ireland—are now among the world's richest economies.

One way to think about convergence is to ask what characteristics of economies underlie the attainment of middle- or upper-income convergence success. For example, for China, one

[7]The data for 2014 are from World Bank, *World Development Indicators*.

might emphasize the opening up to international markets and capitalism in the 1980s. For India (not yet rich enough to make the middle-income list in Table 4), one might focus on the partial relaxation of socialistic restraints and other governmental regulations since the mid-1980s. However, this approach does not really differ from the one pursued in the form of cross-country growth regressions in Table 1, column 1. The only difference is that some basic changes in country institutions can, perhaps, be identified qualitatively but cannot be quantified in the form of X variables that apply across countries and over time.

A view that seems to have gained popularity recently at the World Bank and elsewhere is the "middle-income trap." For a survey and a largely skeptical analysis of this phenomenon, see Bulman, Eden, and Nguyen (2014). According to the trap hypothesis, the successful transition from low- to middle-income status is often followed by barriers that impede a further transition to upper income.

My view is that this idea is a myth. Moving from low- to middle income-income status, as for the middle-income success stories in the upper part of Table 4, is challenging. In particular, according to the criteria applied in the table, this status requires at least a doubling of real per capita GDP from 1990 to 2014. The required average per capita growth rate of 2.9% per year, sustained over 24 years, is well above the typical experience (featuring an average per capita growth rate around 2.0% per year). Conditional on having achieved middle-income status, the further transition to upper-income status requires another extended period of well-above-average economic growth. Again, this transition is challenging, but there is no evidence that this second transition (conditional on having achieved the first goal) is more difficult than the first. In this sense, a middle-income trap is not different from a lower-income trap.

IV. Cross-Country Dispersion of Per Capita GDP

The concept of convergence discussed thus far pertains to whether countries that are poorer (in absolute terms or in relation to their own steady-state position) tend to grow faster than richer ones. In Barro and Sala-i-Martin (1991), this concept is called β-convergence and is distinguished from another form (σ-convergence) that relates to a possible tendency for the cross-sectional dispersion of per capita GDP to decline over time. This dispersion can be measured in proportionate terms by the cross-sectional standard deviation of the log of per capita GDP for a group of economies. In this context, sigma convergence corresponds to declining inequality at the level of countries.

If all countries have the same steady-state per capita GDP, then the existence of β convergence tends to reduce the cross-sectional dispersion over time. However, if individual country shocks are present, these shocks tend to raise dispersion. With purely idiosyncratic country shocks, the cross-sectional variance would tend to approach a value that depends positively on the variance of the shocks and negatively on the rate of β convergence. The cross-sectional variance tends to fall over time if it starts above its steady-state value but tends, otherwise, to rise over time (even though β convergence is present). If the sample comprises a large number of countries that have existed with fixed underlying parameters for a long time, the cross-sectional variance will tend at any point in time to be close to its long-run value, and the dispersion will be roughly stable over time.[8]

More generally, countries differ in their long-run or steady-state levels of real per capita GDP, and the X variables included in Table 1, column 1, hold constant part of these long-term

[8]The notion that a tendency for the poor to grow faster than the rich implies a negative trend in dispersion or inequality is a fallacy; in fact, it is Galton's Fallacy (Galton [1886, 1889], Quah [1993], Hart [1995]), which Galton applied to the distribution of heights across a population. For generations of an extended family, height has positive persistence but tends to revert to the population mean, thereby constituting a form of β convergence. Nevertheless, the dispersion of heights across the overall population typically changes little over time.

differences. In this context, the measured cross-country dispersion of the log of real per capita GDP will tend toward a value that is increasing in the long-term dispersion of the log of steady-state real per capita GDP. If a shock occurs (such as the incorporation of China and India into the world economy around 1980) that lowers the steady-state dispersion, the actual dispersion will tend to decline gradually following the shock toward the reduced steady-state dispersion.

The long-term data on real per capita GDP used in Table 1, column 2, can be used to study the long-run evolution of cross-country dispersion. Figure 1 applies to the longest feasible sample, 1870-2010, for which 25 countries (20 of which subsequently became OECD members) have annual data on real per capita GDP. The countries are listed in the note to the figure. Dispersion is measured by the standard deviation across countries of the log of real per capita GDP. The blue line weights countries equally, and the red line weights by population (thereby corresponding under some conditions to the dispersion of income for persons rather than countries).

