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**Working Paper**

## Divergence, convergence, and the history-augmented Solow model

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## **DIVERGENCE, CONVERGENCE, AND THE HISTORY-AUGMENTED SOLOW MODEL**

**Vadim Kufenko**

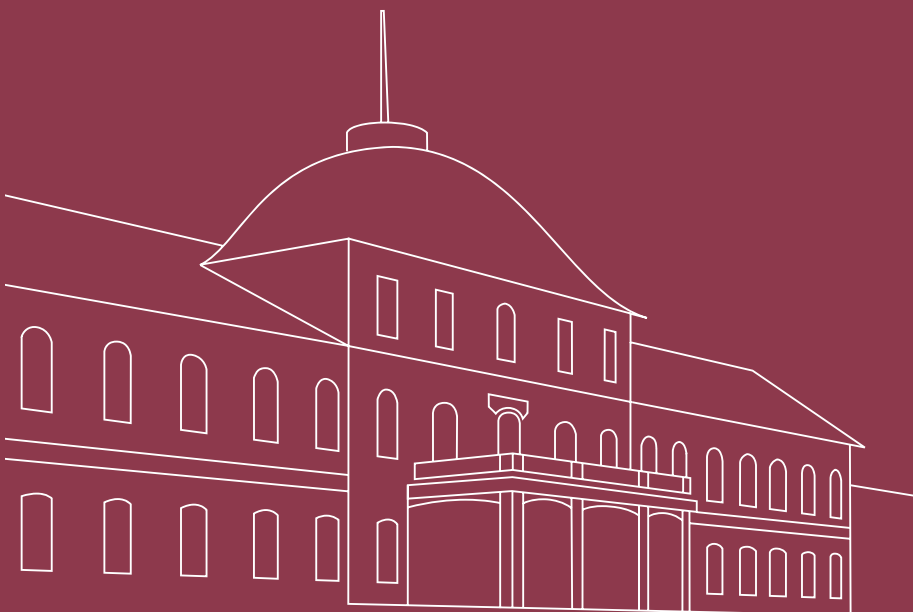
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Discussion Paper 11-2017

**Divergence, convergence, and the history-augmented  
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Vadim Kufenko, Klaus Prettnner, and Vincent Geloso

*Research Area “INEPA – Inequality and Economic Policy Analysis”*

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# Divergence, convergence, and the history-augmented Solow model

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## Abstract

We test the history-augmented Solow model with respect to its predictions on the patterns of divergence and convergence between the nowadays industrialized countries of the OECD. We show that the dispersion of incomes increased after the Industrial Revolution, peaked during the Second World War, and decreased afterwards. This pattern is fully consistent with the transitional dynamics implied by the history-augmented Solow model.

**JEL classification:** J11, O11, O47.

**Keywords:** History-augmented Solow model, divergence, convergence, cross-country inequality.

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# 1 Introduction

From a historical perspective, today's industrialized countries have seen their incomes diverge during the Industrial Revolution. The main reason for this divergence is the differential timing in the takeoff to sustained economic growth as implied by the unified growth theory of Galor and Weil (2000) and Galor (2005, 2011), and as quantified for different countries in terms of the timing of the demographic transition by Reher (2004). In later phases of development, however, club convergence has been observed in the sense that income differences narrowed between countries with similar steady-state characteristics such as the members of the OECD (see, for example, Barro, 1997; Sala-i-Martin, 1997; Barro and Sala-i-Martin, 2004). Most recently, Dalgaard and Strulik (2013) proposed the history-augmented Solow (1956) model to reconcile these two dynamics by accounting for the differential takeoff to growth in an otherwise standard convergence growth regression. They show that their model-based estimates i) have a higher explanatory power than the standard approach with respect to the observed long-run income differences between different countries; ii) do not suffer from the otherwise common anomaly in growth regressions that the estimate of the capital share is exceedingly high.

