The hallmarks of crisis. A new center-periphery perspective on long cycles

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By

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Abstract

Our analysis, based on a variety of standard econometric techniques, aims to be a fairly comprehensive test of the hypotheses about long cycles, associated with the name of Kondratiev/Kondratieff. Our work tries to link the issue of long cycles with the issue of economic convergence and divergence in the world system, because there are very strong cyclical ups and downs of relative convergence in the world system, observable not just in the "national" growth rates and "national" economic cycles. Already the Japanese economist Kaname Akamatsu, who lived from August 7, 1896 to December 20, 1974, and who was a great admirer of Kondratiev/Kondratieff, hinted at this connection. His most well-known tribute to Kondratiev/Kondratieff (Akamatsu, 1961) specifically links the rise and decline of the global peripheries to the larger Kondratiev/Kondratieff cycle. His contribution, which is hardly ever mentioned nowadays in the framework of K-cycle research, is the starting point of our analysis.

In fact, these "Akamatsu cycles", analyzed in this work, are even stronger and seem to be more devastating than the "national Kondratiev/Kondratieff waves" and world systemic waves themselves, leading to the discovery of what might be even termed a "double-Tsunami wave structure".

Both our re-analysis of world industrial production growth data since 1741 as well as the global conflict data since 1495, presented in this article, cautiously support the earlier contentions of world system research with evidence, tested by spectral analysis and auto-correlation analysis.

Using the well-known and now updated Maddison data base at http://www.ggdc.net/maddison/maddison-project/data.htm, Kondratiev/Kondratieff cycles of around 60 years duration at a nation state level are most clearly visible in Argentina, Canada, and Russia, with evidence on the existence of longer cycles of more than 35 years also in Belgium; Chile; Greece; Netherlands; India; New Zealand; Spain; and USA; while for the other countries of the Maddison data set, earlier negative spectral density analysis results reported in the ample literature surveyed in this article could not be falsified. By contrast, the evidence about strong long term cycles of convergence seems to be very convincing.

Future research is recommended to realize that convergence processes in most nations of the world are discontinuous and of a cyclical nature, thus supporting the pessimism inherent in the writings by the world systems scholar Giovanni Arrighi on the subject.

Keywords: Kondratieff; Long waves: Business cycles
JEL-codes: C65; E32; E37

The recurrence of major world economic downturns and depressions, such as the one which began in 1929 and 2007, are linked forever with the name of the Russian economist Nikolai Dmitriyevich Kondratiev/Kondratieff[2] (Никола́й Дми́триевич Кондра́тьев; 4 March 1892 – 17 September 1938). If the crash of 2007/2008 is but a continuation of earlier economic major downturns in the 1970s, the 1930s, the 1890s and 1850s, then the prospects for the semi-peripheries in Europe's South and in Ireland, recently referred to in the economics profession as the "PIIGS countries" (Portugal, Ireland, Italy, Greece, Spain, see, for differing perspectives on this issue, Baglioni and Cherubini, 2010; De Grauwe and Ji, 2012; Erber, 2013; Hadjimichalis, 2011; Noren, 2011; Richardson, 2011; Wind, 2011) are even grimmer. And if we manage to show convincingly that these countries, in addition to suffering a "national" long-term downswing, are also caught in the long-term downturn of their once so successful convergence and catching-up process with the capitalist centers, then we realize how much of an economic and social *tsunami* we are now confronting in the European South.

Preamble

The background to this study is thus the current severe recession on the European continent and in several other regions of the world economy since the crisis, which began in 2007. Is it a world system coincidence or does it correspond to a world systemic regularity that parts of the global periphery crash at regular intervals? What does our social scientific knowledge tell us about the regularity of such crises, and what conclusions can one draw for the center-periphery relationship on a global scale and also for the probable future continued decline of these regions in Europe?

The aim of this article, which tries to summarize recent massive evidence[3] on the issue of long cycles, is to re-assess the entire question of Kondratiev/Kondratieff cycles within this larger center-periphery frame of reference. To facilitate future Kondratiev/Kondratieff cycle research, we have made hundreds of interpretations of our data series, i.e. time series plots, spectral periodograms and spectral density graphs, rolling correlations and regressions freely available on the Internet at

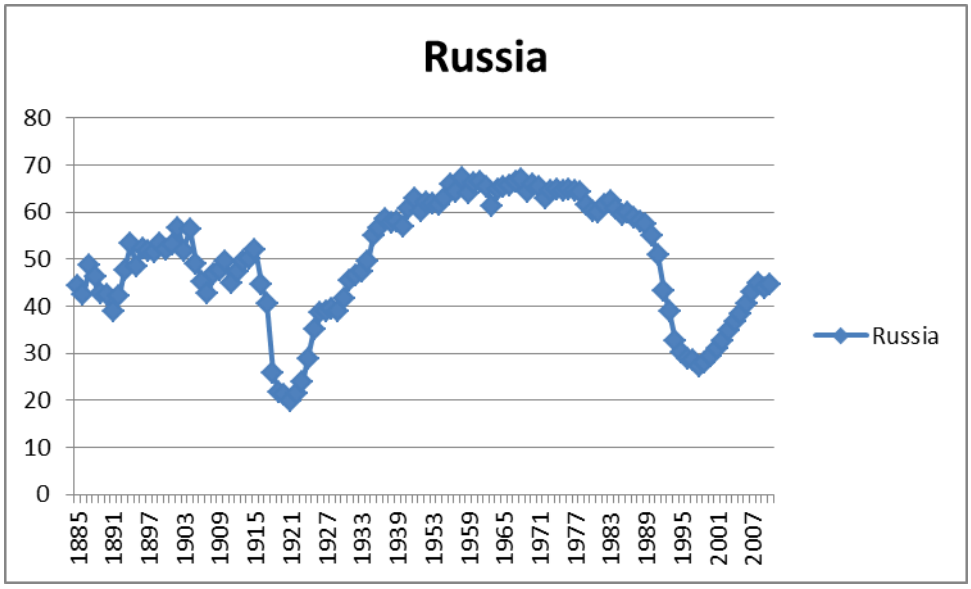
[2] Google scholar at http://scholar.google.at/schhp?hl=de lists 13800 entries with the spelling „Kondratieff" and 13400 with the spelling „Kondratiev". For this reason we have chosen to use, wherever possible, both versions.
[3] All the evidence and sources are available from http://uibk.academia.edu/ArnoTausch/Documentation-for-articles

http://uibk.academia.edu/ArnoTausch/Documentation-for-articles together with some important EXCEL file sheets.

Our analysis thus aims to be a fairly comprehensive test of the hypotheses about long cycles, associated with the name of Kondratiev/Kondratieff and Kuznets (Devezas, 2006; Solomou, 2013a, 2013b). Our work aims to link the issue of long cycles with the issue of economic convergence and divergence, because the startling discovery which one makes upon closer inspection of the trajectories of economic convergence in the 31 countries with the newly available Maddison data set since the 19th Century (Bolt and van Zanden, 2013) is that there are very strong cyclical ups and downs of the relative convergence of these countries in relationship to the real GDP per capita at the world level and in the capitalist system's leading economies, such as the United Kingdom and the United States of America, and not just in their own "national" growth rates and national economic cycles.

Kondratiev/Kondratieff was Russian, and a look at the relative position of his home country, measured by Russian/USSR constant GDP per capita in real purchasing power parity as a percentage of global average constant GDP per capita in real purchasing power parity just shows how dramatic these long-term "Tsunami waves" of global convergence/divergence with a duration of up to 70 or 90 years can be. Thus Russia fell two times within the time-span of 100 years from the comfortable position of the world's income middle class to the level of the world's lower class:

Graph 1: Former USSR/Russian constant GDP per capita in real purchasing power parity as a % of global average constant GDP per in real purchasing power parity. Time series from 1885 to 2010



Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010. The time series of real GDP per capita is expressed in constant 1990 $ for the following countries since 1885 (1942-1948 were omitted): Argentina; Australia; Austria; Belgium; Brazil; Canada; Chile; Colombia; Denmark; England/GB/UK; Former USSR/Russia; Finland; France; Germany; Greece; Holland/Netherlands; India; Indonesia (Java before 1880); Italy; Japan; New Zealand; Norway; Peru; Portugal; Spain; Sri Lanka; Sweden; Switzerland; Uruguay; USA; Venezuela. Source: http://www.ggdc.net/maddison/maddison-project/home.htm

An unexpected Kondratiev/Kondratieff revival might be happening again, this time perhaps via the important link between the theory of global income convergence, best captured by the works of the late Italian American world system researcher Giovanni Arrighi and the already mentioned Japanese economist Kaname Akamatsu. Since Akamatsu' s contributions appeared much earlier than Arrighi's, let us first mention here Akamatsu, and we will deal later on with Arrighi's contribution. In Akamatsu's theory, there are important links between his *"flying geese" (Gankō Keitairon)* model and Kondratiev/Kondratieff's ideas. This *"flying geese"* model was first proposed in a far-reaching and long tribute to Kondratiev/Kondratieff's theory published internationally in 1961. The most well-known tribute to Kondratiev/Kondratieff by Akamatsu, i.e. Akamatsu, 1961 (which was originally published in Japan already in 1937) specifically links the rise and decline of the global peripheries to the larger Kondratiev/Kondratieff cycle. The very essence of the *"flying geese"* and the K-cycle is that the two processes are intractably linked together, and that one cannot separate the one from the other.

Recent contributions in international social science have begun to approach these issues of the evolution of international convergence on the basis of the Maddison data since the 1870s, without, however, mentioning Akamatsu' s economic framework, and without employing econometric time series analysis techniques (Rasler and Thompson, 2009; Reuveny and Thompson, 2008). Giovanni Arrighi also seems to have been very conscious about this problem as well, which is now hitting with the devastating force of a social Tsunami his country of birth, Italy, and his world system theory clearly distinguished between the centers, the semi-peripheries and the peripheries, and highlights the fact that some semi-peripheries rise while others stumble on their development paths (Arrighi, 1995; Arrighi, Silver and Brewer, 2003). So nothing about the idea of linear progress and convergence, so popular in neoclassical economics.

Some time ago, we could read in the *New York Times:*

"The jobless rate among Europeans aged 15 through 24 in the euro area was 24 percent in March [2013], according to official figures, up from 22.5 percent a year earlier. In Greece, 59 percent of young people are unemployed, while in

Spain 56 percent of youths are without work. Portugal and Italy also have extremely high youth unemployment rates, in both cases above 38 percent, according to Eurostat, the E.U. statistics agency." (The New York Times, http://www.nytimes.com/2013/05/14/business/global/14iht-youthjobs14.html?_r=0

- Currently (i.e. June 2013), almost 27 million men and women in the EU-27 were unemployed.[4] Among the EU-Member States, the lowest unemployment rates were recorded in Austria (4.9 %), Germany (5.4 %) and Luxembourg (5.6 %), and the highest rates in Greece (27.0 %), Spain (26.8 %) and Portugal (17.8 %).

- The unemployed could claim a good share in the present decision-making body of the European Union, the Council, because their numbers are now so high that they already surpass the absolute population size of all the other EU-27 countries except "the big six" i.e. Germany; United Kingdom; France; Italy; Spain; Poland.

- What is even more alarming is that in spring of 2013 there were 5.627 million young persons (under 25) who were unemployed, of whom 3.624 million were in the euro area. The highest rates were recorded in Greece (62.5 %), Spain (56.4 %), Portugal (42.5 %) and Italy (40.5 %).

One of the reasons, why a thorough re-analysis of the entire issue of long cycles is necessary is the fact that classifying the cyclical ups and downs in the global economy since the mid-18th Century, leads even among the authors of the recent first *Kondratieff Waves Almanac* (Grinin, Devezas and Korotayev, 2012) to differing dates of the global economic troughs and sometimes also leads them to predict differing dates for the Kondratiev/Kondratieff cycle crashes to come:

Berry and Dean, 2012:[5] 1843; 1899; 1955; **2010.**
Helenius, 2012: 1787; 1842-1843; 1892; 1948; *?*
Korotayev and Grinin, 2012: 1780-1790; 1844-1851; 1890-1896; 1939-1950; 1984-1991; **2015-2020.**
Modelski, 2012: 1792; 1850; 1914; 1973; **2030.**
Perez, 2012: Recessive interval (turning points): 1771, 1829, 1875, 1908, 1971; Recession turning points: 1793-1797; 1845-1850; 1890-1895; 1929-1933; **2007.**
Thompson, 2012: Start-up phases: 1740-1763; 1792-1815; 1850-1873; 1914-1945; 1973-2000; 2030-2050; Schumpeterian troughs: 1827, 1883, 1937, **1990**

[4] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
[5] Rounded values from Figure 4, page 116. Please note that Berry and Dean, 2012, in Figure 2, page 109 talk about prices.

At a time of radical shifts in the market shares of major countries in the world economy and the often dramatic ascent of the BRICs countries and the concomitant – equally dramatic - decline of the West, especially Western Europe, and the very deep crisis in the European South, no other perspective on Kondratiev/Kondratieff cycles could be more up to date than the relationship between the K-cycle and the process of convergence and divergence in the world system (Gosh, Havlik, Ribero and Urban, W. 2009; Havlik, Pindyuk and Stoellinger, 2009).

The title of this article, its style and its way of presentation are meant as a concrete tribute to medicine, and here to the path-breaking article on cancer research by Hanahan and Weinberg, 2000, which received more than 10.000 quotations in world scientific literature, as documented by the Thomson Reuters *Web of Knowledge* since its publication more than a decade ago.

The spirit of the day in Europe is not as equally monolithic as the one existing in Russia in the 1930s, but also this time it is being maintained very uniformly that there is no alternative for the European periphery but to continue to be members of the Eurozone and to be subjected to the ***phlebotomy*** (bloodletting) of austerity packages under the auspices of the European Commission, while in reality the discovery of the organizing principles for rationalizing the complexities of the disease of stagnation and recession are being called for (in accordance with Hanahan and Weinberg, 2000, 2011).

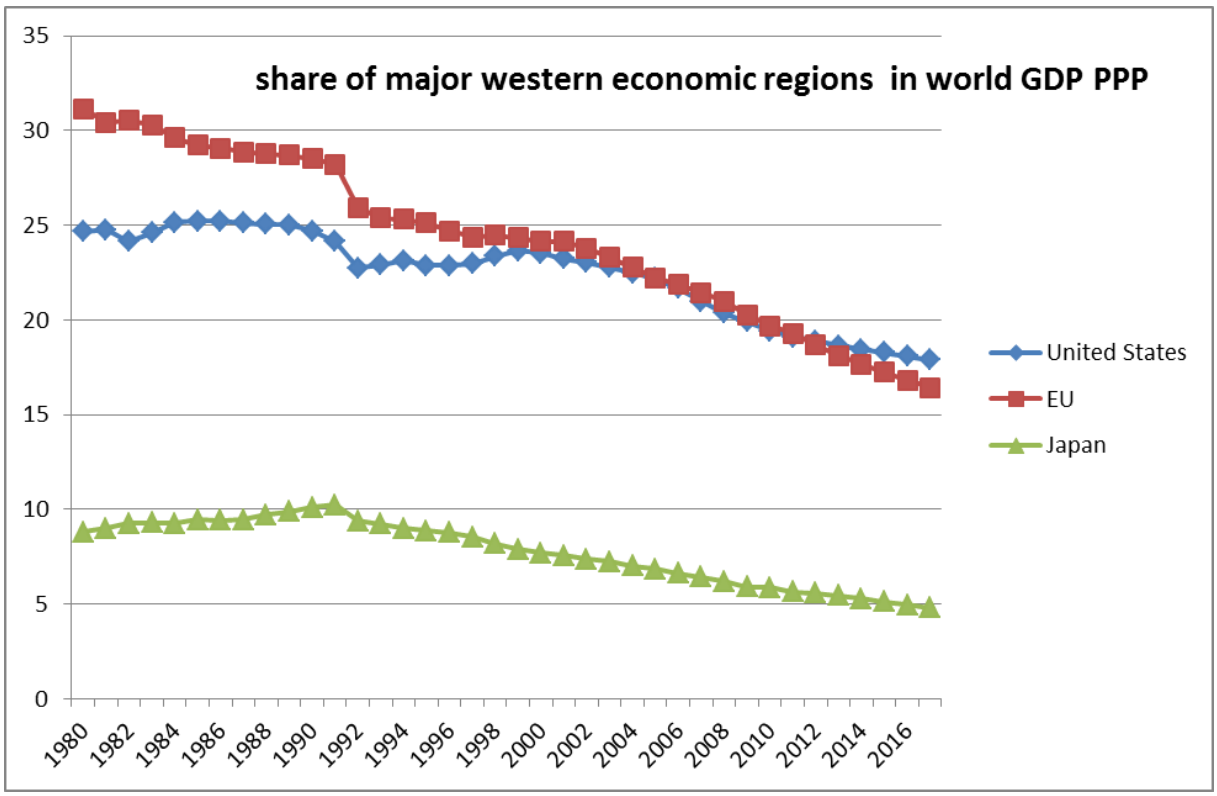
Background

In the single long-wave study that did appear in the flagship journal of the Wallersteinean world systems approach, the *Journal of World Systems Research,* Li, Xiao and Zhu, 2007, which is based on a global aggregate data analysis about movements of the Marxist concept of the rate of profit in the world economy, the authors came to the conclusion that between the mid-19th Century and 2005, in the UK and in the United States there were four long waves, and in Japan, since 1905, there were three such waves. The Euro-zone profit rate has, according to Li, Xiao and Zhu, 2007 tended to fall over the past four decades since 1963, and nearly halved between the early 1960s and the early 2000s**. That would suggest a profit-rate related cycle of around 30-40 years duration.**

Starting with the usual IMF World Economic Outlook data (as of October 2012), we immediately see that the share of the Western "triade" in global

purchasing power has been reduced dramatically. Even in their wildest anti-Western dreams, opponents of the West would not have been able to imagine what has come true today – the tremendous reduction of Western economic power within only three decades:

Graph 2: the observed and projected decline of the share of the United States, the European Union and Japan in global purchasing power, 1980-2016



Legend: our own calculations, based on IMF World Economic Outlook database, available at http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx . Microsoft EXCEL 2010 Graphs and Statistical Analyses.

As Table 1 shows to us, the strong decline of real incomes in many countries in the periods 1929-1933 and 2007-2011 has not been universal, and the data rather suggest that crises are also times of major shifts in the relative position of countries in the global economy. Table 1 underlines how dramatically different the experience of the European periphery is in comparison to the ascending BRIC countries. An no one can say that social sciences did not voice warnings about these tendencies already three decades ago, as the very necessary re-reading of Seers, Schaffer and Kiljunen, 1979 and Seers, Vaitsos and Kiljunen, 1980, 1982 will clearly suggest:

Table 1: comparing the real GDP per capita declines in the two crashes, 1929-1933 and 2007-2011 in the countries of the world system with complete data

	Crash 1929-1933 in %	Crash 2007-2011 in %	Trend value linear regression crash 1929->crash2007	Residual (= how well a country survived the 2007 crisis judged by the crash in 1929)
China	3,02	41,60	3,23	38,37
India	-3,85	25,27	3,88	21,39
Uruguay	-28,52	24,67	6,20	18,46
Sri Lanka	-13,92	23,17	4,83	18,34
Peru	-18,34	23,25	5,24	18,00
Indonesia	-13,71	20,29	4,81	15,49
Ecuador	-3,03	13,47	3,80	9,68
Poland	-24,89	14,59	5,86	8,72
South Korea	11,54	10,39	2,42	7,97
Brazil	-5,36	11,76	4,02	7,74
Colombia	4,78	9,58	3,06	6,52
Philippines	-3,18	10,12	3,81	6,31
Turkey	10,63	7,85	2,51	5,34
Chile	-35,28	11,11	6,84	4,26
Malaysia	-14,39	8,97	4,87	4,10
Bulgaria	6,19	6,82	2,93	3,89
Singapore	-13,88	7,31	4,82	2,48
Russian Federation/USSR	7,72	4,98	2,78	2,20
Costa Rica	4,93	4,48	3,05	1,44
Serbia - Yugoslavia	-15,92	4,89	5,02	-0,12
South Africa	-4,94	3,27	3,98	-0,71
Romania	2,78	2,37	3,25	-0,88
Nicaragua	-16,80	4,15	5,10	-0,95
Australia	-8,00	3,27	4,27	-1,00
Germany	-12,22	3,50	4,67	-1,16
Sweden	-0,74	1,16	3,58	-2,43

Switzerland	-6,70	0,41	4,15	-3,74
Czech Republic - Czechoslovakia	-16,11	1,22	5,03	-3,81
Honduras	-15,81	0,29	5,01	-4,71
Austria	-23,41	0,79	5,72	-4,93
Guatemala	-21,05	0,46	5,50	-5,04
Belgium	-7,38	-1,32	4,21	-5,53
Portugal	7,58	-2,73	2,80	-5,53
Mexico	-14,57	-0,71	4,89	-5,60
El Salvador	-11,43	-1,15	4,59	-5,74
Netherlands	-12,88	-1,22	4,73	-5,95
Japan	4,74	-3,08	3,06	-6,15
Hungary	-4,12	-2,36	3,90	-6,26
France	-10,00	-2,12	4,46	-6,58
Venezuela	-17,37	-1,83	5,15	-6,98
Norway	4,34	-4,48	3,10	-7,58
Canada	-33,46	-1,14	6,67	-7,81
Finland	-0,55	-4,42	3,56	-7,99
Denmark	4,26	-5,76	3,11	-8,87
United States	-30,76	-2,63	6,42	-9,05
United Kingdom	-4,11	-5,19	3,90	-9,09
New Zealand	-13,04	-4,85	4,74	-9,59
Spain	-9,24	-5,52	4,38	-9,90
Italy	-7,67	-6,60	4,24	-10,84
Ireland	-0,85	-13,85	3,59	-17,44
Greece	2,26	-15,46	3,30	-18,76

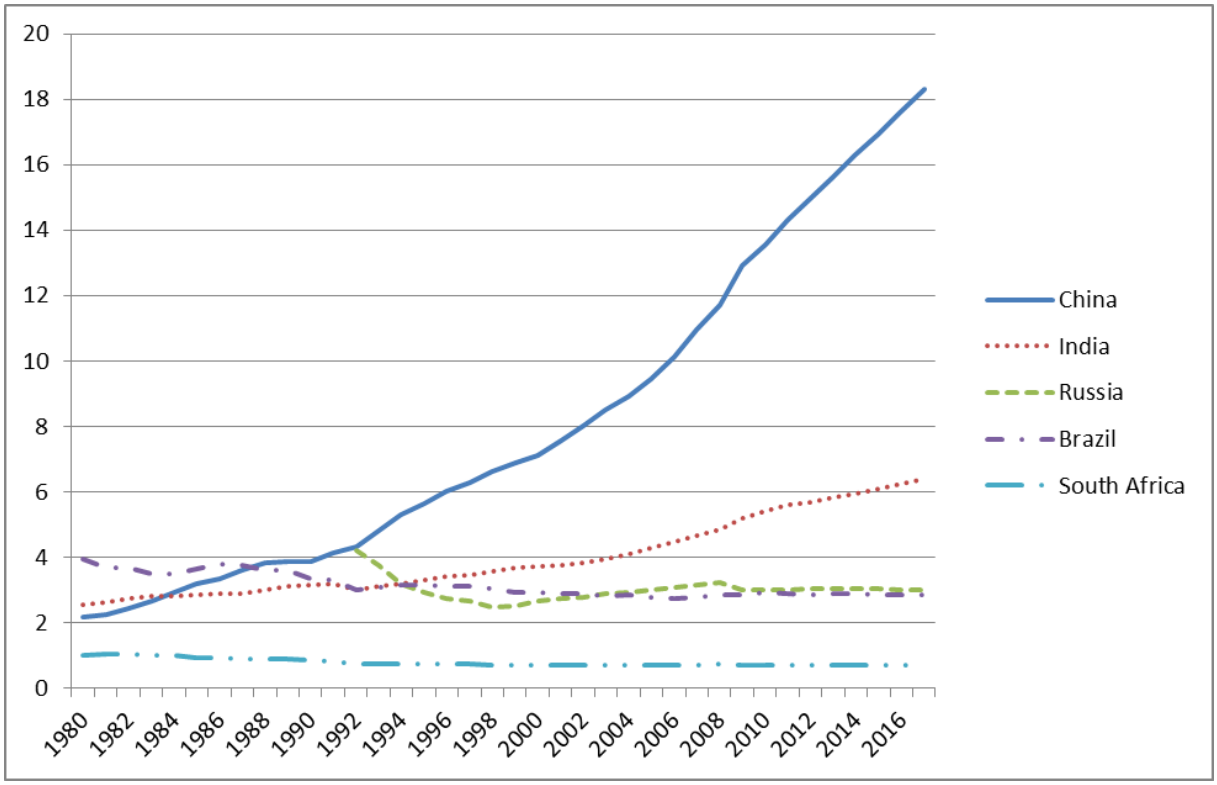
Note: Countries marked in blue color dived through the depths of the 2008 crisis better than had to be expected from the depth of the recession they experienced in the 1930s. Countries marked in yellow color are below this regression line.