The blue line (equally weighted) in Figure 1 shows small changes over time. The range is from 0.56 in 2010 to 0.71 in 1946. The main movement away from the mean of 0.65 associates with World War II—the standard deviation rose from 0.62 in 1938 to 0.71 in 1946. During this crisis period, shocks had a high spatial correlation and affected groups of countries differentially, thereby violating the assumption of purely idiosyncratic country shocks.[9] Otherwise, the main finding is that the cross-sectional standard deviation of the log of per capita GDP is remarkably stable since 1870 around its mean of 0.65.

[9]Similarly, in Barro and Sala-i-Martin (1991, Figure 4), the large dispersion of per capita personal income across the U.S. states in 1880 reflects the differential impact of the Civil War on the South versus the North. However, across the U.S. states, the long-run standard deviation for the log of per capita personal income was only around 0.2, much smaller than that across countries.

The red line (population weighted) tells a similar story, except that this measure of dispersion is more sensitive to the major crises in Russia (a relatively poor country with a large population) during the world wars and the 1990s. In 2010, the population-weighted standard deviation of 0.59 is close to the equally-weighted value of 0.56.

Figure 2 extends to a larger sample by using the 34 countries with GDP data starting at least by 1896. This sample is less subject than the 25-country group used before to the sample-selection problem of tending to include countries that were rich toward the end of the sample. The note to the figure lists the countries. Most importantly, this extension adds the world's two largest countries by population, China and India.

The dispersion measured by the blue line (equally weighted) in Figure 2 is higher than that in Figure 1 because the expansion of the sample brings in several countries with per capita GDP well below the mean. Compared to Figure 1, the blue graph in Figure 2 shows more substantial changes over time, with the standard deviation starting at 0.87 in 1896 and rising during the Great Depression and WWII to 1.04 in 1946. That is, the years from the early 1930s through the mid-1940s exhibit a "great divergence," which persists through the mid-1970s. From there on, the standard deviation falls from 1.07 in 1974 to 0.78 in 2010. The decline of dispersion in this last phase reflects particularly the strong growth in developing countries, including China, India, and Indonesia.[10] Possibly, in the long run, the standard deviation in this 34-country sample will fall toward the average value of 0.65 found in Figure 1—because the added developing countries seem to be joining the richer group selected in Figure 1 (by the criterion of having GDP data back to 1870).

[10]In this respect, the sample-selection criterion in Figure 1 (25 countries having GDP data back to 1870) understates σ convergence since the mid-1970s compared to that in Figure 2 (34 countries having GDP data back to 1896). The long-term results in Baumol (1986, Figure 1) were the reverse—with the restriction of the sample to 16 countries with data from Maddison (1982) back to 1870 tending to overstate σ convergence. See DeLong (1988).

The red line (population weighted) in Figure 2 starts with higher dispersion than the blue line (equally weighted) because the largest countries by population, China and India, begin far below the world mean for per capita GDP. The trend in the population-weighted series is similar to that for the equally-weighted series in exhibiting a great divergence from the early 1930s through the 1940s and persisting up to the mid-1970s. Thereafter, the dispersion falls sharply, going from 1.58 in 1974 to 0.83 in 2010. This recent trend, highlighted in terms of the world distribution of income by Sala-i-Martin (2006), reflects particularly the strong growth in China since the late 1970s and in India since the mid-1980s.

V. Concluding Observations

China's growth rate of real per capita GDP has been remarkably high since around 1990, well above the rates predicted from international experience in a conditional-convergence framework. Although country growth rates can deviate above or below their predicted values for some time, no country, including China, can escape the "iron law of convergence" forever. Therefore, China's per capita growth rate is likely to decline soon from around 8% per year to a range of 3-4%.

