



Phases of global demographic transition correlate with phases of the Great Divergence and Great Convergence



Andrey Korotayev ^{a,*}, Jack A. Goldstone ^{b,c}, Julia Zinkina ^a

^a *Laboratory of Monitoring of Sociopolitical Destabilization Risks, National Research University Higher School of Economics, 20 Myasnitskaya, Moscow, Russia*

^b *George Mason University, School of Public Policy, 3351 Fairfax Drive, Arlington, VA 22201, USA*

^c *Research Laboratory on Political Demography and Social Macro-Dynamics, Russian Presidential Academy of National Economy and Public Administration (RANEPA), 82 Vernadskogo Prospekt, Moscow, Russia*

ARTICLE INFO

Article history:

Received 21 March 2014

Received in revised form 5 December 2014

Accepted 17 January 2015

Available online 17 February 2015

Keywords:

Modernization

Demographic transition

Globalization

Divergence

Convergence

ABSTRACT

The Great Divergence and, to a lesser extent, the Great Convergence phenomena have attracted considerable scholarly attention. However, the existing attempts at explaining these phenomena and their background share two significant drawbacks: first, no model (to the best of our knowledge) has managed to account for both the Great Divergence and the Great Convergence so as to explain the timing of the trend change (around 1970s). Second, most existing models concentrate heavily on the economic forces, frequently neglecting the demographic factor. We offer an approach to overcome these drawbacks, revealing a close coupling between phases of global demographic transition and phases of the Great Divergence and Great Convergence. As we account for the crucial role of the demographic component in these processes, we show that the timing of the trend change was not coincidental. Our findings suggest that the dynamics of global population growth and the Great Divergence and Great Convergence therefore may be considered so closely coupled as to be two sides of the same coin. On the other hand, they also suggest that the Great Divergence and Great Convergence should be treated as a single process, as two phases of the global modernization.

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1. Introduction

In the 19th century, northwestern Europe saw the birth of capital-intensive and fossil-fuel based manufacturing. Spreading throughout Europe and the United States, these changes triggered the explosive growth of a gap in per capita incomes between the First and Third World that has become known as the Great Divergence (see, e.g., Pomeranz, 2000; Goldstone, 2008, 2012; Clark, 2008; Allen, 2011). In the twentieth century, the Great Divergence peaked before the First World War and continued until the early 1970s, then, after two decades of indeterminate fluctuations, in the late 1980s it was replaced by the Great Convergence as the majority of Third World countries

reached economic growth rates significantly higher than those in most First World countries (e.g., Sala-i-Martin, 2006; Korotayev et al., 2011; Spence, 2011; Derviş, 2012).

The majority of the voluminous research on various aspects of the Great Divergence, taken as a whole, mainly focuses on five causes, such as geography, human capital, science and technology progress, cultural/political institutions, and international trade/colonies (for a substantial review see Goldstone, 2002, 2008, 2012; Chen, 2012). The cornerstone for the theory of convergence were laid by Alexander Gerschenkron (1952), who developed the ‘theory of relative backwardness’, stating that ‘the opportunities inherent in industrialization may be said to vary directly with backwardness of the country’ (Gerschenkron, 1952: 6), as well as by Robert M. Solow (1956), whose model accounted for the diminishing returns to capital and implied that in poor countries even small amounts of capital investment would substantially raise the productivity.

* Corresponding author.

E-mail addresses: akorotayev@gmail.com (A. Korotayev), jgoldsto@gmu.edu (J.A. Goldstone), juliazin@list.ru (J. Zinkina).

Abel and Bernanke note that according to the Solow model, if the economy is open, the absolute convergence gets support of some additional economic forces. Since poorer countries have less capital per worker and therefore a higher marginal product of capital than the more affluent countries, investors from richer countries will be able to get greater profits by investing in poor countries. Therefore, foreign investment should provide a more rapid increase in capital stock in poor countries, even if the level of domestic savings in these countries is low (Abel and Bernanke, 2005: 234). It is easy to see that both the ‘Gershenkron’ factor and the ‘Solow’ factor of the faster growth of the peripheral (and especially semi-peripheral) economies are well mutually complementary, as the capital diffusion tends to be accompanied by technology diffusion (what is more, the capital diffusion is one of the main creators of the technology diffusion channels).