2007-2011: GDP per capita, PPP (constant 2005 international $). GDP per capita based on purchasing power parity (PPP). PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2005 international dollars.
http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD

1929-1933: GDP per capita; (1990 Int. GK$). http://www.ggdc.net/maddison/maddison-project/home.htm

Equally astonishing is the contemporary rise of the importance of the two BRICS countries, China and India, in the international system evidenced by their share in the world purchasing power today:

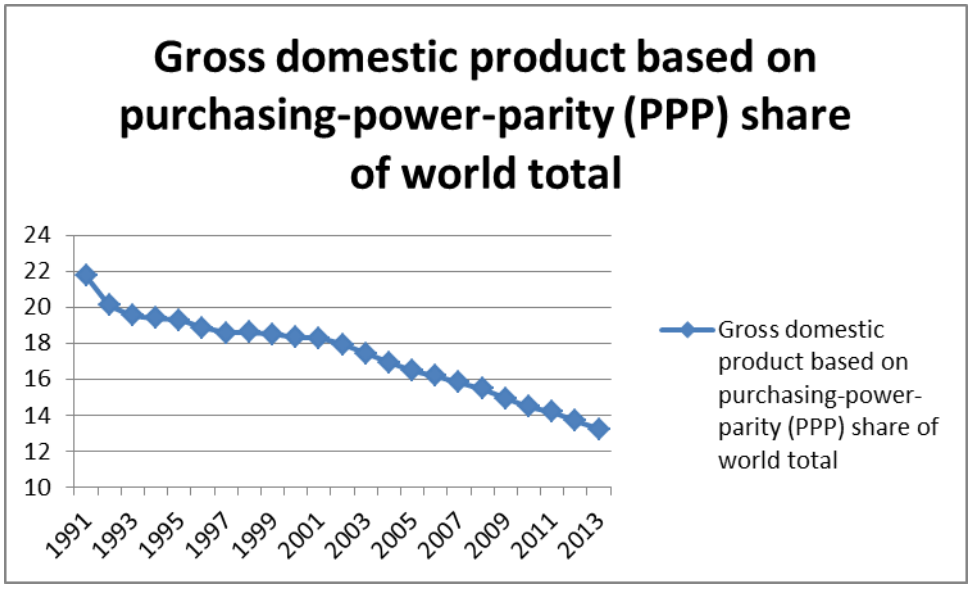
Graph 3: the observed and projected decline of China, India, Russia, Brazil and South Africa in global purchasing power, 1980-2016



Legend: our own calculations, based on IMF World Economic Outlook database, available at http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx .Microsoft EXCEL 2010 Graphs and Statistical Analyses.

Also, equally breathtaking is the decline of the Euro-area, which in the 1990s and early 2000s still hoped to become the world's leading economy by around 2010:

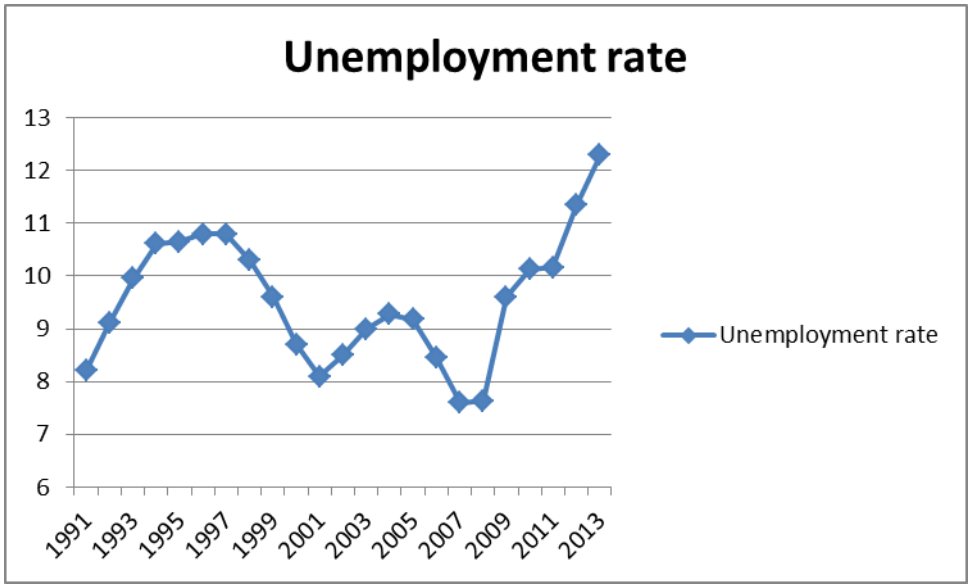
Graph 4: Eurozone – decline: share of the world purchasing power since 1991



Legend: our own calculations, based on IMF World Economic Outlook database, available at http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx .Microsoft EXCEL 2010 Graphs and Statistical Analyses.

Today, not economic ascent, but rising unemployment is the hallmark of the Eurozone:

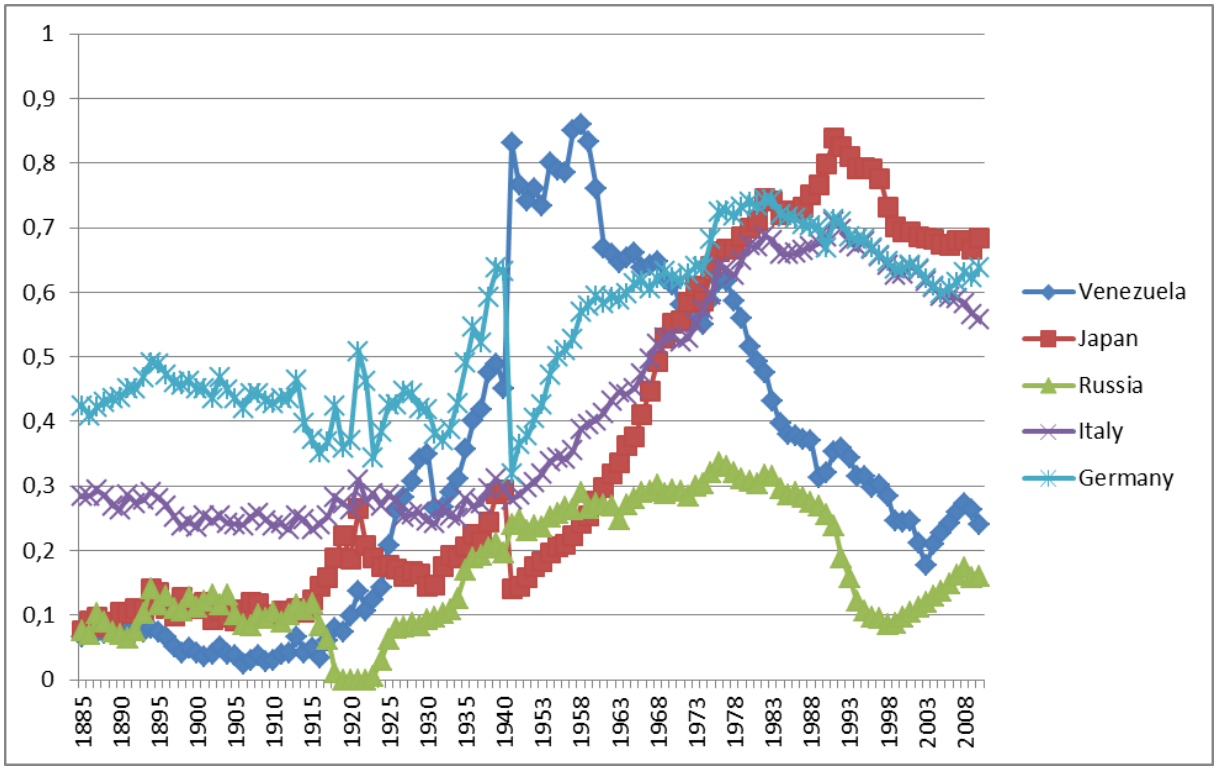
Graph 5: Eurozone – decline: unemployment rates since 1991



Legend: our own calculations, based on IMF World Economic Outlook database, available at http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx .Microsoft EXCEL 2010 Graphs and Statistical Analyses.

There is now some new light in international research on the hotly contested issue of economic convergence, so well-known from neo-classical contemporary economics (Barro and Ursúa, 2008; Jaeger and Springler, 2012; and Mankiw, Romer and Weil, 1992). In their truly remarkable article on all economic crashes and downturns since the mid-19th Century, based on their own version of an earlier edition of the Maddison data set, the neo-classical economists Barro and Ursúa, 2008 open the way for a new long-term, structural research approach to the question of K-cycles in the international system. According to the "iron law of convergence," mentioned by Barro, *inter alia,* in Barro, 2012, countries eliminate gaps in levels of real per capita GDP at a rate around 2% per year. Convergence at a 2% rate implies that it takes 35 years for half of an initial gap to vanish and 115 years for 90% to disappear. But as we will show in our article, this assumption is absolutely unrealistic, since the countries of the world experience – more often than not – dramatic implosions of their once so successful development path, as shown in Graph 6. In this sense, a good part of the experience of the countries of the world rather looks like the Russian experience of Graph 1, and not these optimistic assumptions of neoclassical economics.

Graph 6: The countries which experienced the strongest fluctuations in their convergence/divergence history as measured by a UNDP type yearly index of purchasing power



UNDP type index of purchasing power (purchasing power of the country minus lowest purchasing power in the year/(highest purchasing power minus lowest purchasing power in the year)

Without mentioning the legacy of Kondratiev/Kondratieff, Barro and Ursúa, 2008 reach the conclusion that for their country samples starting at 1870, a peak-to-trough method to isolate economic crises, defined as cumulative declines in consumption or GDP of at least 10 percent, yielded 95 crises for consumption and 152 for GDP in the world system, implying disaster probabilities of 3 percent a year, with a mean size of 21-22 percent declines and average cycle durations of 32 years. This entirely mainstream, neoclassical approach thus opens up the way for a new approach to the whole question of Kondratiev/Kondratieff cycles.

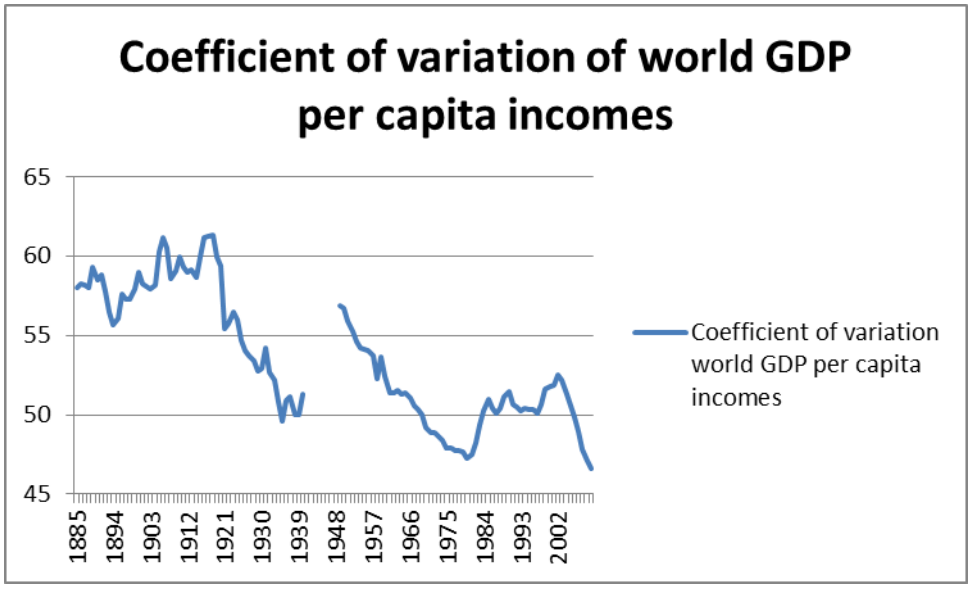
Latest advances in mainstream economic theory in the traditions of research, initiated by Barro and associates, like Gourio, 2012, also seem to be well aware of the kind of causal processes, which for a long time have been at the center of the debates about K-cycles, although also Gourio, 2012 does not even mention the name of Kondratiev/Kondratieff. For Gourio, 2012, a disaster is a

combination of permanent and transitory shocks to productivity, and a depreciation shock to capital, and shows that this simple approach allows replicating accurately the response of consumption to a disaster. An increase in the disaster probability affects the economy by lowering expectations, and by increasing risk. Because investors are risk averse, this higher risk leads, according to Gourio, 2012, to higher risk premia, and has significant implications both for business cycles and for asset prices: stock prices fall, employment and output contract, and investment especially declines.

The notable trend in the reception of Kondratiev/Kondratieff's works by Akamatsu is that he puts the "differentiation" of the world economy into the center of his theoretical developments (Akamatsu, 1961). The differentiation of the world economy leads to the rapid diffusion of new techniques to rising industrial nations, which starts with the import of new commodities by these nations. In time, techniques and capital goods are imported as well, and homogenous industries are being established. The uniformization of both industry and agriculture gave rise to the fierce and conflictive competition between Europe, the United States and Japan in the last quarter of the 19th Century. When an innovation occurs in some industry in an advanced nation, investment is concentrated there, causing a rise in the trade cycle. Innovation leads to an increase in exports, and the nation's prosperity creates and increases the import of raw materials and foodstuffs. Akamatsu sees a counter-movement in other parts of the world, centered on the rising production of gold, which, according to him, leads to an increase in effective demand and further stimulates exports of the innovating nation. In that way, world production and trade expand, prices increase and a world-wide rise in the long-term trade cycle results.

However, innovations spread from the innovating nations to other nations, leading to the development of industries in those countries, with the result of a conflictive relationship with the industries of the innovating nation. Exports of the innovating nation become stagnant, and on the world level, there is a tendency towards overproduction, prices turn downwards, and the rates of growth of production and trade fall. That what later K-cycle research tended to call the first, rising A-phase of the cycle will be according to Akamatsu a period of differentiation in the world economic structure, while the "falling period" (or B-phase of the cycle) will, Akamatsu argues, coincide with a process of uniformization in world economic structure. Graph 7 supports the contention by Akamatsu that the A-phases of long upswings in the world economy widen international inequalities, while the B-phases of long decline reduce constant real international GDP per capita purchasing power differences:

Graph 7: the coefficient of variation of constant real world GDP per capita incomes in purchasing power parity rate according to the Maddison data base (31 countries)



Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

In the 19th Century, Akamatsu sees the following major tendencies at work:

- The innovations of the first wave of the Industrial Revolution and the respective differentiation in the world economy
- The B-phase after the Napoleonic Wars brought about a re-uniformization
- Uniformization especially of European agriculture, innovation in iron industry after 1850; England's position as a prime exporter of railroad materials and textiles. The discovery of gold in California and Australia increases global demand
- The beginning of the decline around the time of the Franco-Prussian War 1870, rising mercantilism and imperialism

The third wave started its stagnation phase in the 1920's and ended with the Great Depression.

For Akamatsu, the characteristic structure of the Center-Periphery relationship is characterized by the fact that the underdeveloped nation will export primary products and will import industrial goods for consumption. Later on, an underdeveloped nation will attempt to produce goods which were hitherto imported, first in the field of consumer goods, and later on in the area of capital goods. As the fourth stage of the process, the underdeveloped nation will attempt to export capital goods. There will be a tendency of “advanced” differentiation in the world economy, however, because the capital goods industries in advanced nations will still advance further, giving rise to “extreme differences of comparative costs”. The wild-geese flying pattern will include three sub-patterns: the first is the sequence of imports – domestic production – exports. The second will be the sequence from consumer goods to capital goods and from crude and simple articles to complex and refined articles. The third will be the alignment from the advanced nations to backward nations according to their stages of growth.

However, there is a darker and more somber nature of these cycles as well – the condition of discrepancy will be met, Akamatsu argues, by means of imports, leading to discrepancies in the balance of payments, and the pressure to increase exports of primary products to improve the balance. Discrepancies will also lead to a shift of production away from domestic industries in the underdeveloped country towards the export sector; leading, in the end, also to problems of excessive supply capacities in the underdeveloped country etc.

At the end of the day, Akamatsu believes in a Hegelian dialectic between the three basic discrepancies, characterizing the process of development: the discrepancy of development, the cyclical discrepancy between the rich and the poor countries, and the structural discrepancy. At this stage however, Akamatsu does not formalize his arguments any further.

Arrighi, Silver and Brewer (2003) further developed these arguments, put forward by Akamatsu, and consciously link their theoretical advances also with the models implied in the works of Raymond Vernon (1966, 1971), which specifies the life cycle of a product as defined by introduction, growth, maturity, saturation, and decline. Profit-oriented innovations (and their impact on competitive pressures) cluster in time, generating swings in the economy as a whole from long phases of predominating "prosperity" to long phases of predominating "depression." Arrighi already foresaw that they not only cluster in time, but that they also cluster in space. There will be a spatial polarization of zones of predominating "prosperity" and zones of predominating "depression". Arrighi draws a specific parallel with Schumpeter's theory of innovations, Akamatsu’ s "flying geese" model (1961), and Raymond Vernon's "product-cycle" model (1966). For Arrighi, Silver and Brewer (2003), both models portray the diffusion of industrial innovations as a spatially structured process

originating in the more "developed" (that is, wealthier) countries and gradually involving poorer, less "developed" countries. But, according to Arrighi, Silver and Brewer (2003), the innovation process will be highly unequal, for it tends to begin in the wealthier countries. The residents of the countries where the innovation process starts have the best chances to win from this. **According to Arrighi, Silver and Brewer (2003), the process tends to begin in the wealthier countries because high incomes create a favorable environment for product innovations; high costs create a favorable environment for innovations in techniques; and cheap and abundant credit creates a favorable environment for financing these and all other kinds of innovations. Moreover, as innovators in wealthy countries reap abnormally high rewards relative to effort, over time the environment for innovations in these countries improves further, thereby generating a self-reinforcing "virtuous circle" of high incomes and innovations. The obverse side of this virtuous circle is a second tendency--the tendency, that is, for the poorer countries at the receiving end of the process to reap few, if any, of the benefits of the innovations.** For Arrighi, Silver and Brewer (2003), by the time the "new" products and techniques are adopted by the poorer countries, they tend to be subject to intense competition and no longer bring the high returns they did in the wealthier countries. Equally, there is for Arrighi, Silver and Brewer (2003) the destructive aspect of innovations in the tradition of Schumpeter at work. For Arrighi, Silver and Brewer (2003), poor countries are not necessarily more exposed than wealthy countries to the destructiveness of major innovations. Nevertheless, the greater mass and variety of resources that wealthy countries command nationally and globally will endow their residents with a far greater capacity to adjust socially and economically to the disruptive strains and to move promptly from the activities that innovations make less rewarding to those they make more rewarding. As a result, even when they do not initiate the innovations, wealthy countries tend to be in an incomparably better position than poor and middle-income countries to reap their benefits and shift their costs and disruptions onto others. In short, opportunities for economic advance, as they present themselves successively to one country after another, do not constitute equivalent opportunities for all countries." (Arrighi, Silver and Brewer, 2003)

Methodology and data

So, our empirical analysis of long cycles will be carried out in the necessary larger framework of center-periphery relationships, and in the framework of ascent and decline in the world economy. We will, as we already stated briefly, look anew into the existence of these larger cycles of the world economy and in the economic history of relative ascent or decline of the 31 center nations and

periphery nations, for which we now have available yearly real GDP per capita estimates from the middle of the 19th Century onwards until today. Our data for the 31 countries under scrutiny here are exclusively based, as we already briefly mentioned, on Angus Maddison's research; see Bolt and van Zanden, 2013, and Maddison, 2003, 2007. The considerable opportunities offered by Microsoft EXCEL 2010 for calculating long rows of percentage changes, relative ascent and decline, and rolling regressions and correlations over long distances of time were extensively used in our research endeavor (Perman and Tavera, 2005; Smith and Taylor, 2001; Tang, 2010).

Our data for world industrial production growth are an extension of the ample materials, first presented by Goldstein, 1988, updated by Tausch and Ghymers, 2007, relying on UNIDO data on world-wide industrial production growth from the mid-1970s to the turn of the millennium, now updated by open access figures from the United States Central Intelligence Agency. Our figures on major power wars were first presented by Goldstein, 1988, updated by PRIO data (major power wars) until 2002 (Tausch and Ghymers, 2007). Our data for the 31 countries under scrutiny here are exclusively based on Angus Maddison's widely received research; see Bolt and van Zanden, 2013, and Maddison, 2003, 2007. These countries currently make up approximately 40.8% of global population and 57.8% of global purchasing power. Appendix 1 and 2 further highlight our freely available data. At the website http://uibk.academia.edu/ArnoTausch/Documentation-for-articles readers can download the most important data and also hundreds of spectral density graphs, rolling correlations and regressions, autocorrelation analyses at the level of the world system and at the level of the 31 analyzed countries.

In the social sciences, there was already a very vast and divergent, often contradictory debate about Kondratiev/Kondratieff's ideas (Kondratieff, 1925, 1926, 1928, 1935). Bornschier, 1996; Goldstein, 1987, 1988, 2006; Husson and Louça, 2012; Korotayev and Grinin, 2012; Korotayev and Tsirel, 2010; Louçã, 1997; Louçã and Reijnders, 1999; Mandel, 1995; Marchetti, 1980, 2006; O'Hara, 1994, 2001, 2005; Perez, 1983; Schumpeter, 1939; and Thompson and Zuk, 1982 are the main studies, often quoted in favor of the Kondratiev/Kondratieff hypotheses.

Especially the idea of a deep and underlying link between the economic cycle and the global war cycle (if there is in reality any, we leave aside here), evoked the more recent attention not only of global social science, but also of very high-ranking western military leadership circles (NATO), which even organized a workshop in Covilha, Portugal, on February 14 to 18, 2005 on that issue (Devezas, 2006).

As de Groot and Franses, 2008, correctly remark:

"Over the years many different types of cycles have been hypothesized. Some well-known examples are the 3 to 4 year Kitchin inventory investment cycle, the 7 to 11 year Juglar cycle which focuses on investment in machines, the 15 to 25 year Kuznets cycle in migration and investment in construction and, of course, the 48 to 60 year Kondratieff cycle which mainly concerns structural economic development. Researchers like Goldstein and Modelski and Thompson claim that there are even longer 110 to 150 year cycles of hegemony." (de Groot and Franses, 2008: 303]

Flagship essays written by professional economists, using advanced econometric techniques of time-series analysis have come to very divergent and often negative assessments on the existence and relevance of *"long cycles"* of economics, let alone global politics. The mentioned essays, using advanced econometric methods, at least should name the publications by Diebolt, 2012; Diebolt and Doliger, 2006; Diebolt and Escudier, 2002; Silverberg, 2006; and van Ewijk, 1982; thus echoing the early criticism against the long 40-60 year *"Kondratiev/Kondratieff cycle",* already voiced by Garvey, 1943; and Kuznets, 1940. Even authors from the econometric research tradition, originally sympathetic to the general notion of Kondratiev/Kondratieff cycles, deny the existence of such fluctuations in the real economy, and rather talk about long swings of prices, like Berry, Kim and Baker, 2001; de Groot and Franses, 2008; Haustein and Neuwirth, 1982; and Van Ewijk, 1982; and prefer to talk about price cycles and not cycles of the real economy. The essay by Haustein and Neuwirth, 1982, is particularly interesting and also – in a way – is typical for the econometric mainstream results on the issue: spectral analysis was applied to long-time series of industrial production, energy consumption, inventions, innovations, and patents in order to reveal quantitative regularities in their behavior and/or in their interdependence.

Spectral analysis is a statistical approach for analyzing stationary time series data in which the series is decomposed into cyclical or periodic components indexed by the frequency of repetition. Spectral analysis falls within the frequency domain approach to time series analysis. The spectral density function plays the central role and it summarizes the contributions of cyclical components to the variation of a stationary time series (Diebold, Kilian and Nerlove, 2013; Vogelsang, 2013). Our website http://uibk.academia.edu/ArnoTausch/Documentation-for-articles contains a non-mathematical primer on spectral analysis with many results from various simulated long cycles of different durations, and with results for different types of stronger or weaker "nested" cycles in the more overall swings in the recent research tradition of Devezas, 2012 (pages 160-163).