Economic growth at a 3-4% per capita rate is sufficient when sustained over 2-3 decades to transition from low- to middle-income status (which China has already accomplished) and then from middle- to high-income status (which China is likely to achieve). Thus, although these realistic growth rates are well below recent experience, they would actually be a great accomplishment. Perhaps the biggest challenge is that the likely prospects for China's per capita growth rates are well below the values of 5-6% per year implied by official forecasts.[11] Thus,

[11] According to Economist Intelligence Unit (2015), the Chinese government's official forecast as of December 2015 implied by the most recent five-year plan was for an average annual real GDP growth rate around 6% from 2016 to

the future may bring major political tensions in reconciling economic dreams with economic realities. Reducing the unrealistically optimistic growth expectations held inside and outside the government would reduce the risk of this tension and lower the temptation to manipulate the national accounts data.

2020. With population growth of about 0.5% per year, this projection corresponds to a per capita growth rate around 5.5% per year.

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Table 1
Growth Regressions for Cross-Country Panels
(all equations estimated by OLS and include time effects)

	(1)	(2)
	89 countries 5-year intervals 1960-2010 no country fixed effects	**28 countries 5-year intervals 1870-2010 country fixed effects**
Log(lagged per capita GDP)	-0.0170** (0.0021)	-0.0262** (0.0041)
1/(life expectancy at birth)	-3.09** (0.58)	--
Log(fertility rate)	-0.0277** (0.0043)	--
Law-and-order (rule-of-law) indicator	0.0157** (0.0054)	--
Investment ratio	0.031* (0.012)	--
Female school years	0.0024 (0.0014)	-0.0026 (0.0025)
Male school years	-0.0028 (0.0015)	-0.0009 (0.0026)
Government consumption ratio	-0.026 (0.023)	--
Openness ratio	0.0056* (0.0025)	--
Terms-of-trade change	0.117** (0.026)	--
Democracy indicator	0.029 (0.015)	-0.032 (0.019)
Democracy squared	-0.028* (0.014)	0.034* (0.017)
Inflation rate	-0.0180** (0.0042)	--
R-squared	0.33	0.26
s.e. of regression	0.024	0.026
No. countries; observations	89; 841	28; 727

*Significant at 5% level. **Significant at 1% level.

Notes to Table 1

Column 1:

The sample criterion is to include countries only if they have data starting by the 1970-75 period for the dependent and independent variables. The countries in the sample appear in Table 2. The dependent variable is the annual growth rate of real per capita GDP for the ten five-year periods: 1960-65, …, 2005-10. Lagged per capita GDP, the reciprocal of life expectancy at birth, the total fertility rate, and female and male years of school attainment for persons aged 15 and over are 5-year lags (for 1960, …, 2005). The ratios of investment and government consumption to GDP, the openness ratio, the indicator for law and order (rule of law) and the democracy indicator are five-year averages of values lagged one to five years. The growth rate of the terms of trade and the inflation rate are for the same periods as the dependent variable. Standard errors of coefficient estimates are in parentheses. For calculating standard errors, the error terms are allowed to be correlated over time within countries.

Definitions and sources:

PPP-adjusted real per capita GDP is from Penn World Tables (www.pwt.econ.upenn.edu), version 7.0, in 2005 international dollars. Data for 2010 are from version 7.1. Also from version 7.0 are the ratios to GDP of investment (private plus public) and government consumption and the openness ratio (exports plus imports relative to GDP). These ratio variables use current-price information.

Life expectancy at birth and the total fertility rate are from the World Bank's *World Development Indicators* (*WDI*).

The law-and-order (rule-of-law) indicator is from Political Risk Services, *International Country Risk Guide*. The data were converted from seven categories to a 0-1 scale, with 1 representing the highest maintenance of law and order and rule of law.

Average years of school attainment for females and males aged 15 and over at various levels of schooling are from Barro and Lee (2015), with data available at www.barrolee.com. These data are at 5-year intervals.

The terms-of-trade change (growth rates over five years of export prices relative to import prices) is from International Monetary Fund, *International Financial Statistics*, and *WDI*. This variable is interacted with the openness ratio.

The democracy indicator is the political-rights variable from Freedom House (www.freedomhouse.org). The data were converted from seven categories to a 0-1 scale, with 1 representing the highest rights. Data on an analogous concept for 1960 and 1965 are from Bollen (1980).