While Dalgaard and Strulik (2013) focus on the long-run steady-state implications of their framework, we analyze the country-specific trajectories of per capita income as implied by the transition path of their model. Our test of the model is based on the notion of  $\sigma$ -convergence (Young et al., 2008), i.e., the change in the dispersion of income levels between different countries over time. If the history-augmented Solow model is an accurate description of the underlying data-generating process, then one should observe an increasing dispersion of incomes first, then a structural break, and finally a reduction in the dispersion of incomes. We show that this is indeed the case by relying on long-run data of per capita GDP. Our results give credence to the history-augmented Solow model and offer additional insights into the dynamics of cross-country inequality over a long time horizon.

## 2 The implications of the history-augmented Solow model for convergence

Following Dalgaard and Strulik (2013), we consider a production function along the lines of Solow (1956)

$$Y(t) = K(t)^\alpha [A(t)L(t)]^{1-\alpha}, \quad (1)$$

where  $Y(t)$  is aggregate output at time  $t$ ,  $K(t)$  is the input of physical capital in the production process,  $L(t)$  is employment in production,  $A(t)$  is the stock of labor-augmenting technology, and  $\alpha$  is the elasticity of output with respect to physical capital. For a constant savings rate  $s \in (0, 1)$ , a constant rate of depreciation  $\delta \in (0, 1)$ , and a constant population growth rate  $n \geq 0$ , it is well-known that income per efficiency unit of labor,  $\hat{y}(t) =$

$Y(t)/[A(t)L(t)]$ , is constant at the steady state and given by  $\hat{y}^* = [s/(n + g + \delta)]^{\alpha/(1-\alpha)}$ . Consequently, per capita income along the balanced growth path is driven by the evolution of technology according to the relationship

$$y(t) = A(t) \left( \frac{s}{n + g + \delta} \right)^{\frac{\alpha}{1-\alpha}}, \quad (2)$$

where  $A(t)$  grows at the rate of technological progress as given by  $g = \dot{A}/A$ . Assuming, as in Dalgaard and Strulik (2013), that the takeoff to positive long-run growth occurred at time  $\tau < t$ , the economy experienced ongoing per capita income growth since  $t - \tau$  years. Altogether, this implies that per capita income in the long run is given by

$$y(t) = A(\tau) e^{g(t-\tau)} \left( \frac{s}{n + g + \delta} \right)^{\frac{\alpha}{1-\alpha}}, \quad (3)$$

where  $A(\tau)$  is the level of technology at the time of the takeoff to sustained growth. Countries that experienced an earlier takeoff (i.e., countries with a lower  $\tau$ ) have a higher per capita income as of time  $t$ . Dalgaard and Strulik (2013) use this equation to derive a cross-country growth regression equation by which they test their history-augmented Solow model. They find that adding a proxy for the differential timing of the takeoff – based upon the data of Reher (2004) – greatly enhances the explanatory power of cross-country growth regressions and solves the issue that most standard growth regressions exhibit an exceedingly high coefficient estimate for the elasticity of output with respect to physical capital,  $\alpha$ .

There is, however, another highly interesting implication of the model that is due to its implied transitional dynamics. Since different countries are very similar before the onset of the industrial revolution in terms of their income levels, the differential takeoff leads countries to diverge in terms of their income levels after the first countries experience their takeoff. As more and more countries transition toward sustained long-run growth, however, the dispersion peaks at some point and afterwards it starts to decline. We display the simulated trajectories of the history-augmented Solow model in Figure 1 for five different groups of countries that can be interpreted as forerunners, followers, latecomers, and trailers according to the classification of Reher (2004). In case of the latecomers we assume for illustrative purposes that there are two types of countries. The first group has a gross savings rate of  $s = 0.3$ , while the second group has a higher gross savings rate of  $s = 0.4$ . The associated coefficient of variation between the income levels of the different country groups is displayed in Figure 2. We observe that the dispersion increases first and decreases afterwards. In the next section we test whether this pattern is consistent with the pattern of divergence and convergence that we observe in the data.