Haustein and Neuwirth, 1982 made an attempt to identify logistics within those time series. According to them, in the long cycle of 50–53 years, no significant autocorrelation could be detected. Logistics exist only in three special periods for innovations and inventions. Nondominant long cycles do appear in the interaction between innovations, production, patents, and energy consumption. The investigation shed light on the causal structure of the innovation system. In particular, it revealed a significant influence of industrial production on patents with a lag of nine years. But this, certainly, is not what adherents of the K-cycle hypothesis would have hoped for? As Berry, Kim and Baker state in their 2001 essay:

"One of the troubling characteristics of the long-wave literature is the equation of 56-year long waves (which Kondratiev explicitly associated with financial indicators) with waves of economic growth. This is wrong. As we teach our students in introductory economics, growth and development are different. It is the clusters of innovation that produce economic development that are associated with the long downwave, per Schumpeter, but the pulses of infrastructure building, capital outlays, and economic growth that flow from these innovation clusters come with the 18-year rhythms of the building cycle. Much of the confusion in the long-wave literature arises from this confusion of the rhythms of inflation and growth, and of the concepts of economic growth and economic development." (Berry, Kim and Baker, 2001).

In turn, flagship empirical analyses, using advanced econometric techniques, including, but not exclusively, spectral analysis in favor of parts or the totality of Kondratiev/Kondratieff's contentions (i.e. 40-60 year swings in prices and the "real economy") are Bornschier, 1996; Devezas, 2010, 2012; Devezas and Corredine, 2001; Forrester, 1977; Goldstein, 1987, 1988, 2006; Korotayev and Tsirel, 2010; Metz, 2011; Sterman, 1985, 1986; Tausch and Ghymers, 2007; and Tausch and Jourdon, 2011. A somewhat surprising turn of evidence is found in the essay published by Weber, 1981, which maintains a cycle of themes and values in advanced societies. De Groot and Franses, in their analysis of the dynamics of national product, industrial production, employment, consumer prices, wages, interest rates, population, and stock market indicators for the USA, the UK and the Netherlands since the 19th Century, however sympathetic as they might have been to the notion of the K-cycle, come to the conclusion that in the USA there is a 40 year significant fluctuation of employment and a 60 year fluctuation of prices and interest rates, but not of GDP or industrial production. In the UK, the situation is similar, and also in the Netherlands. A Kondratiev/Kondratieff cycle – their essay suggests – is rather a cycle of employment, interest rates, and perhaps wages, but certainly not an economic growth cycle per se (de Groot and Franses, 2008).

Rainer Metz comes up with a similar, rather pessimistic conclusion in his 2011 essay:

"Besides these methodological implications, our results also have strong substantial implications. First of all it is noted that regular long waves of the Kondratieff type in UK GDP do not exist if outliers are modelled correctly. GDP movement in the UK displays a trend with a variable mean growth rate, a fairly irregular business cycle with a period of about 11 years and several infrequently occurring exogenous shocks with persistent as well transitory effects. Obviously long-run growth follows a smooth trend with a variable mean growth rate (slope). The shocks causing this slope show long-term up- and downswings but without any regularity. This offers interesting perspectives for future research. First of all, such analysis should be extended to long-run GDP series for other countries. Second, the analysis should be extended to series other than GDP and also to series covering the pre-industrial period. If the results obtained in this article for UK GDP are then confirmed, we strongly recommend that ''long waves'' should not be considered as oscillating trend cycles but as a kind of growth dynamics without any regularity and analyse them in the framework of (unified) growth theory." (Metz, 2011: 235)

In view of the often bitter controversies surrounding the idea of longer 40-60 year cycles, we have decided to re-assess the entire evidence, as far as it is possible, today, as the neat North American English saying goes, *"from scratch",* and using a plurality of different methods. As it is well-known, the initiator of modern historical real purchasing power per capita statistics, Professor Angus Maddison, never believed himself even for a second in the existence of Kondratiev/Kondratieff cycles (Maddison, 2007; Devezas, 2012).

To make matters worse, there is widespread disagreement even among members of the economics profession on the appropriate advanced quantitative methods to be used. A typical case in question is the already mentioned technique of spectral analysis, which for many was THE method par excellence to study long cycles just a few years ago. As Nathaniel Beck, a methodologist working in the field of political science, maintained still in 1991 with quite a strong dose of polemics against the mainstream of K-cycle-researchers:

"Why don't analysts of cycles always use spectral analysis? After all, it is exactly the technique designed to decompose a stationary series into its cyclic components, and its statistical properties are excellent. ***I think the prime fault of spectral analysis is that it usually fails to find long social cycles. My own feeling is that this is shooting the messenger, but such practice is not unknown.*** *" (Beck, 1991)*

The temptation to use this method, now that it is universally available in the IBM-SPSS standard statistical software, implemented at many Universities around the world, is great; and it is even greater because the IBM-SPSS software just requires you to enter the original data and to get the results by simply clicking the proper pre-installed windows.

But econometricians nowadays disagree on the continued appropriateness of this very methodology of spectral analysis as the adequate methodology to analyse data, testing the Kondratiev/Kondratieff hypotheses:

"Spectral analysis thus involves a regularity of movements that is not verified and which, in addition, is not essential in affirming that they exist. In fact, the spectral analysis method cannot truly prove or refute the existence of socioeconomic cycles" (Diebolt, 2012: 122).

Rainer Metz, another prominent theoretician of the art of econometric time series analysis, reaches in his 2011 article (Metz, 2011) the discomforting conclusion that no K-cycle in production exists, while in his book in 2008 (Metz, 2008) he was still more optimistic, with the troughs in world industrial production growth given in 1820, 1880, and 1955 (smoothed component, long waves, Figure 4.3, Figure 4.4 and Figure 4.5, page 165-166, Metz, 2008). Various filtering techniques and the (non)-elimination of the data for mining then, in 2008, did not change his final and resounding verdict on page 196 of his 2008 book that K-cycles in the real economy indeed exist; with tests provided not only at the level of the world economy, but also at the level of Danish, French, German, Italian, Swedish, UK, and US data. But in 2011, the very same researcher, Rainer Metz, reaches a more pessimistic verdict on the validity of the K-cycle hypotheses.

Our own humble approach will be very "down to earth". We first re-analyze the existence of world economic and political cycles and then proceed to show the results of different time series analyses for the 31 countries with fairly complete Maddison data since the middle of the 1880s, i.e. Argentina; Australia; Austria; Belgium; Brazil; Canada; Chile; Colombia; Denmark; England/GB/UK; F. USSR/Russia; Finland; France; Germany; Greece; Holland/ Netherlands; India; Indonesia (Java before 1880); Italy; Japan; New Zealand; Norway; Peru; Portugal; Spain; Sri Lanka; Sweden; Switzerland; Uruguay; USA; and Venezuela in Tables 3 and 4 of this paper and in the freely available Tables and Graphs in our Internet documentation (http://uibk.academia.edu/ArnoTausch/Documentation-for-articles).

We then look at what might be termed the Akamatsu-paradoxon (following Akamatsu, 1961). That is: the true nature of the K-cycle is only revealed by looking at the patterns of ascent and decline in the world economy over a long

time period at the same time. So we will evaluate with a plurality of quantitative techniques the evolution of the real income gap of the 30/31 countries mentioned in relation to the world average, in relation to the highest and lowest income country in each year between 1885 and 2010 and in relation to the dominant country of the capitalist world economy, i.e. the United States of America; and alternately, the United Kingdom, and also with a UNDP type income index. We also calculated simple percentages of real incomes per capita in the other countries of the world as compared to the unweighted world averages from the late 19th Century onwards. Thus we tested very exhaustively the hypothesis whether there is a "Kondratiev/Kondratieff cycle" of convergence or divergence in the countries of the world system, by applying spectral analysis, autocorrelation analysis and rolling regression/correlation analysis to these convergence data as well. By now at the latest, our readers will realize the massive character of evidence amassed in this project.

In writing this piece, we have decided to write a non-mathematical article, which should be readable by a larger public, and not just small circles of economists and econometricians. Just as Camm *et al.,* 1996, in their path-breaking analysis of heart rate variability, and Genzel and Cesarsky, 2000, in their astronomical analysis of extragalactic results from the infrared space observatory (two randomly chosen high-impact articles from the field of heart disease research and astronomy using spectral analysis), we use the very common standard mathematical-statistical procedure (spectral analysis), and we do not hesitate to use an entire array of other necessary statistical tests as well to assess the simple contention: are these deep crises in the capitalist world really a recurrent phenomenon, and is there at least the hope of some light at the end of the tunnel? Or are these lights, as the bitter Irish joke has it, only the headlamps of an approaching train? **Or are the French econometricians Diebolt/Escudier correct in their very harshly formulated assumption that the long-term economic cycles of 40-60 years duration are comparable to the monster of *"Loch Ness"* and that they never existed nor do they exist (Diebolt/Escudier, 2002)?**

Another methodological aspect can be mentioned only briefly: the question of filters in time series analysis. As the already mentioned renown German econometrician and economic historian Rainer Metz explained recently (Metz, 2011), there are three unresolved questions in the entire debate: First, what are valid indicators for the long-wave phenomenon? Second, what time period should be analyzed? Third, are long waves to be conceived as cycles around the trend or oscillations of the trend itself? Most of the traditional approaches to long waves, Metz, 2011 argues, see them as regular 40- to 60-year cycles oscillating around a non-periodic secular trend and superimposed by shorter oscillations such as Juglar and Kitchin cycles. Only this conception of long waves—introduced by Kondratiev/Kondratieff and supported by Schumpeter—

allows a statistical proof of the assumed regularity of long waves. But it requires:

"[…] a statistical apparatus that can isolate such oscillations in historical time series from other cycles, from the trend and from irregular oscillations, which belong neither to the trend nor to cyclical oscillations. Another possibility for formalising long waves is to see them as an endogenous part of the secular movement itself." (Metz, 2011).

But regarding such efforts, the great Polish political economist Michal Kalecki once remarked already back in 1968:

"The contemporary theory of growth of capitalist economies tends to consider this problem in terms of a moving equilibrium, which is frequently not checked for stability, rather than adopting an approach similar to that applied in the theory of business cycles. The latter consists of establishing two relations: one based on the impact of the effective demand generated by investment upon profits and the national income; and the other showing the determination of investment decisions by, broadly speaking, the level and the rate of change of economic activity. […] In fact, the long-run trend is but a slowly changing component of a chain of short-period situations; it has no independent entity, and the two basic relations mentioned above should be formulated in such a way as to yield the trend cum business-cycle phenomenon. It is true that the task is incomparably more difficult than in the case of another abstraction, that of the "pure business cycle" and, as will be seen below, the results of such an inquiry are less "mechanistic". This, however, is no excuse for dropping this approach, which seems to me the only key to the realistic analysis of the dynamics of a capitalist economy."(Kalecki, 1968)

The issue of filtering the data series requires therefore some further comments. Diebolt and Doliger (2006) recommend using the so-called Hodrick and Prescott filter (Hodrick and Prescott, 1996) to apply to the data series before spectral analysis is being performed, because:

"[…] in such a way it is possible a priori to consider that the spectrum of the filtered series is more representative" (Diebolt and Doliger, 2006: 41)

However, another authoritative recent source in time series methodology, Cogley, 2013, comes out against using such filters, a reason, why we altogether abandoned this procedure in favor of the more simple and easily understandable Maddison time series data transformation into annual straightforward percentage growth rates. **In addition to the methodological simplicity of this approach, it is also certain that political decision makers are primarily interested in annual GDP per capita growth rates, and not in filtered time series as such.**

Cogley, 2013 correctly emphasizes that economic models are by definition incomplete representations of reality. To relate business cycle models to data, empirical macroeconomists frequently filter the untransformed GDP per capita etc. data prior to analysis to remove the growth component. Cogley, 2013 mentions that until the 1980s, the most common way to do that was to estimate and subtract a deterministic linear trend. The desire to model permanent shocks in macroeconomic time series led

"to the development of a variety of stochastic de-trending methods. […] Another popular way to measure business cycles involves application of band-pass and high-pass filters. […] In the business cycle literature, the work of Hodrick and Prescott (1997) and Baxter and King (1999) has been especially influential. […] While data filters are very popular, there is some controversy about whether they represent appealing definitions of the business cycle. For one, there is a disconnect between the theory and macroeconomic applications, for the theory applies to stationary random processes and applications involve non-stationary variables. […] In practice, of course, measured cycles are not perfectly predictable because actual filters only approximate the ideal. But this means that innovations in measured cycles are due solely to approximation errors in the filter, not to something intrinsic in the concept. The better the approximation, the closer the measures are to determinism. How to square this deterministic vision with stochastic general equilibrium models is not obvious. […] Business cycle modellers also frequently abstract from trends. […] Contrary to intuition, trend-specification errors spread throughout the frequency domain and are not quarantined to low frequencies. That difference explains why the promising results on seasonality do not carry over to trend filtering. […] Finally, some economists question whether filter-based measures capture an important feature of business cycles. […] Trend reversion is a defining characteristic of the business cycle. […] Expected growth should be higher than average at the trough of a recession because agents can look forward to a period of catching up to compensate for past output losses. By the same token, expected growth should be lower than average at the peak of an expansion. […] Data filters are not for everyone. They are certainly convenient for constructing rough and ready measures of the business cycle, and they produce nice pictures when applied to US data. But some economists worry about the spurious cycle problem, especially in applications to business cycle models where the existence and properties of business cycles are points to be established." (Cogley, 2013)

After having been confronted with the fact that **obviously the leading experts in econometrics, whose expertise has been consulted for the aims of this article, seem to agree nowadays that no *"single shot"* best method to test the relevance of Kondratiev/Kondratieff's claims about a 40-60 year economic cycle exists** (see especially Diebolt, 2012; Diebolt and Doliger, 2006; Metz,

2008, 2011; in contrast to the earlier optimism about the relevance of tests of autocorrelation and spectral density analysis, inherent in Beck, 1991), **the author of this article arrived at the somewhat desperate conclusion that a *"forensic approach"* to long cycles, based on the application of several tests at once is perhaps more appropriate than the search for a rejection or confirmation of the K-cycle hypothesis by a single econometric method.** If the existence of the **monster at Loch Ness** is so highly contested, **different photographic devices, lenses, etc. must be used!**

Since the foundations of the application of all the methods in question to real existing time series of economic variables across time in several countries – especially spectral analysis, once considered being the best single approach – are nowadays questioned, such an application of a plurality of tests, ranging from tests of autocorrelation via periodograms from spectral analysis and the analysis of spectral density to the *"poor man's"* time series analysis methodology of *"rolling regressions"* and *"rolling correlations"* will be applied, not to forget the simple, straight-forward visual inspection of the initial data series in question.

Since the political class across the world is interested in concrete, tangible and easily readable results, we have chosen to opt for a straightforward additional choice, which will meet perhaps with criticism from the econometric time series analysis community:

- Reproducing the periodograms from spectral density and the spectral density analysis graphs in terms of periods and not frequencies without any logarithmic transformations to make the time periods of the cycles more visible to the general public reading this article

But our choice of a plurality of methods, based on autocorrelations, spectral analysis, and "rolling regressions"/"rolling correlations" would find the support of a vast number of studies in the field of time-series methodology, consulted for this article (Abadir and Talmain, 2002; Babetskii, Crowley, 2009; Komarek and Komarkova, 2007; Bartlett, 1946; Beck, 1991; Bloomfield, 1976; Box and Jenkins, 1976; Chu and Freund, 1996; Clark and West, 2006; Collard, 1999; Cryer, 1986; Dempster, 1969; Dittmar, Gavin and Kydland, 2005; Fuller, 1976; Junttila, 2001; Louçã and Reijnders, 1999; Quenouville, 1949; Silverberg, 2006; Zivot and Wang, 2006).

Our article is based on the standard IBM-SPSS-20 time series analysis tools, and all the used methods and their mathematical algorithms are fully documented to the international public in IBM, 2011. For that reason, we refrain from reproducing the mathematical formula, which interested readers might easily

download from the freely available IBM internet documentation, 2011 (if they are not very familiar with the mathematical formula anyway):

- As to **correlations**, we used the standard Pearson-Bravais correlation coefficients. In calculations not reported here also multivariate analyses (principal components) were used (Blalock, 1972; Dziuban and Shirkey, 1974; Harman, 1976, and Rummel, 1970). ***"Rolling"* regressions and correlations** are quite a powerful and straightforward instrument of the analysis of time-series and became more popular in recent times in the framework of financial market trend analysis and the necessity to have easily interpretable and reliable instruments of analysis at hand (Perman and Tavera, 2005; Smith and Taylor, 2001; Tang, 2010; Zivot and Wang, 2006, furthermore: Cook, 1977; Dempster, 1969; Velleman and Welsch, 1981). Throughout this work, we use 25 year (Kondratiev/Kondratieff cycles, 2x25 years = 50 years) and 75 year periods (war cycles, 2x75 years = 150 years) for the moving time window of regression/correlation analysis. We also used shorter windows to reproduce the Barro, the Kuznets and the Juglar cycles.

- Our analyses of **autocorrelation** and **cross-correlation** are based on the standard **IBM-SPSS ACF** and **CCF algorithm**, which are based on Bartlett, 1946; Box and Jenkins, 1976; Cryer, 1986; and Quenouville, 1949 **(autocorrelation)** and Box and Jenkins, 1976 **(cross-correlation).** Our graphs allow also for the inspection of longer time series. In presenting the graphs, we also took care of the better visibility of the significant results.

- The **IBM-SPSS spectral density routine**, which is based on the methodological developments, presented by Bloomfield, 1976, and Fuller, 1976 was performed by using the IBM-SPSS default options; the chosen window was most of the time the Tuckey-Hamming window with three periods. We also tested the validity of our main results with longer windows as well. As we demonstrate however in our non-mathematical primer on spectral density analysis, available at http://uibk.academia.edu/ArnoTausch/Documentation-for-articles, longer windows seem to distort the results even of simulated time series, where *ex definitione* we really know the length of the oscillations already beforehand, and they do not really help us to discover the real periodicity of the oscillations in question, especially when we are confronted with the already mentioned "Devezas" paradox of longer cycles and "nested" shorter cycles, presented in Devezas, 2012: 161. We use both the standard IBM-SPSS periodograms and the spectral density graphs, and add that standard econometric methodological literature usually maintains that the

periodograms are not the best estimator of the spectrum because it is not convergent (Diebolt, 2012).

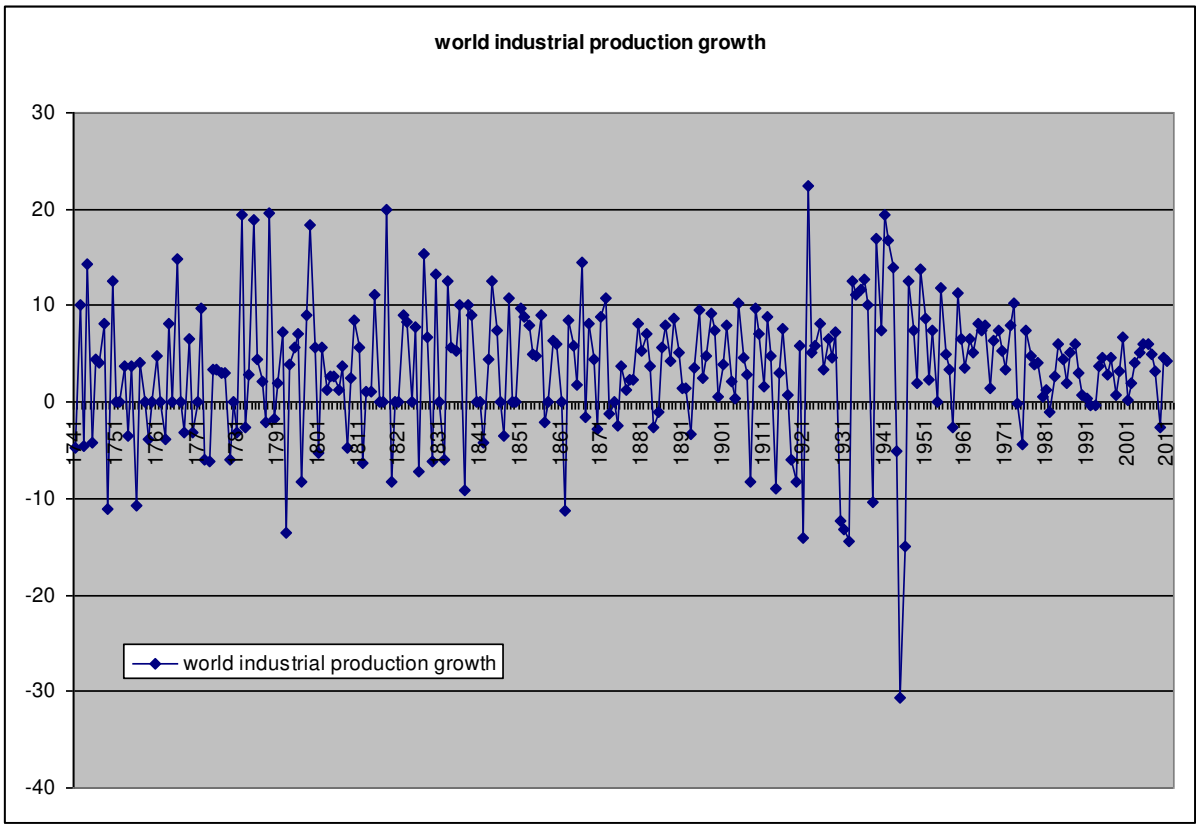
Results on the level of world industrial production growth since 1740 to 2011

Our results on the level of the world economy are a resounding "yes" for the hypotheses voiced by Kondratiev/Kondratieff, but with several additional qualifications and extensions. Reasons of available journal printing space do not permit us to present all the results of this project, so we concentrate on only the most important tendencies and invite the specialists among our readers to the website http://uibk.academia.edu/ArnoTausch/Documentation-for-articles with all the necessary data and results.

Kondratiev/Kondratieff was right in analyzing a 54 year cycle of the real economy as well, but there are other important cycles too; some of them very well known to social science research, others perhaps still more to be explored.

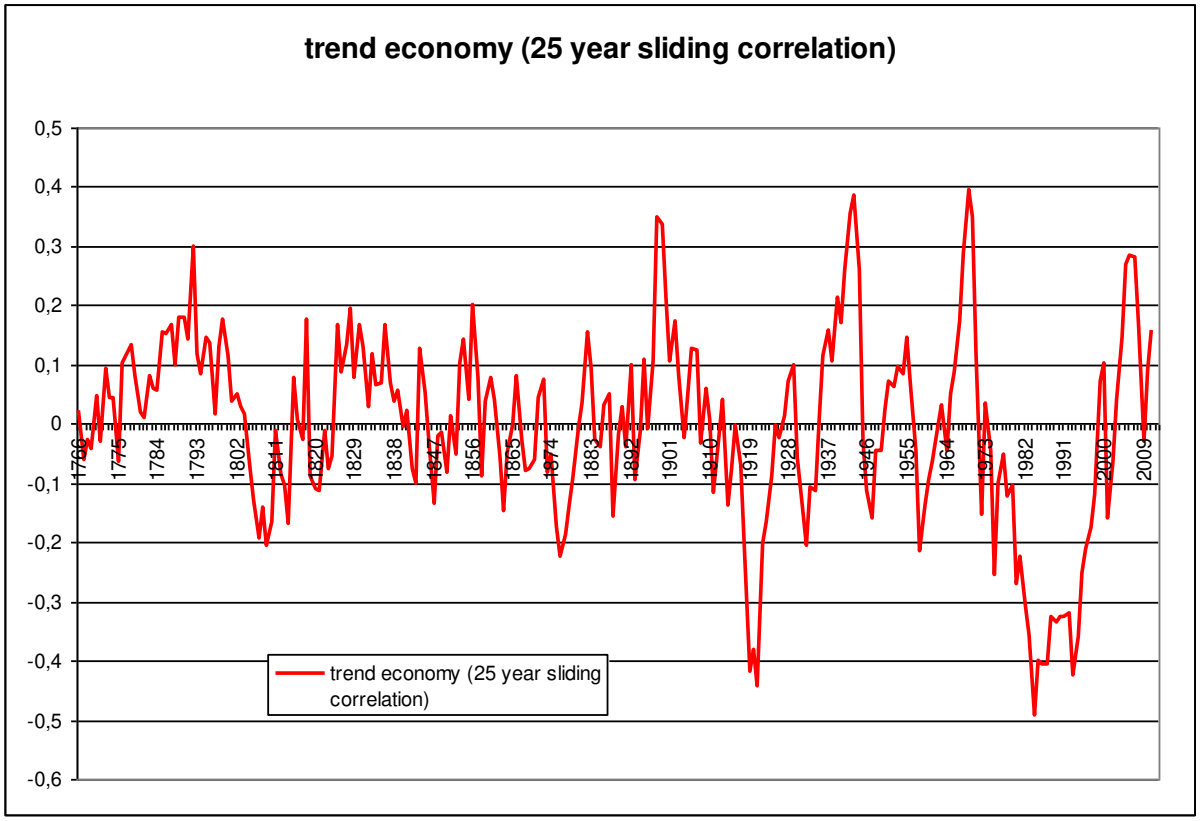
On the level of industrial production growth in the world economy, there is – parallel to the Kondratiev/Kondratieff cycle, a 140 year "logistic" cycle, first analyzed by Immanuel Wallerstein; and in addition, there is this new 36 year disaster cycle, correctly predicted by the neoclassical contemporary economist Robert Barro. For sure, there is also evidence – although somewhat weaker than expected – for a 22-23 year Kuznets cycle and the shorter, well-known Juglar cycles and Kitchin cycles. Graph 8 portrays the original data series from 1741 to 2011, and Graph 8 the result of our "rolling correlation" exercise.