The inflation rate (averaged over 5-year intervals) is calculated from retail-price indexes from International Monetary Fund, *International Financial Statistics*, and *WDI*.

Column 2:

The sample criterion is to include countries only if they have GDP data starting by 1896 and also have data for most of the period on years of schooling and an indicator of democracy from Polity. This criterion selected 28 countries: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Denmark, France, Germany, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Peru, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States, Uruguay, and Venezuela. Standard errors of coefficient estimates are in parentheses. In calculating standard errors of coefficient estimates, the error terms are allowed to be correlated over time within countries.

The dependent variable is the annual growth rate of real per capita GDP for the 28 countries for 28 periods: 1870-75, 1875-80, …, 2005-10. For the independent variables, the log of lagged per capita GDP, average years of female and male school attainment for persons aged 15 and over, and the Polity indicator are five-year lags, referring to 1870, 1875, …, 2005.

Sources: GDP is from "Barro-Ursúa Macroeconomic Data," available at www.rbarro.com/data-sets. The Polity indicator is for democracy less autocracy (converted from a -10 to +10 scale to a 0-1 scale, with 1 representing highest democracy), from Polity IV (www.systemicpeace.org). The data at 5-year intervals since 1950 on female and male average years of school attainment for persons aged 15 and over are as for column 1. Data from 1870 to 1945 at five-year intervals are estimates described in Barro and Lee (2015).

Table 2 Sample of 89 Countries Used in Table 1, column 1			
Country	**Starting period**	**Country**	**Starting period**
Argentina	1960-65	Jordan	1965-70
Australia	1960-65	Japan	1960-65
Austria	1960-65	Kenya	1960-65
Belgium	1960-65	South Korea	1965-70
Bangladesh	1965-70	Sri Lanka	1960-65
Bahrain	1970-75	Luxembourg	1960-65
Bolivia	1965-70	Morocco	1960-65
Brazil	1960-65	Mexico	1960-65
Botswana	1965-70	Mali	1965-70
Canada	1960-65	Malta	1970-75
Switzerland	1960-65	Malawi	1965-70
Chile	1960-65	Malaysia	1960-65
China	1960-65	Niger	1960-65
Cote d'Ivoire	1960-65	Nicaragua	1960-65
Cameroon	1965-70	Netherlands	1960-65
Congo, Republic	1960-65	Norway	1960-65
Colombia	1960-65	New Zealand	1960-65
Costa Rica	1960-65	Pakistan	1960-65
Cyprus	1960-65	Panama	1965-70
Denmark	1960-65	Peru	1965-70
Dominican Republic	1960-65	Philippines	1960-65
Algeria	1960-65	Papua New Guinea	1960-65
Ecuador	1960-65	Portugal	1960-65
Egypt	1960-65	Paraguay	1960-65
Spain	1960-65	Sudan	1970-75
Finland	1960-65	Senegal	1960-65
France	1960-65	Singapore	1965-70
Gabon	1965-70	Sierra Leone	1965-70
United Kingdom	1960-65	El Salvador	1960-65
Germany	1970-75	Sweden	1960-65
Ghana	1960-65	Syria	1970-75
Gambia	1965-70	Togo	1965-70
Greece	1960-65	Thailand	1960-65
Guatemala	1960-65	Trinidad	1960-65
Guyana	1970-75	Tunisia	1965-70
Honduras	1960-65	Turkey	1965-70
Haiti	1960-65	Taiwan	1960-65
Hungary	1970-75	Tanzania	1970-75
Indonesia	1965-70	Uganda	1965-70
India	1960-65	Uruguay	1965-70
Ireland	1960-65	United States	1960-65
Iceland	1960-65	Venezuela	1965-70
Israel	1970-75	South Africa	1960-65

Italy	1960-65	Zambia	1965-70
Jamaica	1960-65		

Table 3

Growth Rates of Real per capita GDP in China

Actual and Model-Fitted Values

Period	Per capita growth rate	Fitted value	Residual
1960-1965	-0.013	0.040	-0.053
1965-1970	0.017	0.046	-0.029
1970-1975	0.025	0.047	-0.022
1975-1980	0.038	0.060	-0.022
1980-1985	0.061	0.046	0.015
1985-1990	0.024	0.054	-0.031
1990-1995	0.084	0.046	0.038
1995-2000	0.034	0.048	-0.014
2000-2005	0.094	0.051	0.043
2005-2010	0.089	0.042	0.047

Note: The fitted value and residual come from the panel regression in Table 1, column 1.