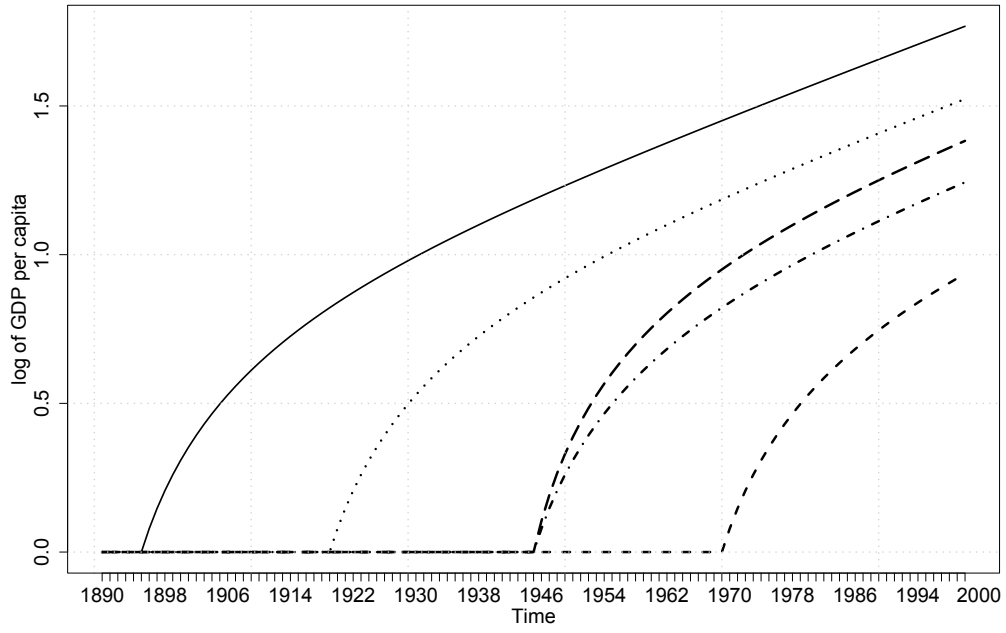


Figure 1: Simulated trajectories for the differential takeoff of five different groups of countries according to the history-augmented Solow model.

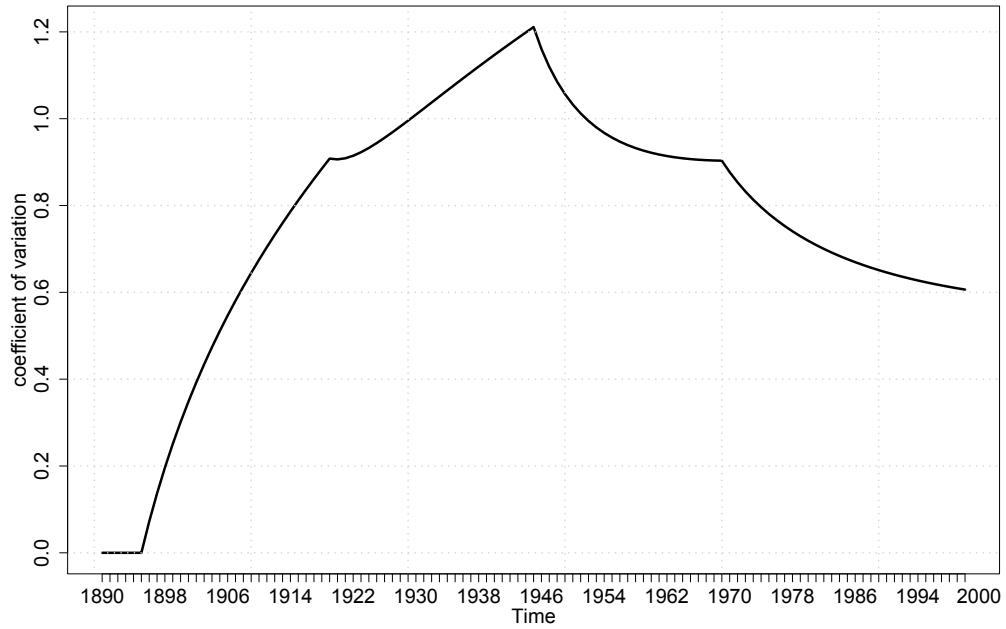


Figure 2: Coefficient of variation associated with the simulation of the history-augmented Solow model.