Graph 8: world industrial production growth, 1741 – 2011 – the untransformed annual growth raw data



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles“* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

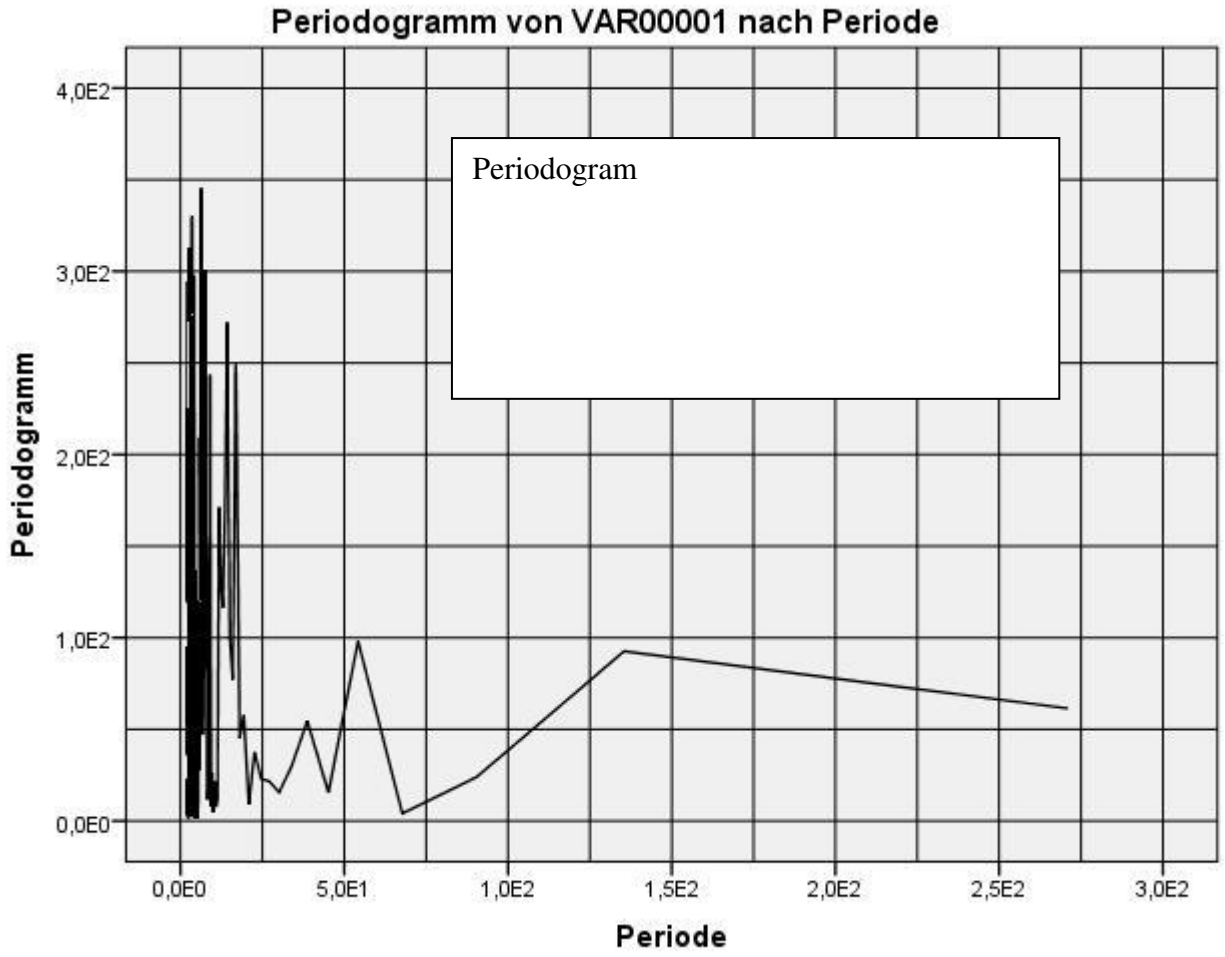
Graph 9: The "rolling" 25 year correlation analysis of these data reveals interesting results of the deeper underlying trends, 1741-2011:



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles"* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

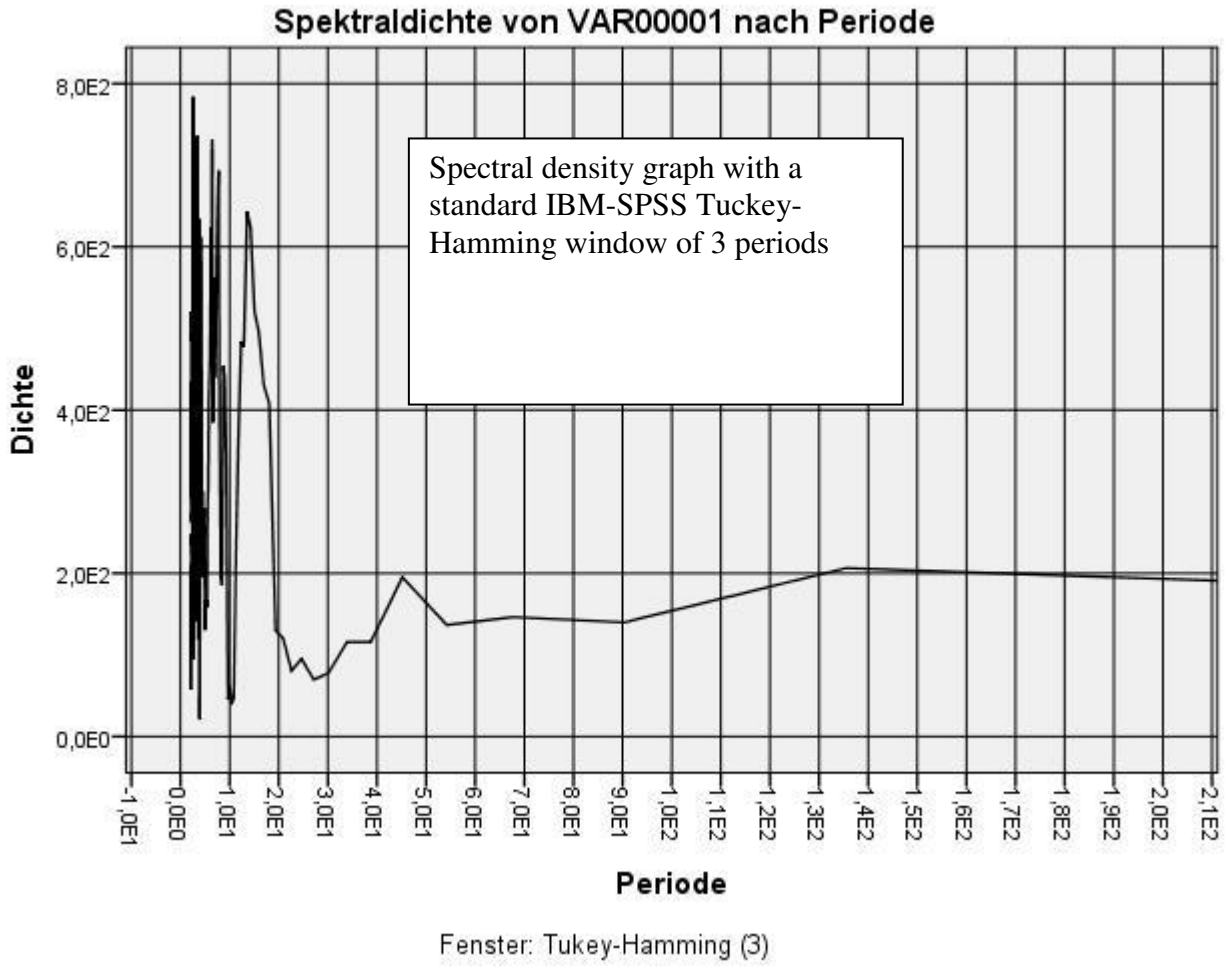
Graph 10 and Graph 11 reproduce the main results of the spectral analysis of the cyclical movements in the original, untransformed data. The Kuznets cycle, the Barro cycle, the Kondratiev/Kondratieff cycle and the Wallerstein logistic cycle are all confirmed in their existence. Appendix (3) mentions results, which relied on a prior 5-year moving average transformation of the original data in the tradition of the important Korotayev and Tsirel, 2010 study.

Graph 10: The periodogram from IBM-SPSS spectral analysis: short-term fluctuations, the Kuznets cycles, the Barro cycles, the Kondratiev/Kondratieff cycles, and a 130-140 year cycle (Wallenstein's "logistic cycle")



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles"* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

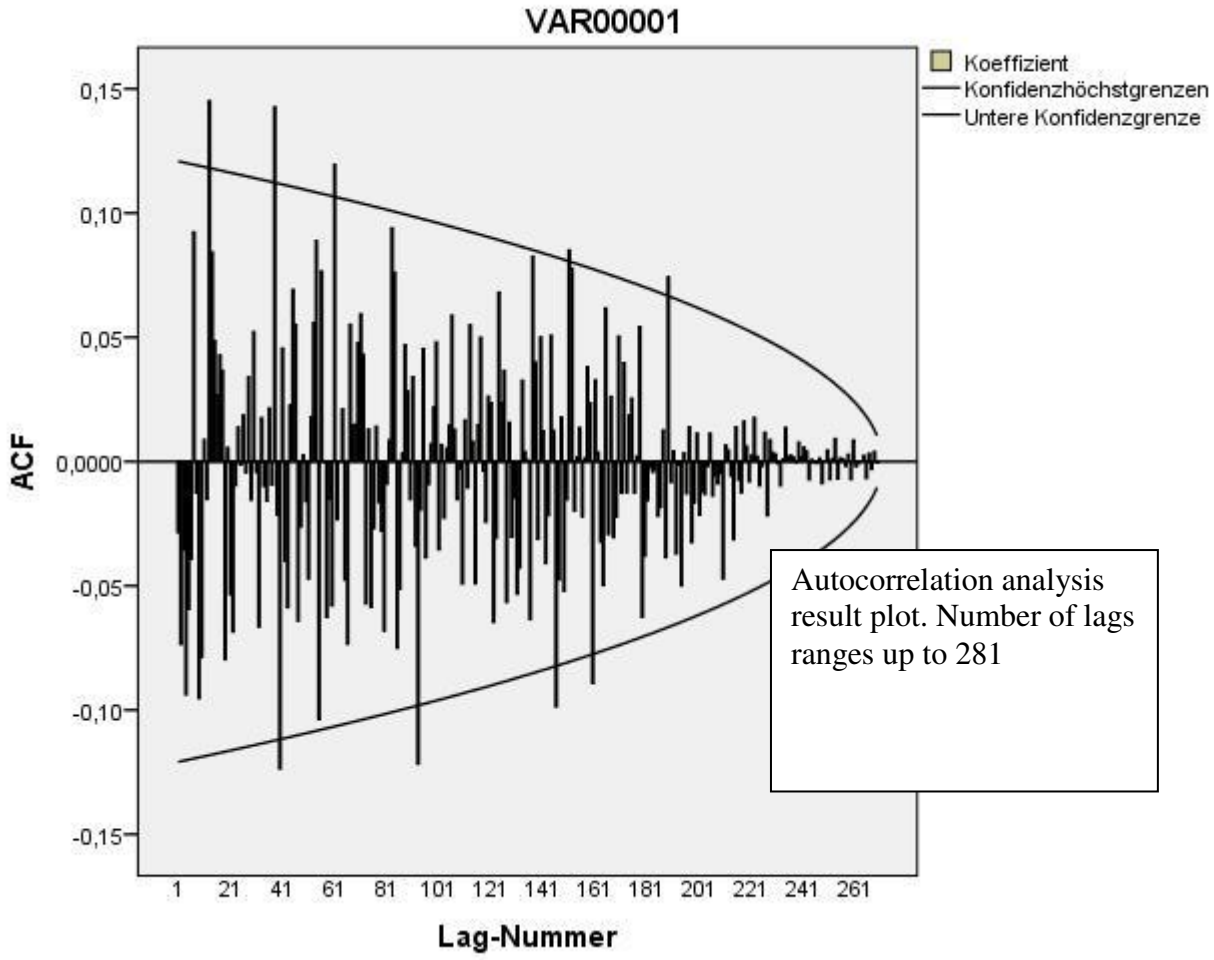
Graph 11: spectral density analysis of world industrial production growth, 1741-2011



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles“* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

Thus spectral density analysis of the untransformed global data indeed suggests that, on the world level, there are all the cycles at work, which have been discussed for decades now in economic research. Also autocorrelation analysis supports the claims of the K-cycle researchers:

Graph 12: autocorrelation analysis of world industrial production growth, 1741-2011

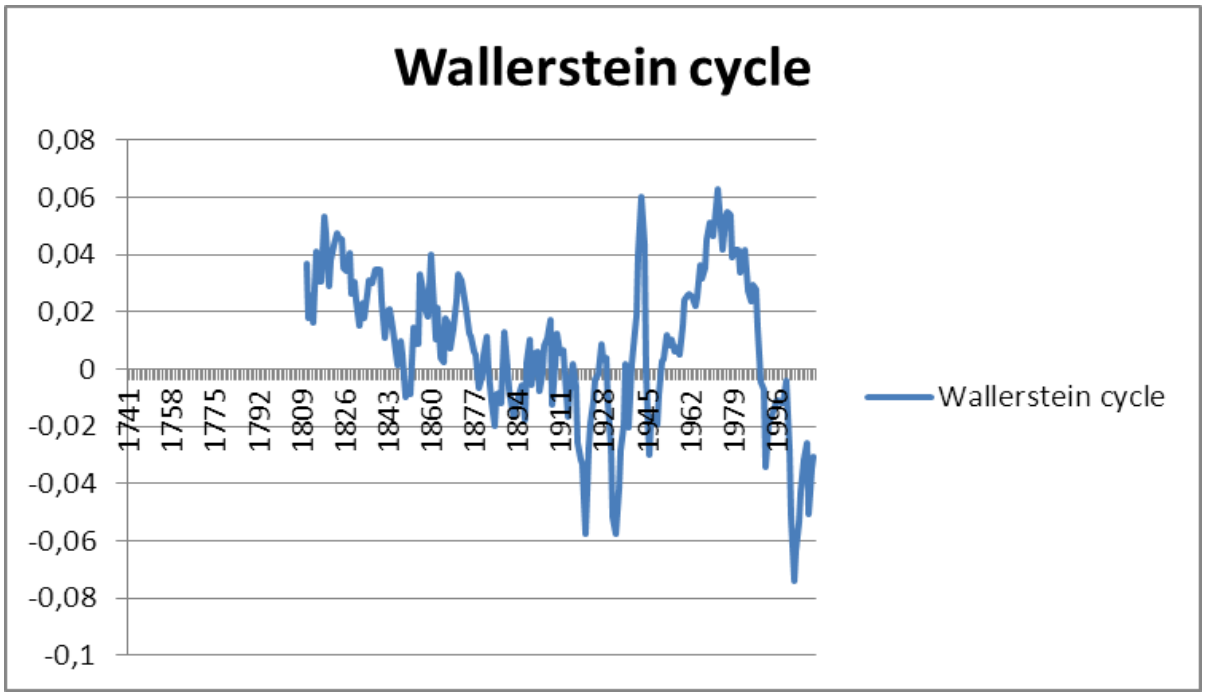


Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles"* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

Graph 13 draws the attention of our readers to a type of cycle, really neglected in empirical K-wave research: the Wallerstein logistic cycle, whose shape suggests that the current crisis heralds the beginning of a trough along the oscillations of this cycle. In terms of its statistical qualities, this cycle is about equal in strength to the Kondratiev/Kondratieff-cycle. There is strong reason to believe that the Wallerstein cycle is closely connected to the issue of leadership in the international system. The period from the end of the Napoleonic Wars to

the Great Depression in the 1930s was the period of the British dominance in the world economy, while the US hegemony evolved as a result of World War II and seems to be declining:

Graph 13: The Wallerstein logistic cycle – 75 year rolling regressions



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles"* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

In Appendix 3, we also document our results based on a 5-year moving averages research design, based on the original data. The 5 year moving averages design should serve to replicate the results, achieved by Korotayev and Tsirel, 2010, who also used such 5-year moving averages. **Also this exercise neatly reproduces our results mentioned above. The Kuznets, Barro, Kondratiev/Kondratieff and Wallerstein cycles re-appear in the periodogram for that research design (see also our periodogram for the periods 0 – 70 years with a wider spread); while there is also a confirmation of our hypothesis about the Kuznets, Barro, Kondratiev/Kondratieff and Wallerstein cycles in the spectral density graphs under the assumption of a window (Tukey-Hamming) of three periods.** In the spectral density diagram, the IBM-SPSS results suggest to talk about a cycle length of 45 years for the

Kondratiev/Kondratieff cycle, but in accordance with the periodogram, the analysis of autocorrelation suggests a longer cycle. The strength of the Wallerstein cycle is again shown to be considerable.

In the following, we will test the validity of another major contention of contemporary K-cycle research, the assertion of war cycles, made tremendously popular internationally by the works of Goldstein, 1985, 1987, 1988, 1991, 2006; although Goldstein in one of his later major works (Goldstein 2011) distances himself from the certain determinism which might have been evident in the international reception of his earlier work. And he now believes that humanity can be at the brink of abolishing war.

Results on the level of major power wars in the world system since 1495

Our data about major power war in the global system, as we stated, are an extension of the Goldstein 1988 data set about battle fatalities from major power wars (i.e. the 5 current permanent members of the UN Security Council + Germany) from 1495 onwards. From 1946 onwards, we used the PRIO, Oslo data, reported in Tausch and Ghymers, 2007, since the Goldstein data stop in 1975, while the PRIO/Tausch/Ghymers data cover the period 1946 – 2002. To make the battle fatality rates comparable over time and to correct for the advances of international weapons technologies as well as practices of general conscription since the French Revolution, which all caused an exponential increase of annual battle fatalities from major power wars in the 20th Century, we decided to calculate the fourth root of this variable.

Interested readers will find, however, similar other results at their disposal as well, which are based on the original untransformed annual major power wars battle fatalities data series, and on a series which is based on the 10th root of the battle fatalities variable. Our chosen transformation properly highlights the intensity of earlier terrible wars in human history, like the Thirty Years War and the War of Spanish Succession, and makes a comparison to the destructive character of the wars of the 20th Century more feasible than other mathematical transformations of the war intensity variable. War intensity under the formulation of the 4th root does not have a rising or falling trend over the time axis and thus better allows to analyze the real fluctuations of war intensity over time:

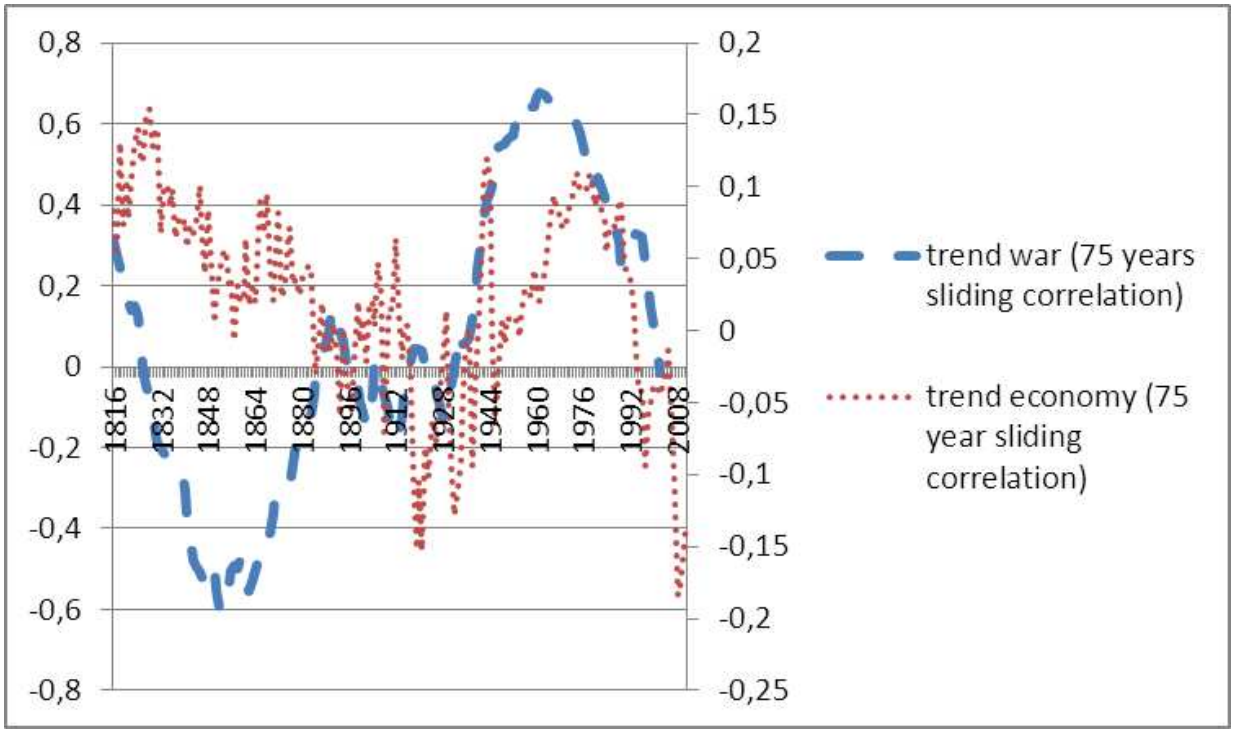
(1) **Untransformed war intensity:** $y = 0{,}4165x - 32{,}636$
$R^2 = 0{,}0487$

(2)**4th root war intensity:** y = 0,0002x + 1,7307
R^2 = 0,0005

(3)**10th root war intensity:** y = -0,0007x + 1,2304
R^2 = 0,0273

Commenting on the results, we would like to say that still there is a seemingly alarming connection between the 75-year rolling correlation trend of the war cycle and the 75-year rolling correlation trend of the Wallerstein economic cycle. Major world economic depressions have such a Tsunami force that they destabilize the entire international system as well. Graph 14 reproduces these trends, although we should also emphasize at this point that our econometric time series data, based on cross-correlation (CCF) reveal no significant direct connection between the war variable (the fourth root of battle fatalities from major power wars) and the global economic variable (annual growth of world industrial production).