Table 4

Convergence Success Stories

Middle-Income and Upper-Income Successes

Country	Real per capita GDP, 1990 (2011 U.S. dollars)	Real per capita GDP, 2014 (2011 U.S. dollars)
Middle-Income Successes		
China	1500	12600
Indonesia	4500	10000
Peru	5300	11400
Thailand	6400	13900
Uruguay	9800	19900
almost met criteria for middle-income success:		
Costa Rica	7300	14200
Upper-Income Successes		
Chile	9200	22000
Ireland	22500	46600
Korea (South)	12100	33600
Malaysia	10200	23800
Poland	10100	24000
Singapore	34300	79000
Taiwan*	13700	37900
almost met criteria for upper-income success:		
Hong Kong	27000	52600

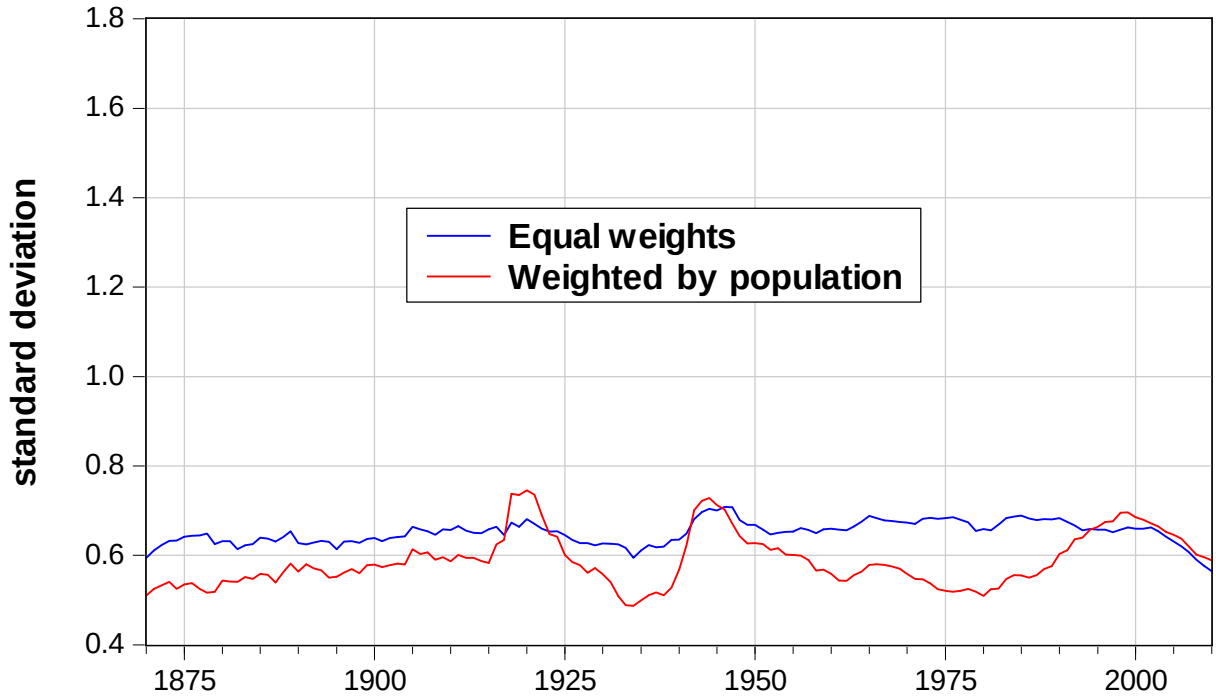
Notes: The definition of a convergence success is, first, that real per capita GDP has to at least double from 1990 to 2014 (per capita growth rate of at least 2.9% per year). Second, a middle-income success has to reach a level of per capita GDP in 2014 of at least $10000 in 2011 U.S. dollars. An upper-income success has to reach at least $20000.