### 3 Main results

In order to test the implications of the history-augmented Solow model, we calculate the coefficient of variation for per capita output in the long run and analyze the data as a time series to identify the slopes and breakpoints, providing they exist. We use the data of Bolt and Zanden (2014) which covers the GDP and population series for the following OECD countries: Australia, Canada, England, Finland, France, Greece, Hungary, Ireland, Japan, the Netherlands, New Zealand, South Korea, Sweden, and the United States between 1890 and 2000. To tackle the changes in the composition of the sample over time and the associated size effects, we weight the GDP per capita series by the population size. Doing so yields a smoother series as compared to the unweighted one.

First, we apply the structural break test of Bai and Perron (2003), which was implemented in the software package “R” by Zeileis et al. (2002, 2003). The minimal size of segments is set to 30 and the number of structural breaks is set to one, which is a reasonable assumption, given the theoretical implications. The Bai–Perron test yields 1942 as the breakpoint: a brief visual examination shows that indeed, the coefficient of variation has been increasing before the breakpoint and decreasing afterwards (see Figure 3). In order to quantify the slope before and after the breakpoint, we apply a segmented regression as in Muggeo (2003, 2008). In so doing we use the result of the Bai–Perron test as the initial guess of the breakpoint  $\psi^{(0)}$ . The advantage of the used method is that it updates the breakpoint estimate through iterations, yielding a final value  $\hat{\psi}$  of 1949. The results of this procedure are presented in Table 1 and yield a significantly positive slope before the breakpoint and a significantly negative slope afterwards. The annual increase of the population weighted coefficient of variation before the breakpoint is given by 1.39%, whereas the annual decrease after the breakpoint is 0.972%. These results show that there has been a significant divergence between the different countries until the end of the Second World War, whereas thereafter the results are consistent with the notion of gradual club convergence.

Table 1: Segmented regression estimates of the slopes of the trends

Dependent variable: Population-weighted coefficient of variation of per capita GDP	
$t < \hat{\psi}$	0.0139*** (0.0006)
$t > \hat{\psi}$	-0.00972*** (0.00072)
Initial breakpoint $[\psi^{(0)}]$ from Bai and Perron (2003)	1942
Updated $\hat{\psi}$	1949
Adjusted R sq.	0.8829

Note: Standard errors are reported in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$