Graph 14: The Wallerstein cycle and the trend towards warfare in the international system

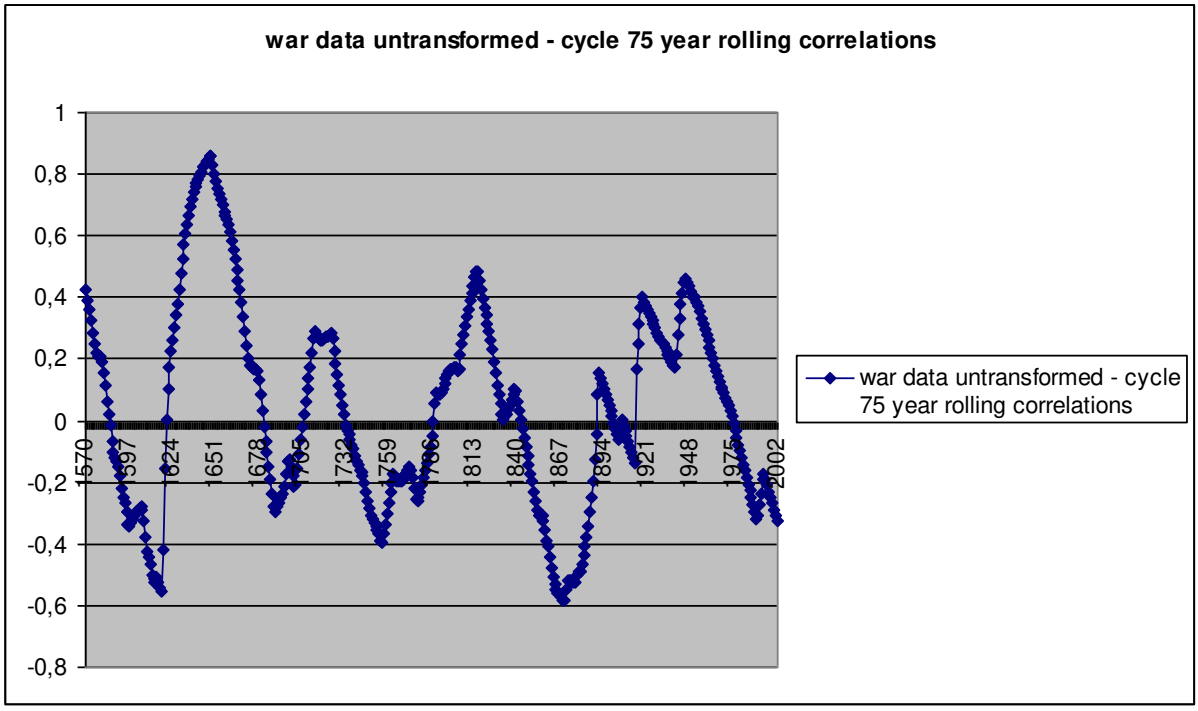


Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles"* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work.

Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

Graph 15 no shows the results from the rolling correlation analysis of the untransformed battle fatalities rate in history since the end of the Middle Ages, again showing – as Goldstein, 1988, so correctly emphasized – the peaks of the international conflagrations in the Thirty Years War, the French wars of the 18th Century, the Napoleonic Wars, and the German quest for global dominance, 1914-1945 and the evolution of the postwar order with the Korean and Vietnam Wars:

Graph 15: the cycle of warfare in the international system



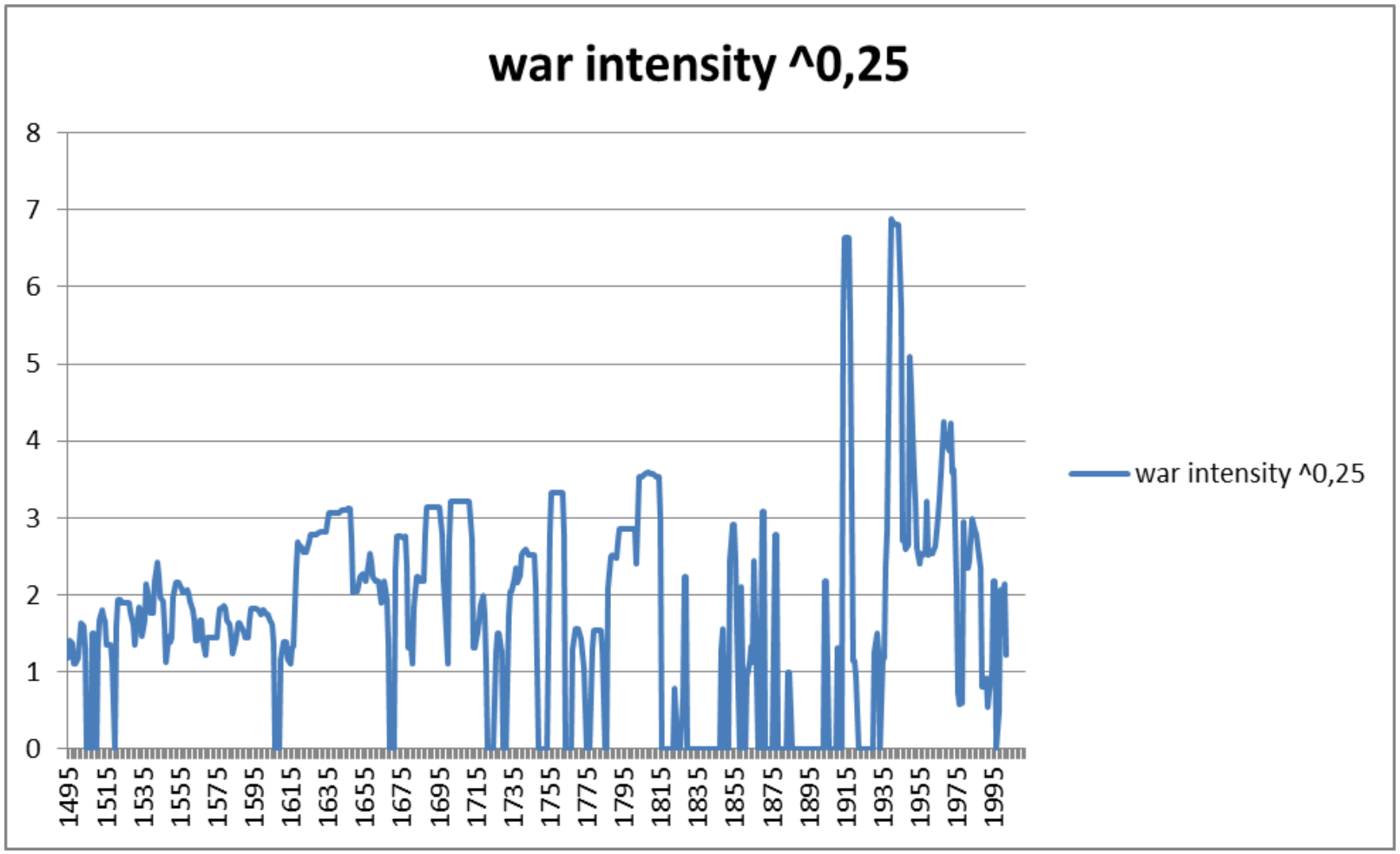
Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles“* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

Graph 16a and Graph 16b reproduces the time series plots, and Graph 17 and Graph 18 the results of the spectral analysis procedure, based on the 4th root of the intensity of warfare variable. Our data clearly support the hypothesis of longer waves of wars in the international system, which is part and parcel of

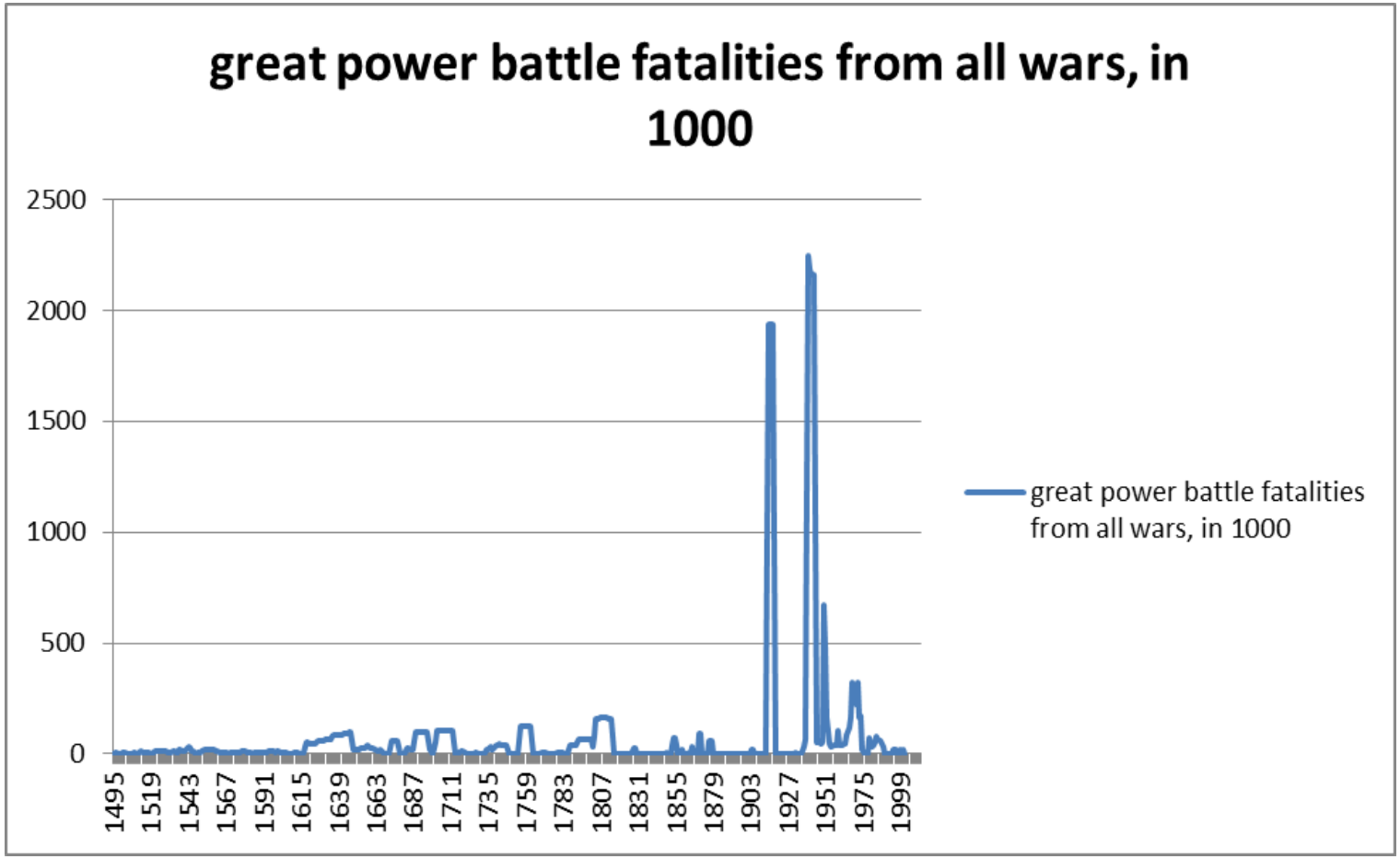
contemporary world system research (our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles“* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software).

Spectral analysis clearly reveals a 160 year cycle of global warfare, which was already evident in the earlier research by Goldstein, 1985, 1987, 1988, 1991, and 2006 on the subject. The *“illusion of cycles”*-type of literature, initiated by Beck, 1991, thus has to be refuted.

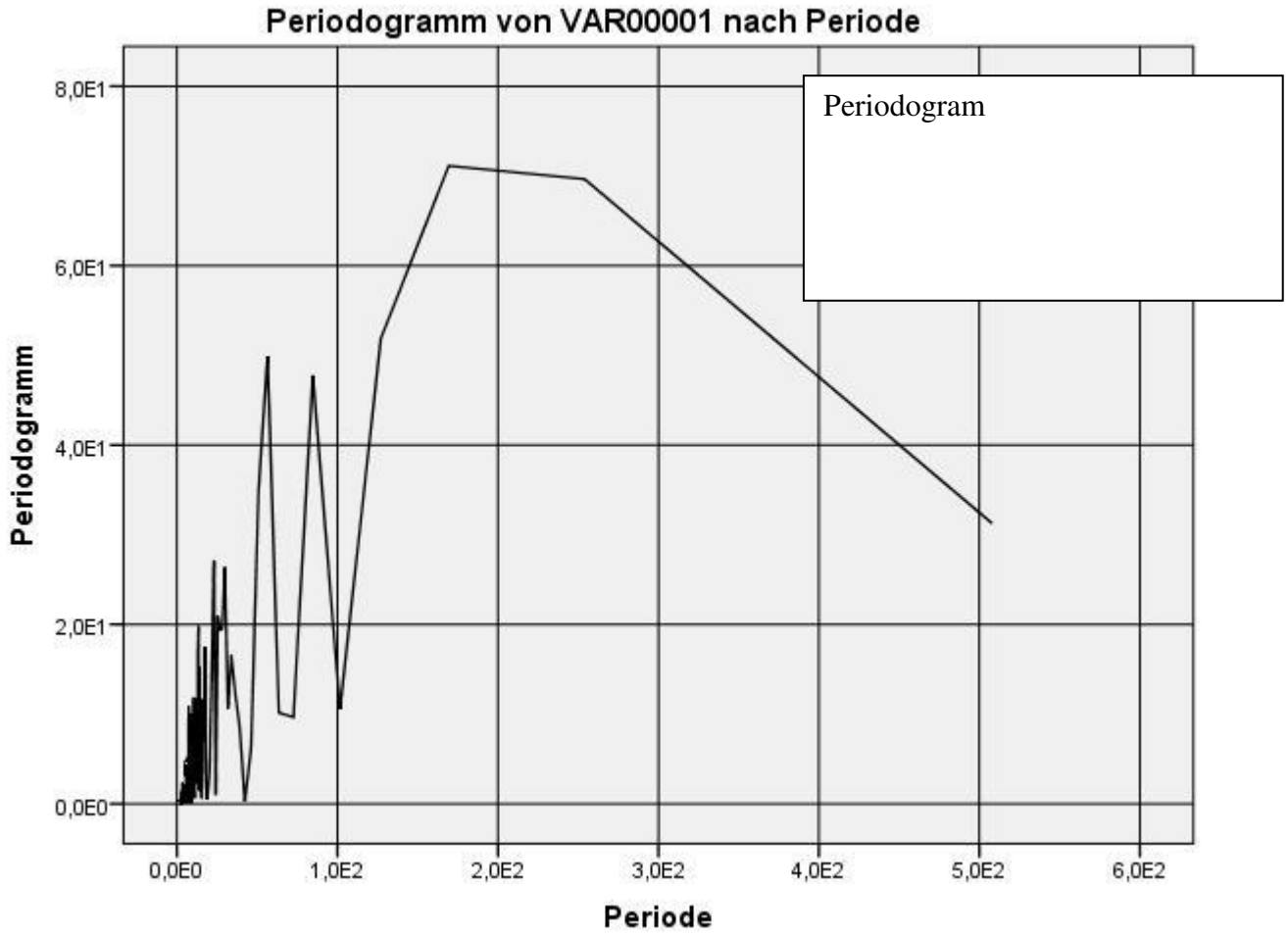
Graph 16a: The war cycle in the international system – intensity of major power wars^.25



Graph 16b: The war cycle in the international system – intensity of major power wars

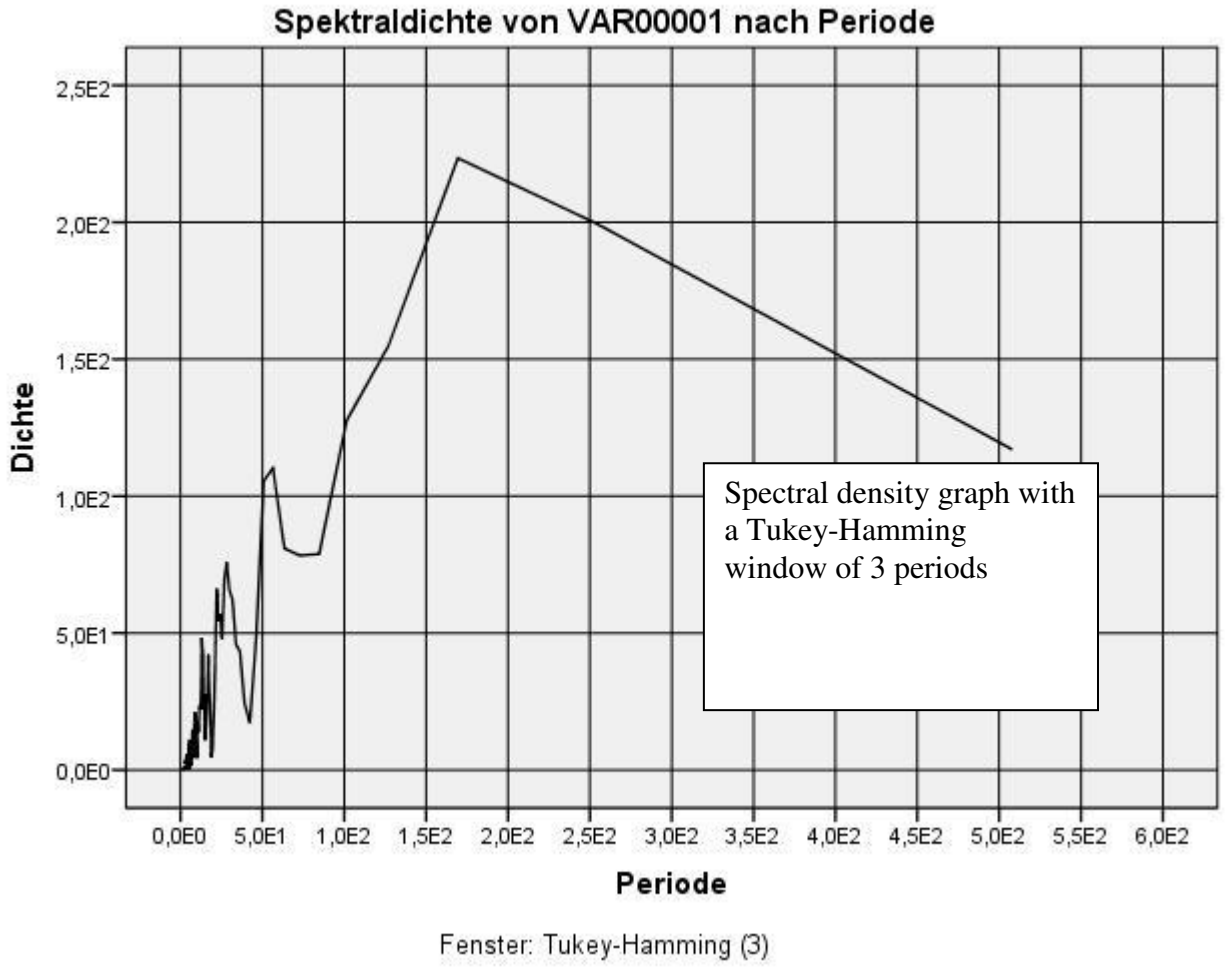


Graph 17: periodogram of war intensity since 1495



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles“* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

Graph 18: spectral density analysis of war intensity since 1495



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles“* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

In the following paragraphs, we will now look more closely into the results of the analysis of the Maddison data and the cyclical fluctuations of the Akamatsu type.

To present the original growth data or convergence data, the diagrams with the periodogram, the spectral density graphs, the autocorrelation plots and the rolling correlation plots would require for each of the 31 nations in the world 5 graphs for each country, that is to say 155 graphs for the Maddison economic growth data and 155 graphs for the Maddison convergence data, i.e. 310 graphs.

Of course this is way past any content limit in international social science journals. The author of this article does not preclude the possibility to present these results in a later book publication, but already now makes all these data and graphs available for global scholarship at http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. We will thus concentrate in the following on the interpretation of the main results.

New evidence on economic cycles in 31 countries of the world system and the discovery of the Akamatsu cycle

Tables 3 and 4 present the main results of our analysis of the Maddison data set. **Kondratiev/Kondratieff cycles** of around 60 years duration are most clearly visible in the periodograms **for Argentina, Canada, and Russia**. These periodograms and other econometric time series tests are available from http://uibk.academia.edu/ArnoTausch/Documentation-for-articles.

We also found evidence on the existence of longer cycles of more than 35 years in

Belgium
Chile
Greece
Netherlands
India
New Zealand
Spain
USA

while for the other countries, the spectral density analysis results reported in Diebolt and Doliger, 2006 could not be falsified.

The hypothesis, why there are such differences in cycle length between the various countries of the world, has to be found: a simple center-periphery or machinery exporter versus raw material exporter dychotomy does not apply, and also other factors, such as GDP per capita, education also would not explain the difference. An interesting hypothesis could be the application of Bornschier's dependency theory, centered around penetration by transnational capital in the different economies of the world and the weakness or **strength of *"national capital"*** (Bornschier and Chase-Dunn, 1985; Tausch, 2010). By and large, the role of transnational capital in the countries with longer cycles seems to be historically more pronounced than in the countries with shorter cycles, and the strength or weakness of the national bourgeoisie seems to determine the shortness or length of cycles. Tpyical cases, supporting such an interpretation would be the short cycles in France, Germany, Japan, the Netherlands, and

Switzerland versus the long cycles in Argentina, Canada, Chile, Greece, India, New Zealand, Spain and Russia.

Table 2: The Kondratiev/Kondratieff cycles in the countries of the world system

xx	**Cycle length (years) K-cycles, as suggested by the Periodograms**
Argentina	**20 and 60**
Australia	**20 and 30**
Austria	**20**
Belgium	**20 and 38**
Brazil	**20 and 30**
Canada	**18 and 58**
Chile	**15 and 38**
Colombia	**20 and 30**
Denmark	**15 and 30**
UK	**15 and 30**
Russia	**18 and 22 and 58**
Finland	**25**
France	**18**
Germany	**14 and 22**
Greece	**15 and 25 and 40**
Netherlands	**20 and 40**
India	**25 and 40**
Indonesia	**20**
Italy	**18**
Japan	**15**
New Zealand	**20 and 40**
Norway	**18 and 30**
Peru	**20**
Portugal	**30**
Spain	**40**
Sri Lanka	**15**
Sweden	**16**
Switzerland	**16**
Uruguay	**20**
USA	**20 and 40**
Venezuela	**20**

For the 31 nations trajectories, see http://uibk.academia.edu/ArnoTausch/Documentation-for-articles.

Appendix 4 and 5 as well as the numerous other background data, presented in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles highlight the Akamatsu cycles in 31 countries of the world economy since 1885.

In Table 3, we test the crucial relationships of the Akamatsu cycles and the cross correlation relationship between the Akamatsu cycle and the Kondratiev/Kondratieff cycle.

In Argentina, Austria, Italy, and Venezuela there are either clear linear overall convergences (Austria) or divergences (Argentina), and in Italy and in Venezuela, as well as in Russia, convergence had the shape of an inverted "U". **Akamatsu cyclical oscillations are shortest in Spain, and longest in Russia**, and the ascending order of implied Akamatsu cycle length is given by the following list of countries:

1. Spain
2. Uruguay
3. Denmark
4. Norway
5. Sweden
6. Chile
7. Canada
8. Finland
9. Japan
10. New Zealand
11. Portugal
12. Australia
13. Germany
14. Switzerland
15. India
16. Indonesia
17. Belgium
18. Brazil
19. UK
20. France
21. Greece
22. Netherlands
23. Peru
24. Sri Lanka
25. Colombia
26. Russia

Cross correlation analysis also reveals that in

Spain
Denmark
Finland
Australia
Greece
Netherlands
Argentina

there is a **clear priority of the cyclical Akamatsu movements over the economic growth rates,** while in the **other countries the Kondratiev/Kondratieff cycle determines the Akamatsu cycle.** Only further research can clarify whether these differences are to be explained by the structure of exports, the role of raw material exports in the economic processes etc. Thus in

Austria
Belgium
Brazil
Canada
Chile
Colombia
France
Germany
India
Indonesia
Italy
Japan
New Zealand
Norway
Peru
Portugal
Russia
Sri Lanka
Sweden
Switzerland
UK
Uruguay
Venezuela

there was a clear priority role of the Kondratiev/Kondratieff cycle over the Akamatsu cycle.