*Data are from Taiwan's national accounts.

Figure 1

Cross-Country Dispersion of the Log of Real per capita GDP

25 countries, 1870-2010

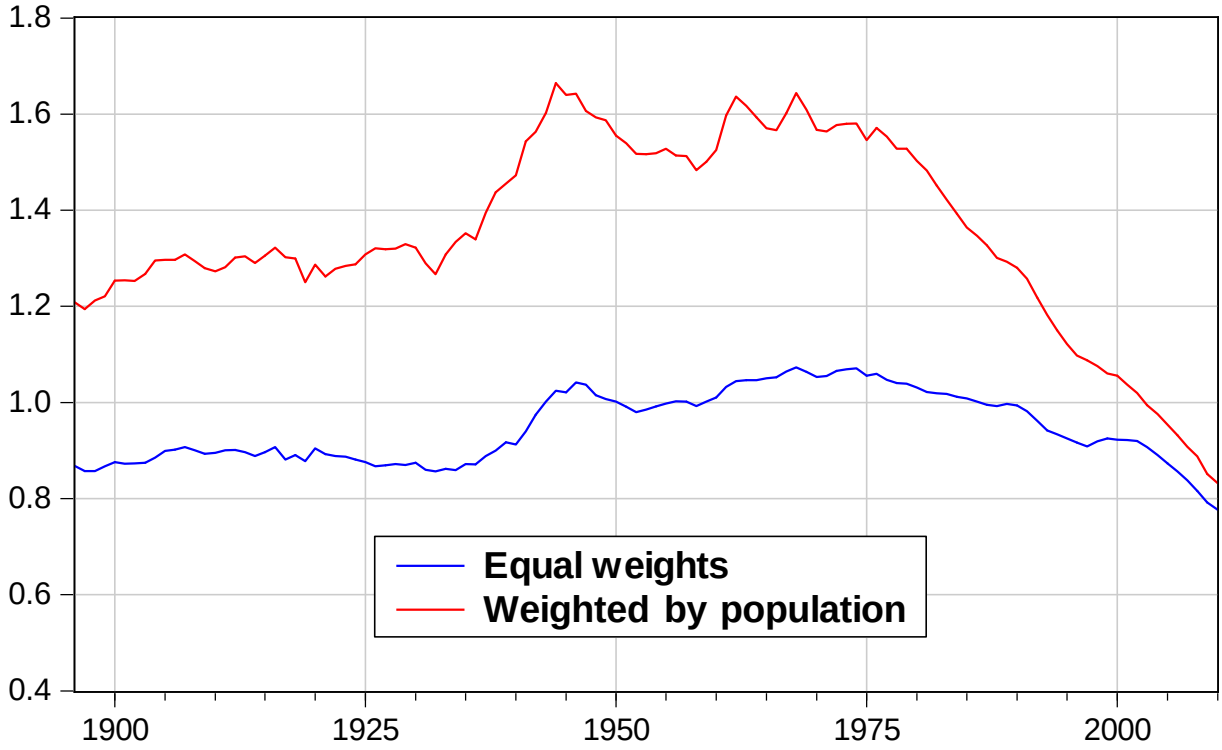


Note: The 25 countries included are Australia, Austria, Belgium, Brazil, Canada, Chile, Denmark, Finland, France, Germany, Iceland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Russia, Spain, Sri Lanka, Sweden, Switzerland, United Kingdom, United States, and Uruguay. The graphs show the cross-sectional standard deviation of the log of real per capita GDP. The blue series has equal weights; the red series weights each country by population. The source of data (which also includes data on population) is given in the notes to Table 1, column 2.

Figure 2

Cross-Country Dispersion of the Log of real per capita GDP

34 countries, 1896-2010



Note: The 34 countries included are Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Denmark, Egypt, Finland, France, Germany, Iceland, India, Indonesia, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Peru, Portugal, Russia, Spain, Sri Lanka, Sweden, Switzerland, Turkey, United Kingdom, United States, Uruguay, and Venezuela. The graphs show the cross-sectional standard deviation of the log of real per capita GDP. The blue series has equal weights; the red series weights each country by population. The source of data (which also includes data on population) is given in the notes to Table 1, column 2.