However, the existing attempts at explaining these phenomena and their background share two significant drawbacks: first, no model (to the best of our knowledge) has managed to account for both the Great Divergence and the Great Convergence so as to explain the timing of the trend change (around 1970s) (for our earlier attempt to account for this with a special mathematical model see Zinkina et al., 2014). Second, most existing models concentrate heavily on the economic forces, frequently neglecting the demographic factor. We offer an approach to overcome these drawbacks, revealing a close coupling between phases of global demographic transition and phases of the Great Divergence and Great Convergence. We show here that the dynamics of the size of the gap in GDP per capita between the First and Third Worlds corresponds to the dynamics of the growth rate of the world population (the specific countries we identify as composing the “First World” and “Third World” are listed in the Supplementary Information). We provide supporting evidence that this is not coincidental, and that the demographic component plays an important role in these processes.

2. Methods summary

GDP and population data were obtained from Maddison (2010) and the World Bank’s *World Development Indicators* Database (World Bank, 2014). First World countries comprised 30 Western European Countries, the USA, Canada, Australia, New Zealand, and Japan. GDP was totaled across these countries, and divided by total population to obtain First World GDP per capita. We designated as Second World countries the U.S.S.R. and its successor republics, Yugoslavia and its successor republics, and 5 eastern European countries. The Third World population and GDP were obtained by subtracting the sum of First World and Second World GDP and population from the World totals. Full specification of the country lists for First and Second worlds are given in the Supplementary Information.

Data was taken for the following years, to span the entire period 1–2012 AD, at points spaced to capture the movements of GDP/capita: AD 1, 1000, 1500, 1820, 1870, 1913, 1940, 1952, then every five years up through 2012. Full data is given in the Supplementary Information.

3. Parallel dynamics

The general dynamics of the gap in GDP per capita, shown as the ratio between the GDP/capita in the First and Third

Worlds from AD 1 to 2008, is presented in Fig. 1a. This curve can be seen to display a rather close similarity to the curve of the world’s population growth rate (shown here as the annual increase per thousand) presented in Fig. 1b. This similarity becomes especially salient when both curves are plotted in the same graph (Fig. 1c and d), and persists whether looking at the full span of two millennia or only at the two most recent centuries.

Regression analysis indicates that the correlation between the relative growth rates of the world population and the GDP per capita gap between the First and Third Worlds has a remarkably high value (see Fig. 2).

We are dealing here with a very tight correlation, accounting for 92% of all the variation. The match between the dynamics of world population growth, on the one hand, and the dynamics of the gap between the First and the Third World GDP per capita, on the other, looks especially salient in Fig. 3, where a logarithmic scale is used to facilitate the comparison across different scales.

The high correlation of the two time series is apparent. The significant acceleration of the world population growth rate observed in the 19th century (from 4.1‰ per year c. 1820 to 7.95‰ by 1870) corresponds to an explosively accelerated widening of the per capita income gap between the First and Third Worlds. During the period of 1870–1940 the deceleration of world population growth corresponded to a certain slowdown in the pace of the Great Divergence. Then, following the Second World War, a surge of acceleration of world population growth took place; and, as expected, it coincided with a renewed, corresponding acceleration of the global Divergence. Even a certain hitch in the acceleration of the world population growth rates that was observed in the 1950s was accompanied by a certain hitch in the Divergence speed. Both the gap between the First and Third World GDP per capita and the relative world population growth rate reached their peaks almost simultaneously (at 8.1 times for the gap and a rate of 20.65‰ per year for world population growth) in the late 1960s. There followed a decade in which the values of both variables declined, commencing the Great Convergence. However, in the late 1970s and early 1980s both the slowing-down of the world’s population growth rate and the decrease of the per capita income gap were interrupted (almost simultaneously). One could observe, throughout most of the 1980s, certain proportional, and mostly simultaneous, increases in both the per capita income divergence between the First and the Third World, and the world population growth rate. Then in the late 1980s there began a sharp and mostly steady (though not without certain hitches) decrease of both the GDP gap and the world population growth rate that has continued to the present day.

4. The income gap and world population growth as tightly-coupled processes

It could not be entirely ruled out, of course, that at least some of the consistency in this picture may be attributable to coincidence. However, the existence of a high correlation between the two time series can be explained. In truth, both of the global processes (the global demographic transition, otherwise known as the global demographic modernization, on the one hand, and the Great Divergence turning into the Great

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