Table 3: The length of the Akamatsu cycles and the relationship between the K-cycles and the Akamatsu cycles in 30 countries of the world

	Cycle length (years) Akamatsu cycles, as suggested by the periodograms based on the original convergence data with the US	**time series cross-correlation analysis suggests the following causality**
Argentina	**no significant result**	**A->K**
Australia	**20 and 40**	**A->K**
Austria	**no significant result**	**K->A**
Belgium	**40**	**K->A**
Brazil	**40**	**K->A**
Canada	**30**	**K->A**
Chile	**25**	**K->A**
Colombia	**60**	**K->A**
Denmark	**20 and 30**	**A->K**
UK	**40**	**K->A**
Russia	**60**	**K->A**
Finland	**30**	**A->K**
France	**40**	**K->A**
Germany	**20 and 40**	**K->A**
Greece	**40**	**A->K**
Netherlands	**40**	**A->K**
India	**30 and 40**	**K->A**
Indonesia	**30 and 40**	**K->A**

Italy	**no significant result**	**K->A**
Japan	**30**	**K->A**
New Zealand	**30**	**K->A**
Norway	**20 and 30**	**K->A**
Peru	**40**	**K->A**
Portugal	**30**	**K->A**
Spain	**18**	**A->K**
Sri Lanka	**40**	**K->A**
Sweden	**20 and 30**	**K->A**
Switzerland	**25 and 40**	**K->A**
Uruguay	**20**	**K->A**
Venezuela	**no significant result**	**K->A**

For the 31 nations trajectories, see http://uibk.academia.edu/ArnoTausch/Documentation-for-articles

Table 4 highlights another important consequence of our research for the study of world system dynamics. In that Table, we highlight the **"convergence slopes"** of the countries of the world system with available data in terms of their GDP per capita distance, parity or superiority with the county, which dominated the capitalist world system right to the time of the Great Depression, **the United Kingdom.** Table 4 highlights the dramatic singularity of Keynesian postwar European reconstruction, and it also shows that since the 1990s, other mechanisms have set in, which clearly are to the detriment of countries of the European Union, and which benefit, among others, some countries of neoliberalism. We highlight these tendencies in Table 4 as well as in Appendix 6, **which presents the country graphs for the changing logic of global capitalist development since 1885**. These data are also a possible important input for future cross-national development research. Multiple regression designs on the explanation of economic growth and convergence today most probably will lead to different results for such explanatory variables as state sector influence or MNC Penetration during, say, 1954 and 1973 and 1974 to 1992 or 1993 to 2010. It is even feasible that each period has its own "correct" economic theory, with Keynesian strategies being most successful in the postwar period. We present the following list of the three best and worst performers for the periods:

Best convergence performers (reference point: purchasing power per capita in the United Kingdom):

cycle 1885-1913: convergence superstars:

Canada

Switzerland
USA

cycle 1914-1932: convergence superstars:

Venezuela
Switzerland
Holland/Netherlands

cycle 1933-1953: convergence superstars:

Venezuela
USA
Canada

cycle 1954-1973: convergence superstars:

Japan
Italy
Greece

cycle 1974-1992: convergence superstars:

Japan
Italy
Greece

cycle 1993-2010: convergence superstars:

USSR/Russia
Finland
Chile

In the same way, we can also analyze the worst time series performances in relationship to the United Kingdom:

Worst convergence performers (reference point: purchasing power per capita in the United Kingdom):

cycle 1885-1913: worst convergence failures:

Australia
Holland/Netherlands
Greece

cycle 1914-1932: worst convergence failures:

New Zealand
Chile
Australia

cycle 1933-1953: worst convergence failures:

Greece
Germany
Japan

cycle 1954-1973: worst convergence failures:

Venezuela
Uruguay
New Zealand

cycle 1974-1992: worst convergence failures:

Venezuela
Argentina
New Zealand

cycle 1993-2010: worst convergence failures:

Japan
Italy
Switzerland

Table 4 and Appendix 6 provide the more in depth-analysis of these strategically important questions:

Table 4: The Akamatsu cycle and convergence with the United Kingdom – convergence slopes in the Kondratiev/Kondratieff cycles, 1885-2010

	cycle 1885-1913	cycle 1914-1932	cycle 1933-1953	cycle 1954-1973	cycle 1974-1992	cycle 1993-2010
Argentina	0,519	0,961	0,154	-0,003	-1,734	-0,495
Australia	-0,474	-0,055	0,814	0,502	-0,404	-0,139
Austria	0,405	1,024	0,075	1,575	0,192	-0,317
Belgium	0,009	1,527	-0,222	1,255	-0,153	-0,552
Brazil	-0,159	0,290	0,258	0,279	-0,387	-0,219
Canada	1,360	0,125	2,427	0,632	-0,494	-0,435
Chile	0,400	-0,073	0,412	-0,243	0,042	0,376
Colombia	-0,130	0,728	0,126	-0,099	-0,106	-0,198
Denmark	0,707	1,631	0,229	1,363	-0,108	-1,143
USSR/Russia	0,195	0,456	0,552	0,472	-0,798	0,516
Finland	0,316	1,104	0,621	1,407	0,342	0,479
France	0,324	1,645	0,170	1,658	-0,281	-1,042
Germany	0,486	1,093	-0,847	1,468	-0,185	-1,061
Greece	-0,171	1,377	-0,878	1,767	-0,290	0,357
Holland/Netherlands	-0,229	2,032	-0,033	1,125	-0,615	-0,494
India	-0,021	0,014	-0,186	-0,078	0,041	0,276
Indonesia (Java before 1880)	-0,054	0,190	-0,309	-0,062	0,156	-0,044
Italy	0,069	0,597	0,184	2,005	0,489	-1,376
Japan	0,163	0,432	-0,524	3,545	1,230	-1,711
New Zealand	0,693	-0,765	1,199	-0,566	-1,229	-0,393
Norway	0,171	1,066	0,847	0,845	0,773	-0,504
Peru	0,306	0,651	0,200	0,072	-1,038	0,155

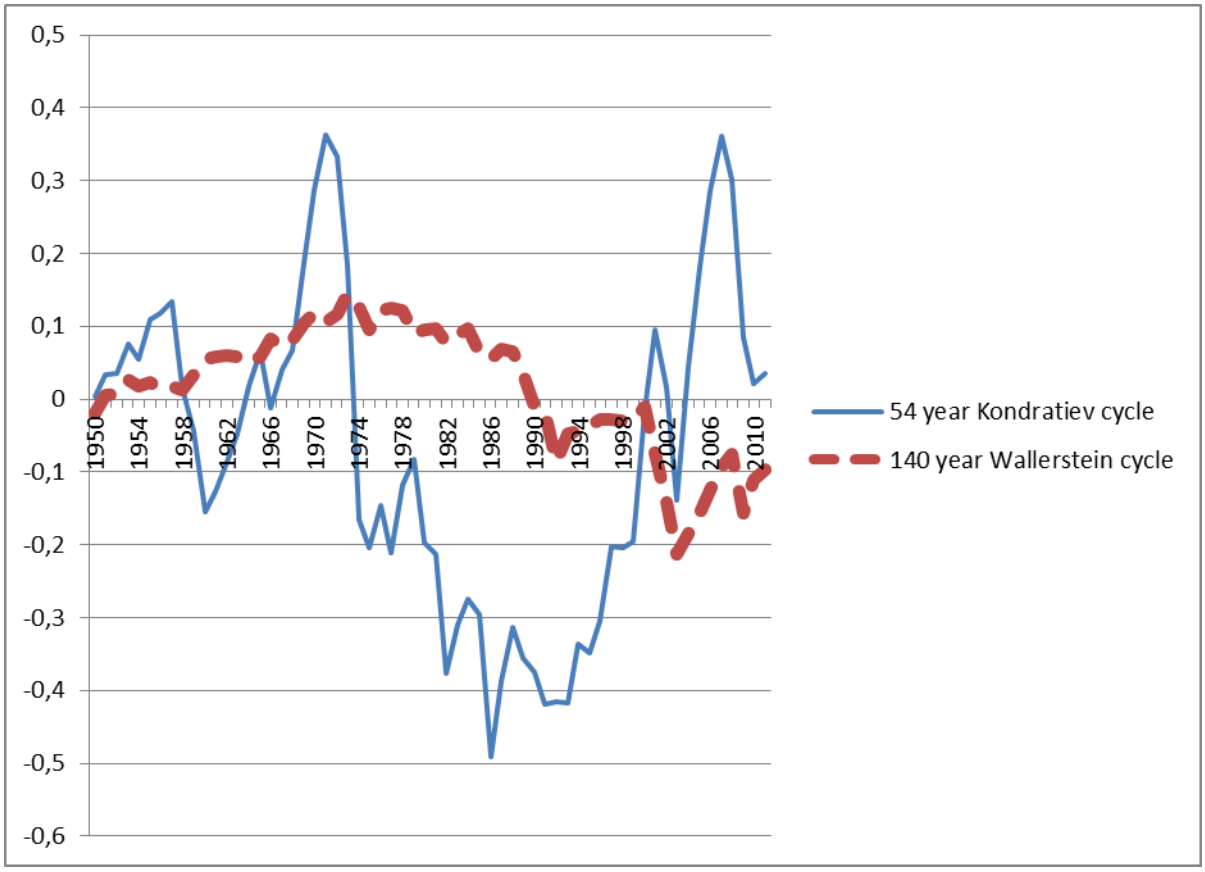
Portugal	-0,096	0,472	0,078	1,410	0,560	-0,544
Spain	-0,062	0,660	-0,337	1,630	0,181	-0,187
Sri Lanka	0,050	0,058	-0,170	-0,224	0,150	0,249
Sweden	0,595	1,334	1,250	1,104	-0,639	0,245
Switzerland	1,132	2,110	-0,239	0,887	-1,187	-1,213
Uruguay	-0,029	1,329	0,787	-1,495	-0,398	-0,219
USA	0,921	0,987	2,808	0,384	0,103	-1,007
Venezuela	-0,135	2,742	3,274	-1,510	-2,513	-0,711

For the 31 nations trajectories, see http://uibk.academia.edu/ArnoTausch/Documentation-for-articles

New insights into the Kondratiev/Kondratieff cycle dating game

Our research also sheds lights on the necessary reformulation of Kondratiev/Kondratieff cycle dating schemes and the assessment of the current crisis, which began in 2007. As we show in Graph 19, there is good reason to believe that the current crisis is NOT a Kondratiev/Kondratieff cycle trough (which hit the world economy in the late 1980s, culminating in the disintegration of Communist rule in Eastern Europe and the end of the Soviet Union), but a downswing phase of the 140 year Wallerstein cycle:

Graph 19: the 54 year Kondratiev/Kondratieff cycle and the 140 year Wallerstein cycle since 1950



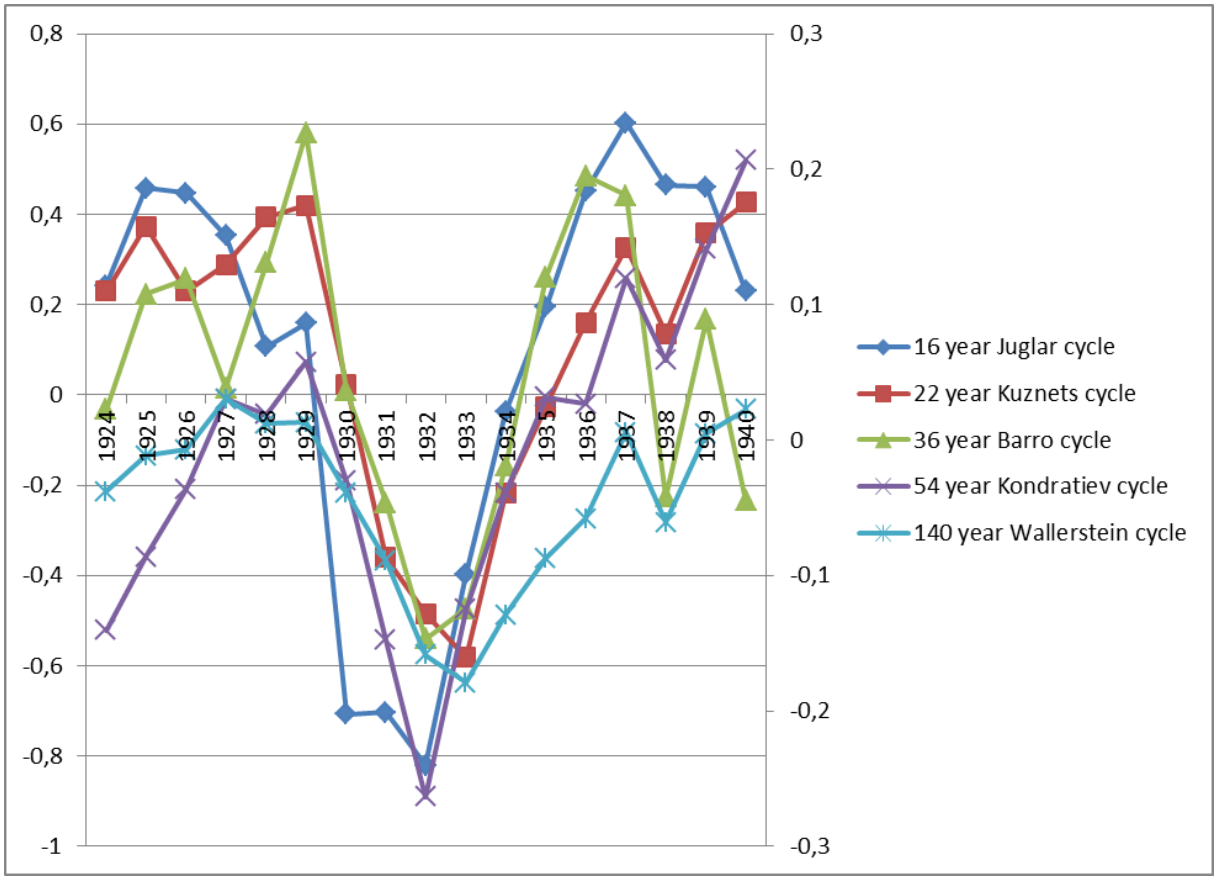
Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles"* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

Graph 20 and Graph 21 show that the big difference between the current crisis and the Great Depression starting in 1929 is that in 1929, ALL cycle troughs coincided, while in the crisis of 2007, such an occurrence of ALL the cyclical troughs at once is just not the case. This is the main reason why the current crisis is far from being the *"final crisis of capitalism"*, and why social science today can learn a lot from Kondratiev/Kondratieff's stubborn resistance to similar conceptions advanced at the time of the Great Depression.

Graph 20: The unique character of the Great Depression, 1929: all cycles hit the world economy at once

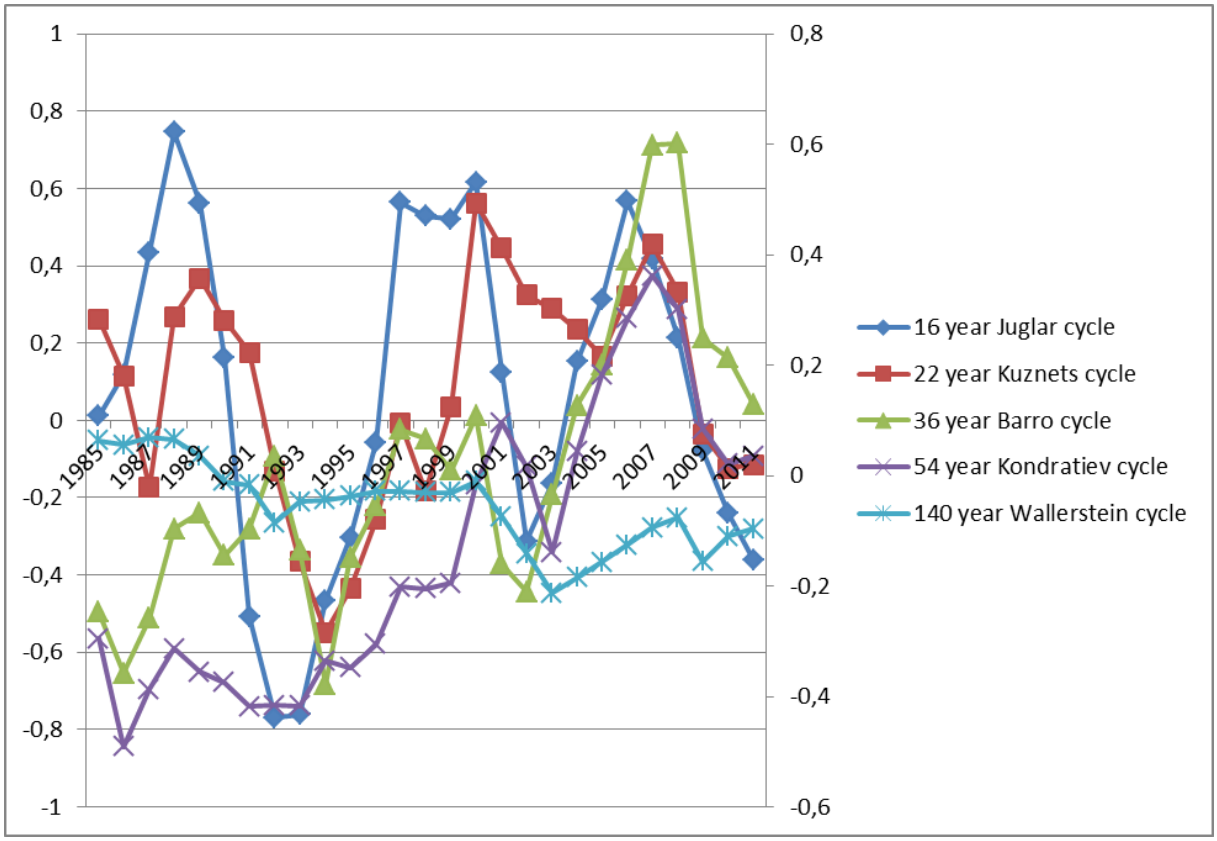
rolling correlation windows:

8 = 16 year Juglar cycle
11 = 22 year Kuznets cycle
18 = 36 year Barro cycle (secondary axis, right hand scale)
27 = 54 year Kondratiev/Kondratieff cycle (secondary axis, right hand scale)
70 = 140 year Wallerstein cycle (secondary axis, right hand scale)



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles“* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

Graph 21: By contrast: in 2007, the world economy was NOT affected by such a unique combination of downward trends



Legend: our own calculations from the data set *„Kondratiev/Kondratieff cycles and war cycles"* contained in http://uibk.academia.edu/ArnoTausch/Documentation-for-articles. As to the documentation, see also: Tausch and Ghymers, 2007, and Appendix 1 and 2 of this work. Our calculations are based on the IBM-SPSS XX and Microsoft EXCEL 2010 statistical software.

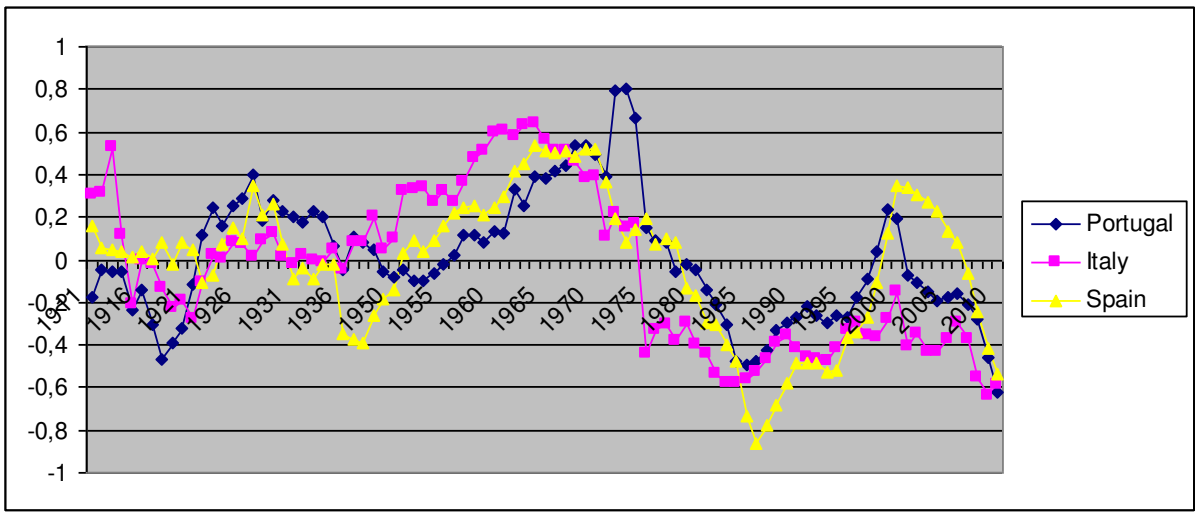
Another interesting point to be mentioned here is what social science can offer to the policy makers at the level of the G-8, the G-20, the European Union, the OECD and other institutions of democratic global governance in terms of the lessons one can draw about the most successful and the least successful strategies to confront the crises in 1929 and 2007.

Exits from the crisis

Our main policy conclusions can be found in the messages, conveyed by Graphs 22 and 23, and Table 5. Our K-cycle analysis suggests that India, Russia, and

Peru are the Maddison sample countries most successfully diving out from the depths of the crisis, while indeed Portugal, Italy and Spain are the Maddison countries most seriously affected by the current downturn. A UNDP type GDP per capita index, comparing the GDP per capita of any Maddison country any time since 1885[6] neatly informs us about the real extent of progress along global convergence. The four countries with the most consistent and stable convergence path in human history did practice many policy receipts, which are a *"forbidden medicine"* for neoliberal economics – the Scandinavian social Keynesian models Norway, Finland, Sweden and Denmark, combining a fair amount of social spending, investment in human capital, free trade, and a political partnership between wage labor and capital, tending towards wage rises in tandem with the growth of productivity. Their historical progress to stable democracy, humanism and well-being is really unparalleled. They all started out belonging to the lower half of purchasing power per capita in the world, and they all belong now to the highest 1/3 of countries.

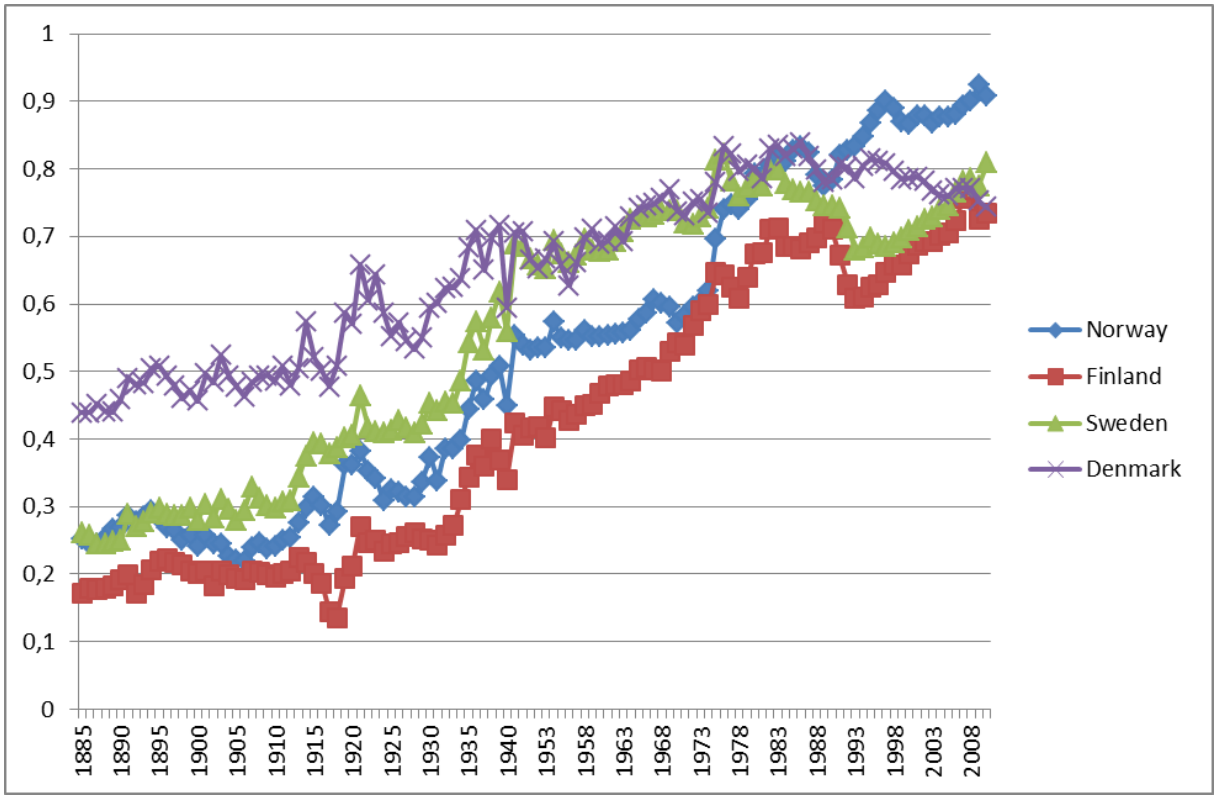
Graph 22: the K-cycle (rolling 25 year correlations) of three most unfortunate semi-peripheries: Portugal, Italy and Spain



For the 31 nations trajectories, see http://uibk.academia.edu/ArnoTausch/Documentation-for-articles

[6] with the respective lowest GDP per capita, divided by the difference between the highest and the lowest GDP per capita for each year

Graph 23: UNDP type GDP per capita Index, 1886 – 2010 for the countries with the most consistent path of ascent in the world economy



For the 31 nations trajectories, see http://uibk.academia.edu/ArnoTausch/Documentation-for-articles

The systematic comparison of the effects of the 2007 crisis (purchasing power per capita in 2010 as compared to purchasing power per capita in 1995) show to us that Japan, Italy, Denmark, France and Germany are the biggest losers, while Finland, Russia, Sweden, Chile and Uruguay were the biggest winners.