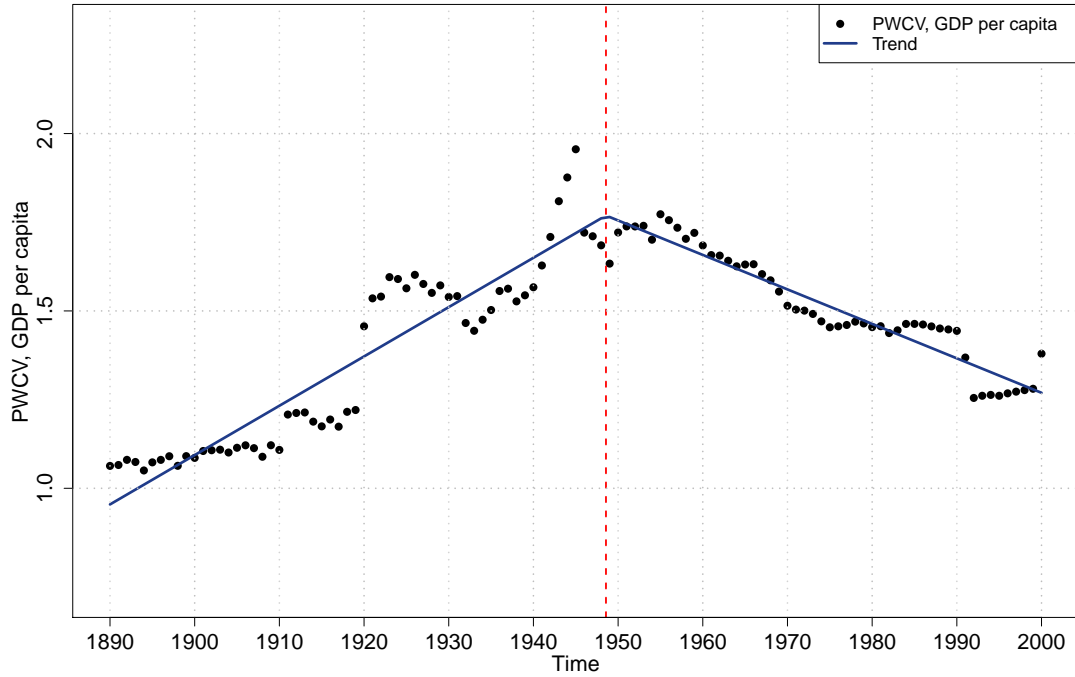


Figure 3: Population-weighted coefficient of variation of per capita GDP; breakpoint and segmented trend estimation.

## 4 Conclusions

We put the history-augmented Solow model with respect to its predictions on cross-country divergence and convergence since the Industrial Revolution to the test. The transition phase toward the long-run steady state of the model implies increasing dispersion of incomes first and decreasing dispersion in later phases. This pattern is supported by the data for the nowadays industrialized OECD countries, which gives further credence to the history-augmented Solow model as suggested by Dalgaard and Strulik (2013).

## References

- Bai, J. and Perron, P. (2000). Computation and Analysis of Multiple Structural Change Models. *Journal of Applied Econometrics*, Vol. 18(No. 1):1–22.
- Barro, R. J. (1997). *Determinants of Economic Growth: A Cross-Country Empirical Study*. MIT Press, Cambridge MA.
- Barro, R. J. and Sala-i-Martin, X. S. (2004). *Economic Growth*. The MIT Press. Cambridge, Mass.
- Bolt, J. and van Zanden, J. D. (2014). The Maddison Project: Collaborative Research on Historical National Accounts. *The Economic History Review*, Vol. 67(No. 3):627–651.

- Dalgaard, C.-J. and Strulik, H. (2013). The history augmented solow model. *European Economic Review*, Vol. 63:134–149.
- Galor, O. (2005). *Handbook of Economic Growth*, chapter 4. “From Stagnation to Growth: Unified Growth Theory”, pages 171–293.
- Galor, O. (2011). *Unified Growth Theory*. Princeton University Press.
- Galor, O. and Weil, D. (2000). Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond. *The American Economic Review*, Vol. 90(No. 4):806–828.
- Geloso, V., Kufenko, V., and Prettnner, K. (2016). Demographic change and regional convergence in Canada. *Economics Bulletin*, Vol. 36(No. 4):1904–1910.
- Muggeo, Vito M. R. (2003). Estimating Regression Models with Unknown Break-points. *Statistics in Medicine*, Vol. 22(No. 19):3055–3071.
- Muggeo, Vito M. R. (2008). Segmented: an R package to fit Regression Models with Broken-line Relationships (Ver. 0.5-2.1). *R News*, Vol. 8(No. 1):20–25.
- Reher, D. S. (2004). The Demographic Transition Revisited as a Global Process. *Population, Space and Place*, Vol. 10:19–41.
- Sala-i-Martin, X. (1997). I just ran two million regressions. *American Economic Review*, Vol. 87(No. 2).
- Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, Vol. 70(No. 1):65–94.
- Young, A. T., Higgins, M. J., and Levy, D. (2008). Sigma Convergence versus Beta Convergence: Evidence from U.S. County-Level Data. *Journal of Money, Credit and Banking*, Vol. 40(No. 5):1083–1093.
- Zeileis, A., Leisch, F., Hornik, K., and Kleiber, C. (2002). strucchange: An R Package for Testing for Structural Change in Linear Regression Models (Ver. 1.5-1). *Journal of Statistical Software*, Vol. 7(No. 2):1–38.
- Zeileis, A., Kleiber, C., Kraemer, W., Hornik, K. (2003). Testing and Dating of Structural Changes in Practice. *Computational Statistics & Data Analysis*, Vol. 44:109–123.

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