Table 5: Emerging from the global crisis

	GDP per capita as a % of global GDP per capita 1995	GDP per capita as a % of global GDP per capita 2010	Losses or gains in %
Japan	149,04	126,97	-22,07
Italy	129,13	107,20	-21,93
Denmark	152,63	136,10	-16,53
France	136,97	124,31	-12,65
Germany	129,74	119,59	-10,15
Switzerland	154,95	144,90	-10,05
Venezuela	66,23	57,15	-9,08
USA	184,78	176,49	-8,29
Portugal	87,11	82,65	-4,45
New Zealand	111,82	109,32	-2,50
Spain	98,49	97,23	-1,26
Belgium	137,03	136,35	-0,67
Colombia	41,03	40,88	-0,14
Canada	144,29	144,37	0,08
Norway	161,84	162,00	0,16
Brazil	39,60	39,82	0,22
Netherlands	140,23	140,67	0,44
Argentina	58,40	59,36	0,97
Indonesia	25,31	27,33	2,03
Austria	135,72	139,47	3,75
UK	131,90	137,63	5,73
Peru	26,80	33,42	6,62
Greece	77,41	85,04	7,63
India	11,57	19,52	7,95
Sri Lanka	22,28	31,03	8,74
Australia	138,98	148,09	9,11
Uruguay	57,59	66,72	9,12
Chile	66,83	80,36	13,53
Sweden	132,35	146,48	14,13
Russia	30,18	44,76	14,58
Finland	119,83	134,81	14,98

Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

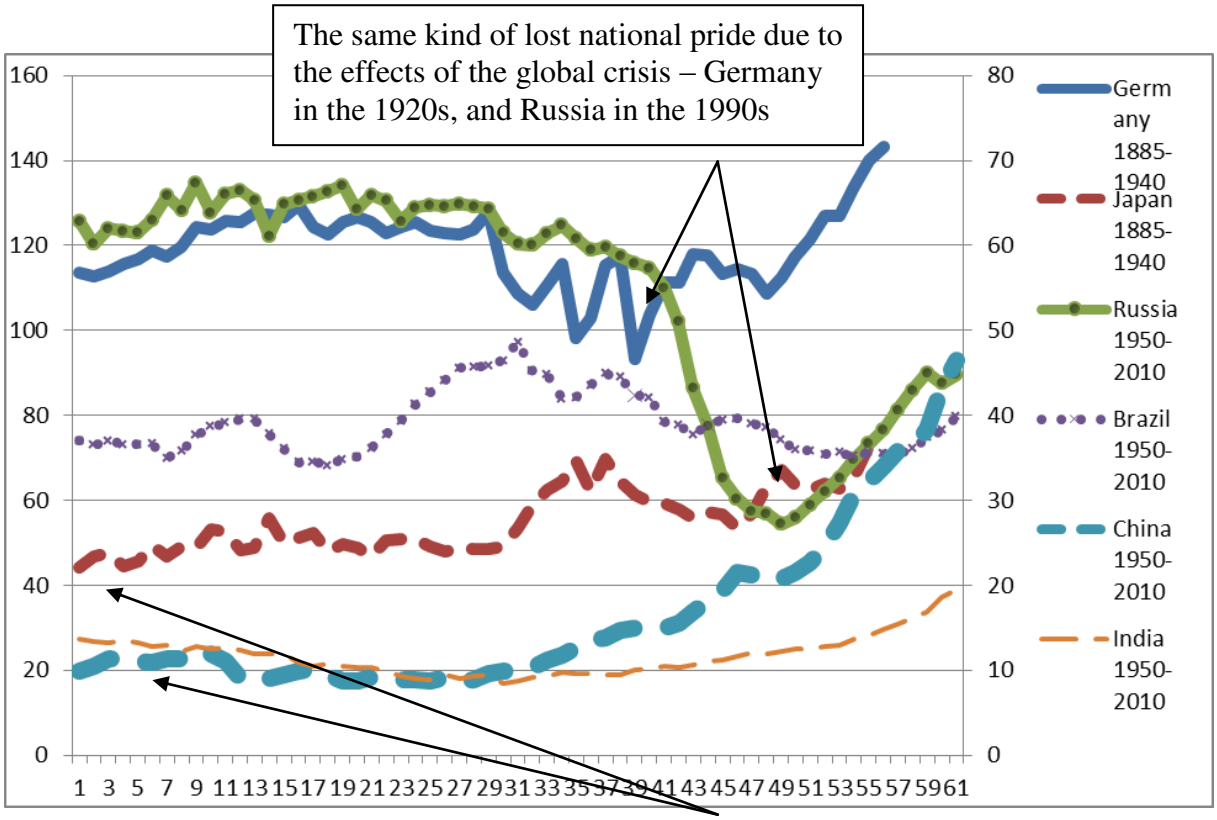
In the following, we will also try to draw some conclusions into our insights about hegemonial contenders and their structural positions in the world economy, then, during the Great Depression, and nowadays. By comparing their historical trajectories, we of course would not like to commit the error of *"the*

poverty of historicism" (Popper, 1961). On the contrary, we would simply like to draw our readers' attention to the various Scyllas and Charybdis, which nations might face emerging from crises and non-democratic previous political systems on their possible transition path towards a socio-liberal, open society and full-scale democracy.

Predictions about the hegemonial contenders and the global hegemons in the 21st Century

Graph 25 shows the striking parallels between the global order in the six decades before 1940 (i.e. 1885-1940) and before 2010. Both Germany and Russia experienced a considerable decline during the world crisis of the 1920s (Germany-Weimar Republic) and the 1980s and early 1990s (Russia today), and both countries find another, formerly very poor and rising hegemonial contender among the nations of the international system on their side.

Graph 25: The comparison of hegemonial contenders, 1885-1940 and 1950-2010. Their GDP per capita in purchasing power in relationship to the world average of 31 countries



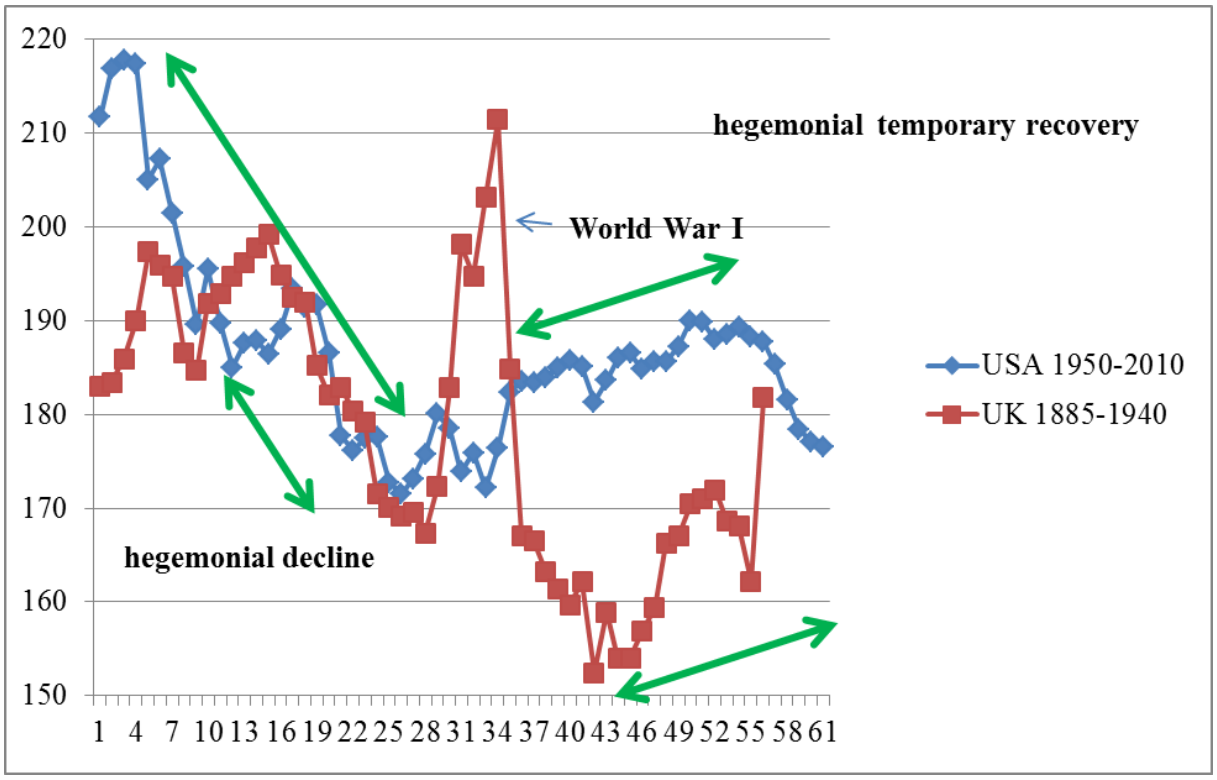
Primary axis: Germany and Japan
Secondary axis: Russia, Brazil, China and India

Japan and China share in their history that their industrialization started at relatively low levels of capitalist development.

Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

Not only the possible hegemonial contenders (Germany and Japan prior to World War II; Russia and China in the contemporary period) have many world economic characteristics in common; also the hegemons (UK before 1940; the US before the crisis of 2007) were on comparable global trajectories: both experienced a history of sharp hegemonial decline (in the UK interrupted by the temporary rally during World War I). And both nations managed to have a hegemonial temporary recovery associated with the names of the UK-Prime Ministers Stanley Baldwin and Ramsey MacDonald, and the US-Presidents Ronald Reagan, George H. W. Bush and William J. Clinton.

Graph 26: The comparison of the trajectories of the world hegemons, 1885-1940 (UK) and 1950-2010 (the USA). Their GDP per capita in purchasing power in relationship to the world average of 31 countries



Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

Implications for Russia

So should Russia follow the footsteps of the Weimar Republic and the later hegemonial challenge against the West, or try to find a "Scandinmavian path"? Given the limitations of journal space, it would not be possible to present here the details of the debates among the Marxist classics of the early 20th Century on the proper development strategies to follow once Labor has won a decisive influence in the political system of a country. As has been shown already in Tausch and Prager, 1992, the European social democrats, above all the Austrian Otto Bauer and the Swede Ernst Wigforss, were correct in emphasizing a path of slow and fundamental democratic reforms, while Lenin, from the very start, harshly criticized the social democrats, overlooking the powerful societal tradeoffs between reforms and economic growth, and political stability. Not only that: while agricultural and educational reform, an army, based on general conscription and democratic control, social security, public health etc. are all mighty drivers of economic growth in a democratic and free society, the European social democrats of the early 20th Century were also very correct in emphasizing the long-term limitations of unlimited state power, with Otto Bauer clearly predicting, already in 1920, the subsequent state terror under Bolshevik power in Russia.

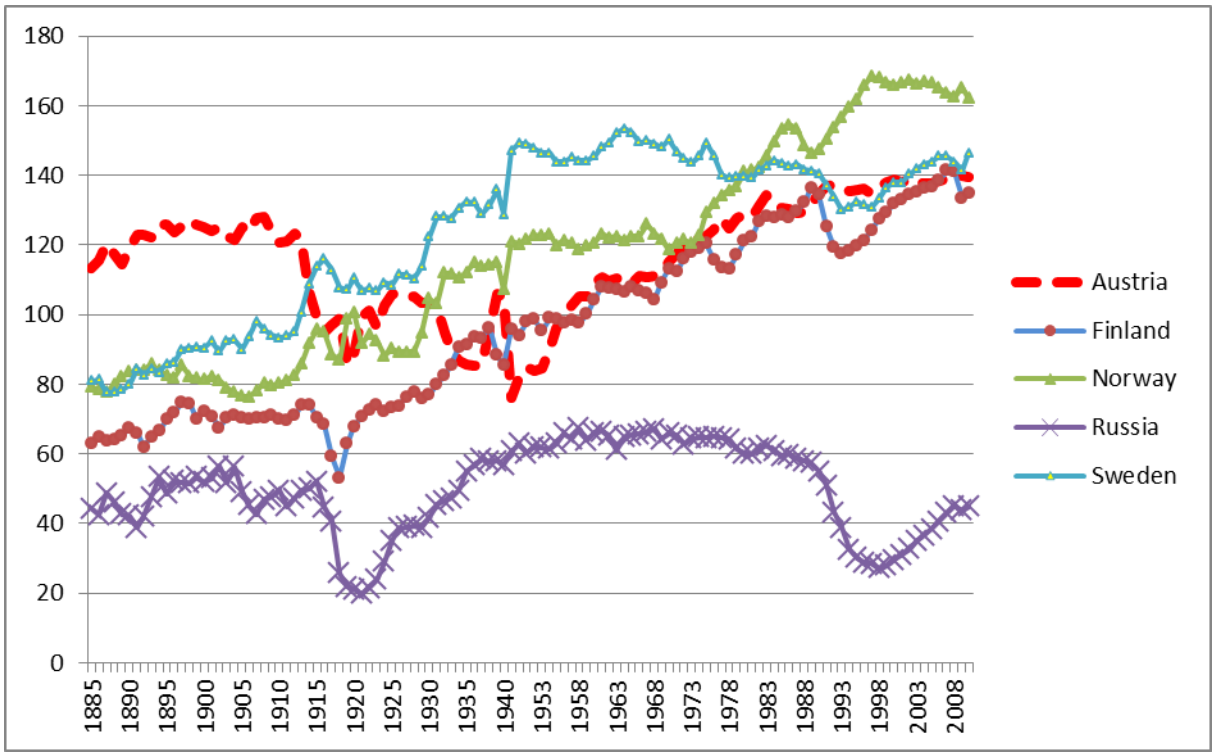
Graphs 27a and 27b show the dramatic truth of these predictions and debates in the history of the 20th Century then to follow. Without debating the twisted turns of political history in Europe since the 1930s (Finland, Norway and Sweden) and since 1945 (Austria), social democratic reform ideas in the spirit of Polanyi's *"Great Transformation"* all gained ground in these countries and decidedly influenced the growth of a social welfare state, social partnership between wage labor and capital, and a strong state sector, which together assured the spectacular growth and ascent in world society right through to the early 1980s, and in some countries even beyond. At the same time, and starting from the post-World-War I recession, which was as equally deep in Russia as in the other countries, Russia's path towards state socialism initially led to an improvement of 45% vis-à-vis the global average until the mid-1960s. Thus the net gains in world systemic position as compared to the times before the transformation were then about equal in size in both Russia and in the European social partnership models, but the models in the framework of a bourgeois liberal democracy **were far more resilient against the world economic and political changes, which set in in the late 1970s**. It has to be emphasized as well that the temporary relative decline of the world systemic position suffered by Finland and Sweden in the late 1980s and early 1990s is also connected with the crisis in the USSR/Russia, which was an important market for the export

oriented industries in the Scandinavian countries at that time. In the direct comparison between the USSR/Russia on the one hand and Austria and Finland on the other hand, the results couldn't be more dramatic. Lenin's strategy brought about a net gain of around 45% in the world system position, to be wiped out again almost completely in the final phase of the collapse of communism, while the resilience of the social partnership model in Finland and Austria brought about an almost uninterrupted net gain of around 50% to 60% in per capita purchasing power as compared to the world average.

For Russia, after having suffered so much damage in all the cataclysms of its history over the last 100 years, it would be important to remember that the most successful postwar political economic strategies (see also Tausch and Prager, 1992; Schulmeister, 2013) were all defined by

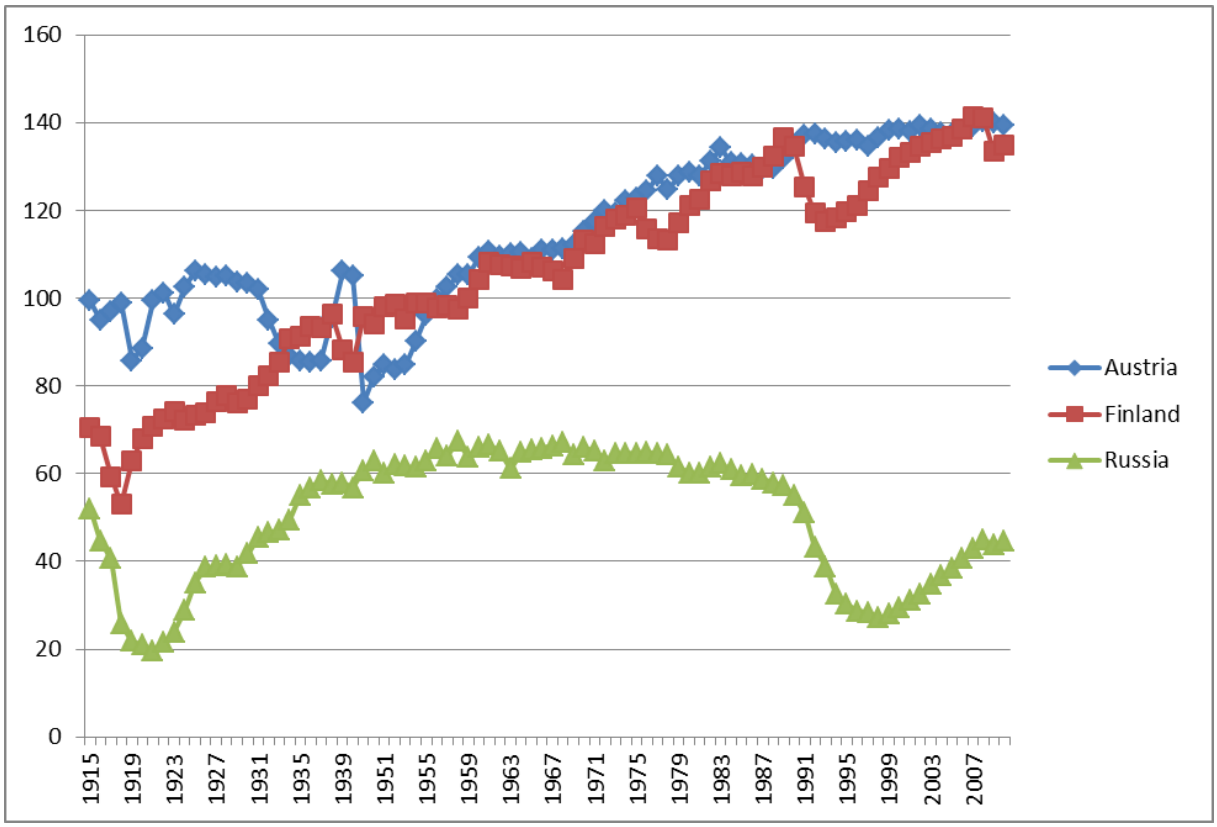
(a) net real wage increases in the rhythm of economic growth
(b) net interest rates slightly below the rate of economic growth
(c) a strong mixed economy
(d) a strong presence of the organized interests of wage labor, capital, and agriculture in a democratic decision making processes

Graph 27a: Russia and its development alternatives, 1917. The GDP per capita in purchasing power Austria, Finland, Norway, Russia and Sweden in relationship to the world average of 31 countries



Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

Graph 27b: Austria, Finland, and Russia – similarities and dissimilarities in their development trajectory (GDP per capita in purchasing power in relationship to the world average of 31 countries)



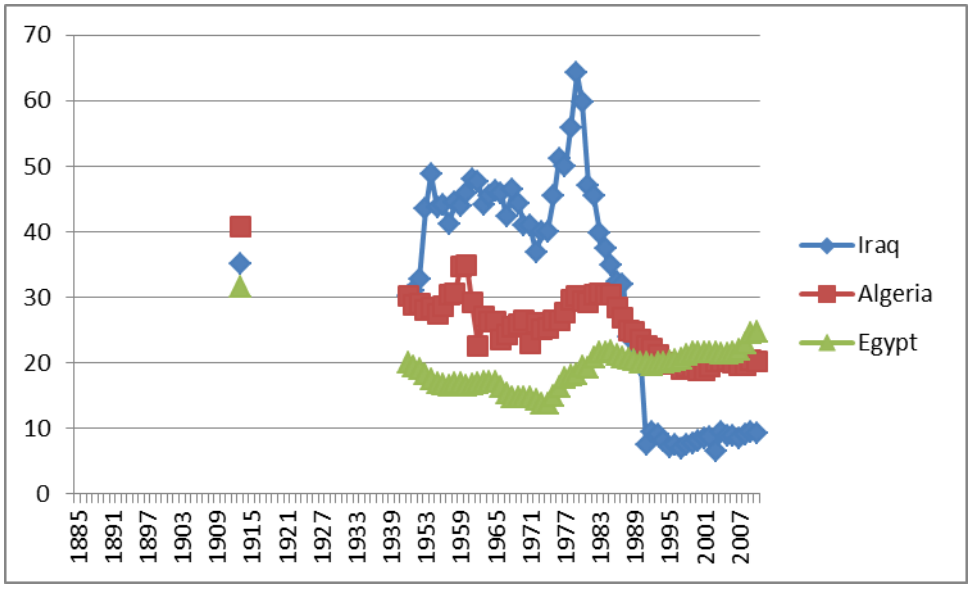
Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

In the following, we will also look at the implications of the "Akamatsu cycles" for the Arab world and the Muslim world in general. Severe limitations of data, however, restrict the scope of our investigation, so that we might only present some very preliminary hypotheses.

The convergence cycles in the Muslim world – a first approximation

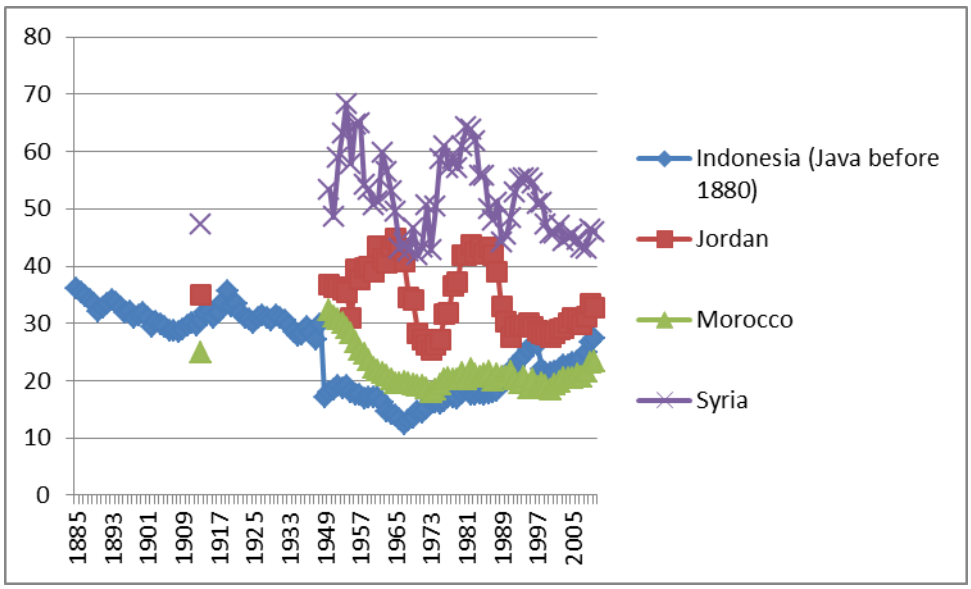
World systems theory in the traditions of Arrighi and Wallerstein and structuralist economics in the tradition of Akamatsu also have important lessons to offer for the analysis of the current situation in the Arab countries and the Muslim world in general. Although long-term annual data series about GDP per capita in real purchasing power are available only for Java/Indonesia and the Ottoman Empire/Turkey, we can cautiously draw the following conclusions presented in Graph 28a – 28d. Let us start with the optimistic message first: all the countries of the region under scrutiny in Graph 28a – 28d currently recover from their relatively weak position into which they were sliding in the 1950s and 1960s and beyond. From the trough of the Kondratiev/Kondratieff cycle in the 1980s and early 1990s onwards, the following majority Muslim semi-periphery countries in the Maddison sample: Albania; Algeria; Egypt; Iran; Jordan; Malaysia; Morocco; Tunisia; all somehow managed to recover from their Akamatsu cycle troughs they were in some decades ago. Turkey's ascent with some strong upward-directed fluctuations is a special case, showing also the strong lift-up in its world system position the country experienced in the heyday of the Kemalist reforms in the 1920s, a lift-up which the current government in Turkey should not forget. Tunisia, and especially Malaysia experienced a strong convergence process over the last four decades. In Malaysia, the effects of the Asian crisis (short-term interruptions in an upward path) are clearly visible in Graph 28d. Iran and Iraq experienced their peaks in their Akamatsu cycle fluctuations during the world oil-price hikes of the 1970s, and experienced a strong divergence process afterwards. Syria's case is an interesting confirmation of a Kuznets-cycle length of some 20 year fluctuations also in its convergence process.

Graph 28a: Iraq, Algeria and Egypt – similarities and dissimilarities in their development trajectory (GDP per capita in purchasing power in relationship to the world average of 31 countries)



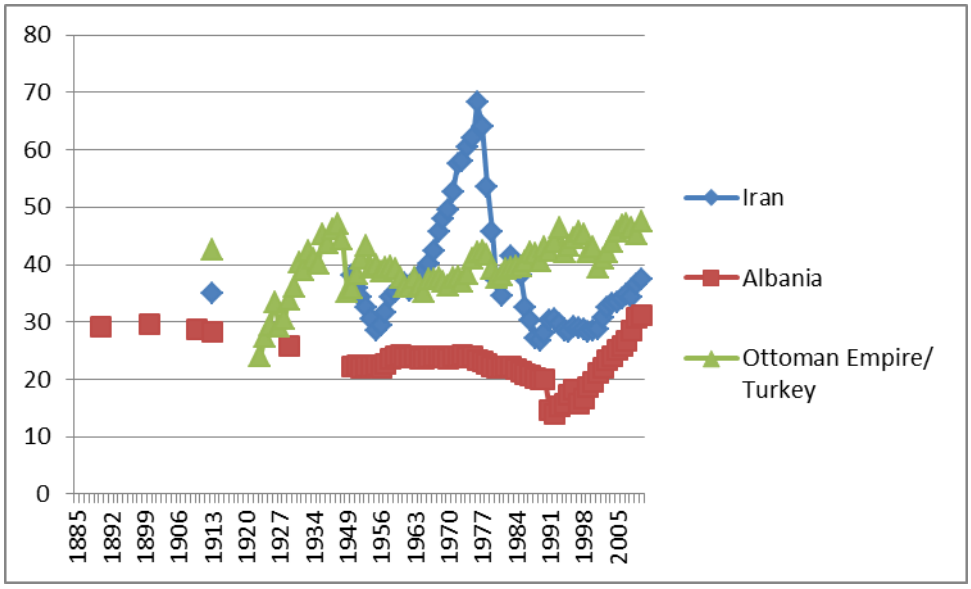
Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

Graph 28b: Indonesia, Jordan, Morocco and Syria – similarities and dissimilarities in their development trajectory (GDP per capita in purchasing power in relationship to the world average of 31 countries)



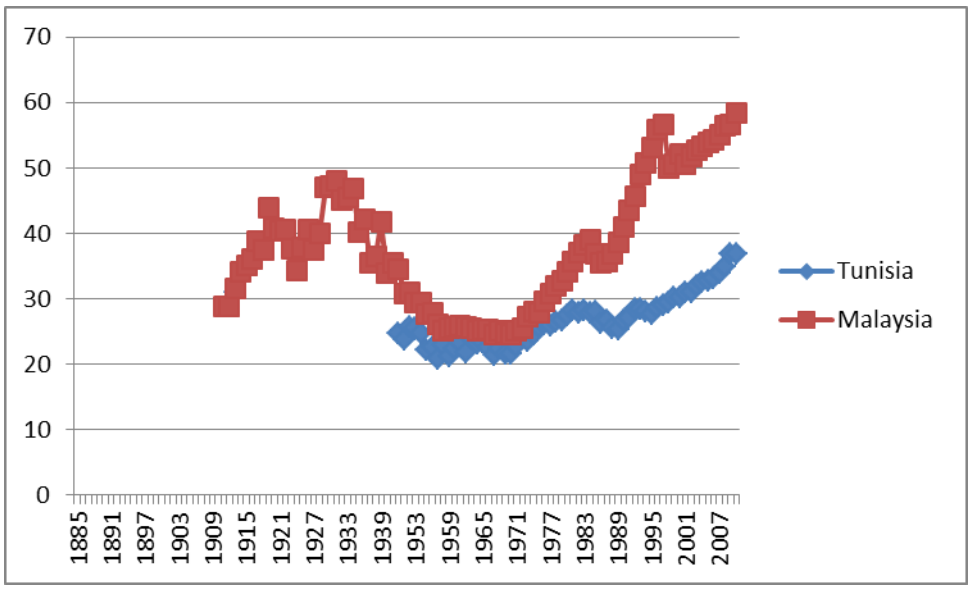
Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

Graph 28c: Iran, Albania, Turkey – similarities and dissimilarities in their development trajectory (GDP per capita in purchasing power in relationship to the world average of 31 countries)



Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

Graph 28d: Tunisia and Malaysia – similarities and dissimilarities in their development trajectory (GDP per capita in purchasing power in relationship to the world average of 31 countries)



Legend: our own compilations, based on the Maddison data sets, as documented in Bolt and van Zanden, 2013. Calculated from the original data with Microsoft EXCEL 2010

Discussion and conclusions

We of course very much appreciate the already existing research results, presented in the framework of world-system scholarship and in the framework of other theoretical traditions on long cycles of economics and politics. Studies confirming or claiming to confirm the basic tenets of the world systems approach in the tradition of Kondratieff, 1925, 1926, 1928, 1935; Schumpeter, 1939; and Wallerstein, 2000, about 40-60 year cycles of economics and even longer cycles of global wars were presented, among others, by Bornschier, 1996; Devezas, 2006, 2010, 2012; Devezas and Corredine, 2001; Forrester, 1977; Goldstein, 1985, 1987, 1988, 1991, 2006; Husson and Louça, 2012; Korotayev and Grinin, 2012; Korotayev and Tsirel, 2010; Louçã, 1997; Louçã and Reijnders, 1999; Mandel, 1995; Marchetti, 1980, 2006; Metz, 2008; O'Hara, 1994, 2001, 2005; Perez, 1983; Schumpeter, 1939; Sterman, 1985, 1986; Tausch and Ghymers, 2007; Tausch and Jourdon, 2011; and Thompson and Zuk, 1982.

The readers of this publication in particular are probably well acquainted with the results of these studies. And yet, to be honest, these advances in the direction of confirming the long cycle hypotheses nowadays faced up to a formidable and technically often very advanced and growing phalanx of various competing studies, which question the very existence of longer cycles in international economics and politics altogether, or at least restrict the relevance of K-cycles to the movements of prices, and not the movements of the "real economy"; thus partially or completely falsifying a core concept of the entire world system approach (Berry, Kim and Baker, 2001; de Groot and Franses, 2008; Diebolt, 2012; Diebolt and Doliger, 2006; Diebolt and Escudier, 2002; Garvy, 1943; Haustein and Neuwirth, 1982; Kuznets, 1940, 1976; Metz, 2011; Van Ewijk, 1982).

The parallel world system research hypothesis about cycles of global warfare was also fundamentally questioned in research, using advanced time-series analysis techniques (Beck 1991; Silverberg G. 2006). And we should recall, as has been re-stated recently by Robinson, 2011 that these long cycles are of a central and not only peripheral conceptual and theoretical importance for the entire paradigm of the world system approach, especially Wallenstein's (Wallerstein, 2000).

Our re-analysis of the entire issue of global cycles and national cycles as well as cycles of global convergence and divergence revealed that Kondratiev/Kondratieff cycles exist, but that there are other types of cycles as well in the global economy, among them two cycles hitherto virtually neglected in quantitative research on the subject – the 36 year Barro cycle and the 140 year Wallerstein cycle.

For the first time in the literature, we also tried to analyze in a more systematic fashion the cycles of convergence and divergence.

So, our results on the level of the world economy are to be interpreted as a resounding *"yes"* for the hypotheses voiced by Kondratiev/Kondratieff, but with several additional qualifications and extensions. Kondratiev/Kondratieff was right in analyzing a 54 year cycle of the real economy as well, but there are other important cycles too; some of them very well known to social science research, others perhaps still more to be explored. On the level of industrial production growth in the world economy, there is – parallel to the Kondratiev/Kondratieff cycle, a 140 year *"logistic"* cycle, first analyzed by Immanuel Wallerstein; and in addition, there is this new 36 year disaster cycle, correctly predicted by the neoclassical contemporary economist Robert Barro. For sure, there is also evidence – although somewhat weaker than expected – for a 22-23 year Kuznets cycle and the shorter, well-known Juglar cycles and Kitchin cycles. We achieved our results with the untransformed data at our

disposal, but also a 5-year moving average transformation of the original data wielded the same results. There is strong reason to believe that the Wallerstein cycle is closely connected to the issue of leadership in the international system. The period from the end of the Napoleonic Wars to the Great Depression in the 1930s was the period of the British dominance in the world economy, while the US hegemony evolved as a result of World War II and seems to be declining. Major world economic depressions have such a Tsunami force that they destabilize the entire international system as well. Our results indicate the peaks of the international conflagrations in the Thirty Years War, the French wars of the 18th Century, the Napoleonic Wars, and the German quest for global dominance, 1914-1945 and the evolution of the postwar order with the Korean and Vietnam Wars.

Our data clearly support the hypothesis of longer waves of wars in the international system. Spectral analysis clearly reveals a 160 year cycle of global warfare, which was already evident in the earlier research by Goldstein, 1985, 1987, 1988, 1991, and 2006 on the subject. The "illusion of cycles"-type of literature, initiated by Beck, 1991, thus has to be refuted.

The main results of our analysis of the Maddison data set at the national cycle level indicate that Kondratiev/Kondratieff cycles of around 60 years duration are most clearly visible in Argentina, Canada, and Russia. We also found evidence on the existence of longer cycles of more than 35 years in Belgium; Chile; Greece; Netherlands; India; New Zealand; Spain; and USA; while for the other countries of the Maddison data set, the spectral density analysis results reported in Diebolt and Doliger, 2006 could not be falsified.

A reasonable hypothesis, why there are such differences in cycle length between the various countries of the world has to be found: an interesting hypothesis could be the application of Bornschier's dependency theory, centered around penetration by transnational capital in the different economies of the world and the weakness or strength of "national capital" (Bornschier and Chase-Dunn, 1985; Tausch, 2010). By and large, the role of transnational capital in the countries with longer cycles seems to be historically more pronounced than in the countries with shorter cycles, and the strength of the national bourgeoisie seems to determine the shortness of cycles. Typical cases, supporting such an interpretation would be France, Germany, Japan, the Netherlands, and Switzerland versus Argentina, Canada, Chile, Greece, India, New Zealand, Spain and Russia.

In this essay, we also tested the crucial relationship of the Akamatsu cycles of convergence and the cross correlation relationship between the Akamatsu cycle and the Kondratiev/Kondratieff cycle. In Argentina, Austria, Italy, and Venezuela there are either clear linear overall convergences (Austria) or

divergences (Argentina), and in Italy and in Venezuela, as well as in Russia, convergence had the shape of an inverted "U". Akamatsu cyclical oscillations are shortest in Spain, and longest in Russia. Cross correlation analysis also reveals that in Spain; Denmark; Finland; Australia; Greece; Netherlands; Argentina there is a clear priority of the cyclical Akamatsu movements over the economic growth rates, while in the other countries of the 30 nations with available data the Kondratiev/Kondratieff cycle determines the Akamatsu cycle. Only further research can clarify whether these differences are to be explained by the structure of exports, the role of raw material exports in the economic processes etc.

In this work, we also highlight the "convergence slopes" of the countries of the world system with available data in terms of their GDP per capita distance, parity or superiority with the county which dominated the capitalist world system right to the time of the Great Depression, the United Kingdom. We highlight the dramatic singularity of Keynesian postwar European reconstruction, and we also show that since the 1990s, other mechanisms have set in, which clearly are to the detriment of countries of the European Union and which currently benefit, among others, some countries of neoliberalism.

Our research also sheds lights on the necessary reformulation of Kondratiev/Kondratieff cycle dating schemes and the assessment of the current crisis, which began in 2007. There is good reason to believe that the current crisis is NOT a Kondratiev/Kondratieff cycle low (which hit the world economy in the late 1980s, culminating in the disintegration of Communist rule in Eastern Europe and the end of the Soviet Union), but the beginning of a downswing phase of the 140 year Wallerstein cycle. We also highlight the big difference between the current crisis and the Great Depression starting in 1929: the current crisis is far from being the "final crisis of capitalism".

Another interesting point to be mentioned here is what social science can offer to the policy makers at the level of the G-8 and the G-20 and beyond in terms of the lessons one can draw about the most successful and the least successful strategies to confront the crises in 1929 and 2007.

Our main policy conclusions can be found in the messages, conveyed by Graphs 22 and 23, and Table 5. Our K-cycle analysis, contained in Graph 22, suggests that Portugal, Italy and Spain are the Maddison sample countries most seriously affected by the current downturn. The four countries with the most consistent and stable convergence path did practice many policy receipts, which are a *"forbidden medicine"* for neoliberal economics – the Scandinavian social Keynesian models Norway, Finland, Sweden and Denmark, combining a fair amount of social spending, investment in human capital, free trade, and a political partnership between wage labor and capital, tending towards wage rises

in tandem with the growth of productivity. Their historical progress to stable democracy, humanism and well-being in an otherwise unstable Europe is really unparalleled. They all started out belonging to the lower half of purchasing power per capita among the scale of the countries of the world, and they all belong now to the highest 1/3 of the scale.

Being conscious about the limitations of the current paper both in terms of the estimates used from the Maddison data set as well as the econometric techniques applied, we hope to have shown clearly that some of the foundations of current world system research, i.e. the discourse about "long cycles" is not just a discourse about a non-existing monster like in Loch Ness in Scotland. Both the re-analysis of world industrial production growth data since 1741 as well as the global conflict data since 1495 cautiously support the earlier contentions of world system research with evidence, tested by spectral analysis and auto-correlation analysis.

We think that the most important message for future world systems research is the realization that convergence processes in most nations of the world are discontinuous and of a cyclical nature, thus supporting the pessimism inherent in the world system research by Giovanni Arrighi and somehow questioning the optimism inherent in the neoclassical convergence analysis, proposed by Robert Barro.

Appendix (1): Data for world system cycles: industrial production, war, defense pacts

Applying ACF and spectral analysis to real world data, 1495-2013

World industrial production growth since 1495

Data:

http://www.hichemkaroui.com/?p=2383

for the period after 1998:

http://www.ereport.ru/en/stat.php?razdel=country&count=world&table=ipecia&time=2

Industrial Production Growth Rate, % (based on US CIA World Factbook)

year	value
1998	0.5
1999	3.2
2000	6.8
2001	0.2
2002	1.9
2003	4.1
2004	5.1
2005	6.0
2006	6.0
2007	5.0
2008	3.2
2009	-2.7
2010	4.6
2011	4.5

Appendix (2): Data for the war cycle 1495 - today

The great question, already raised by Joshua Goldstein, is whether wars correspond as well to such a pattern. Allowing for changes in global battle technology, which greatly increased military and non-military battle fatalities, we performed a transformation of the original data, based on the 10^{th} root of annual battle fatalities from major power wars. The 130 to 160 years cycle of major power wars seems to be confirmed again, with shorter cycles in between:

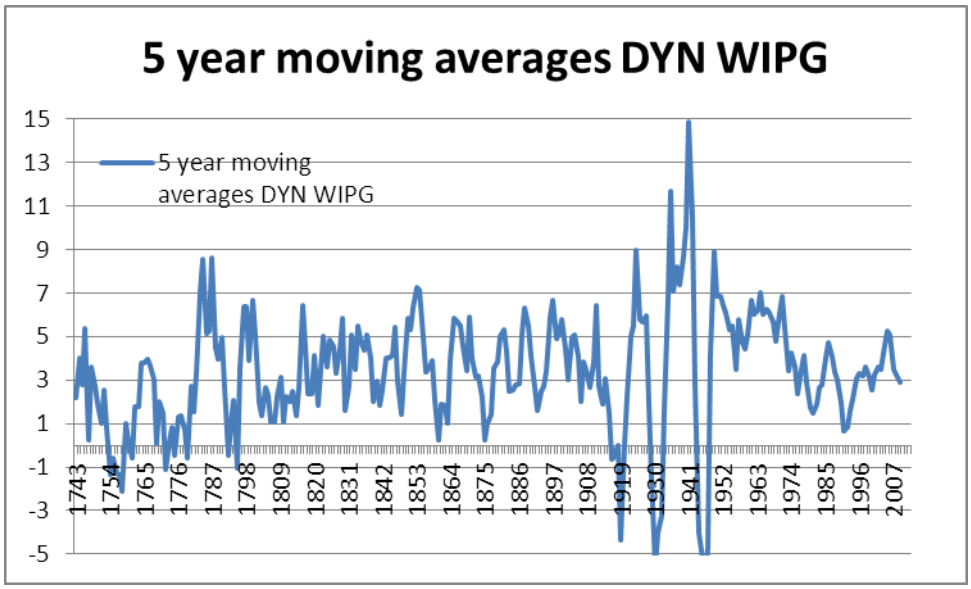
War cycle since 1495

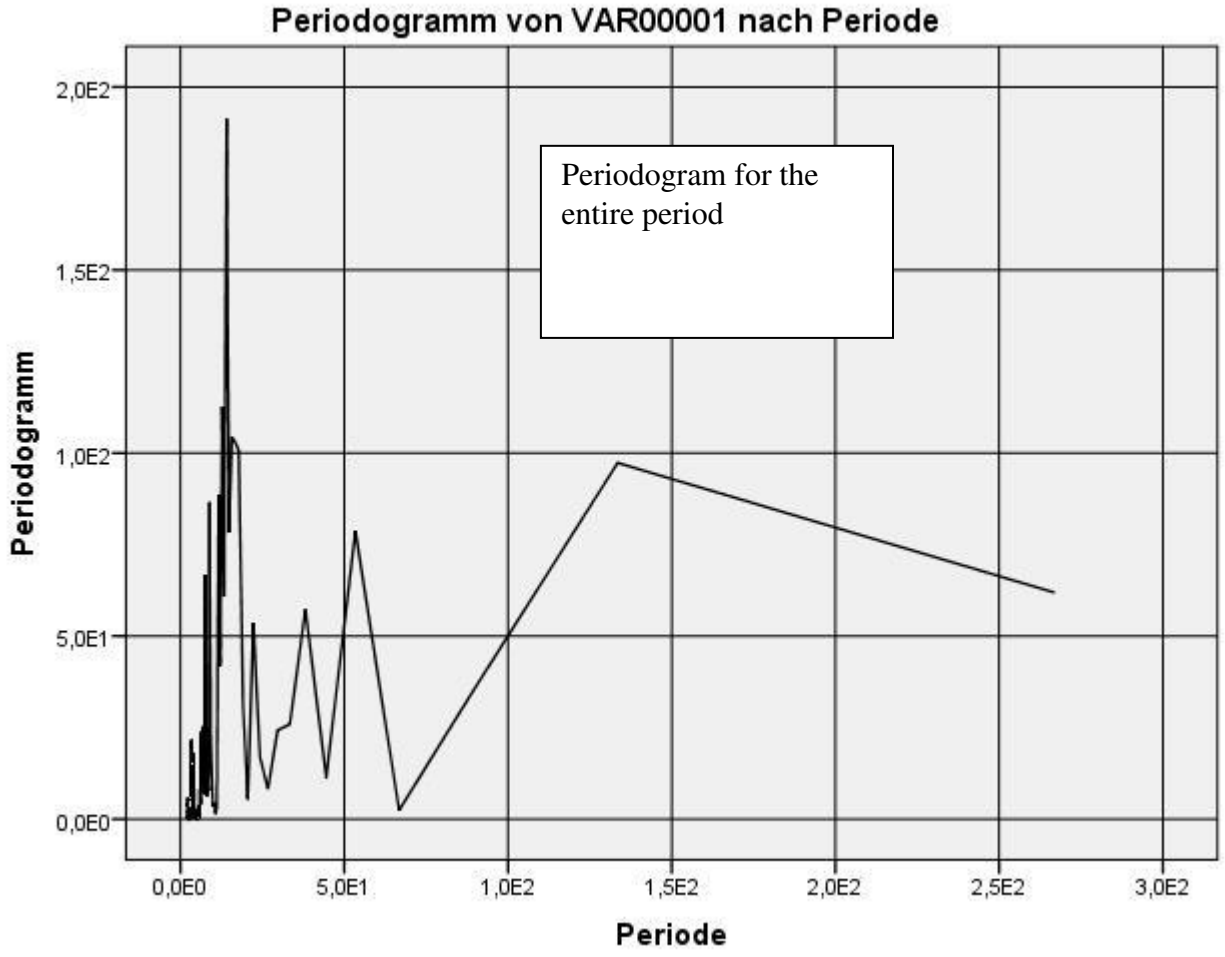
Data: Goldstein and – after 1945 – PRIO Oslo, see:

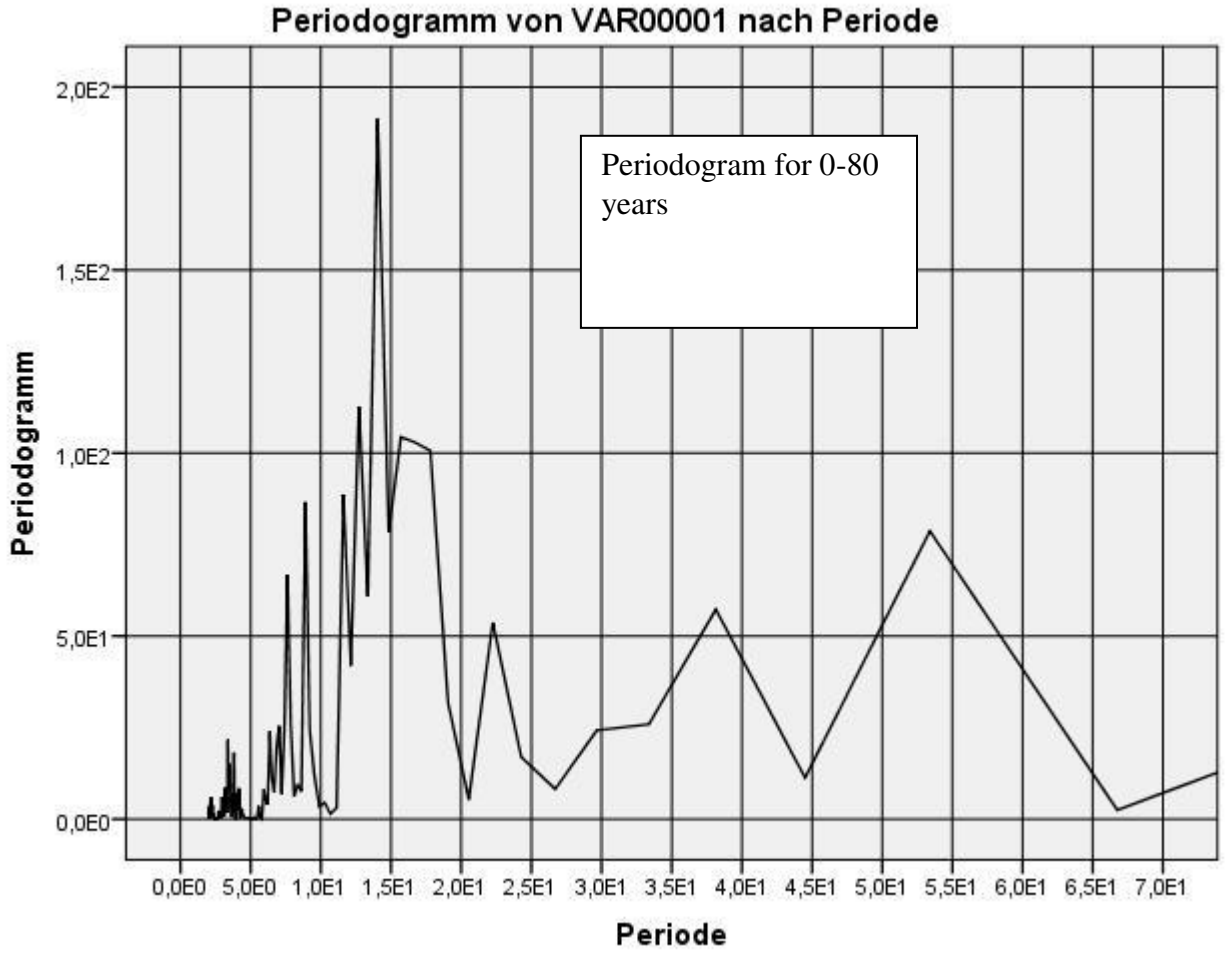
http://www.hichemkaroui.com/?p=2383

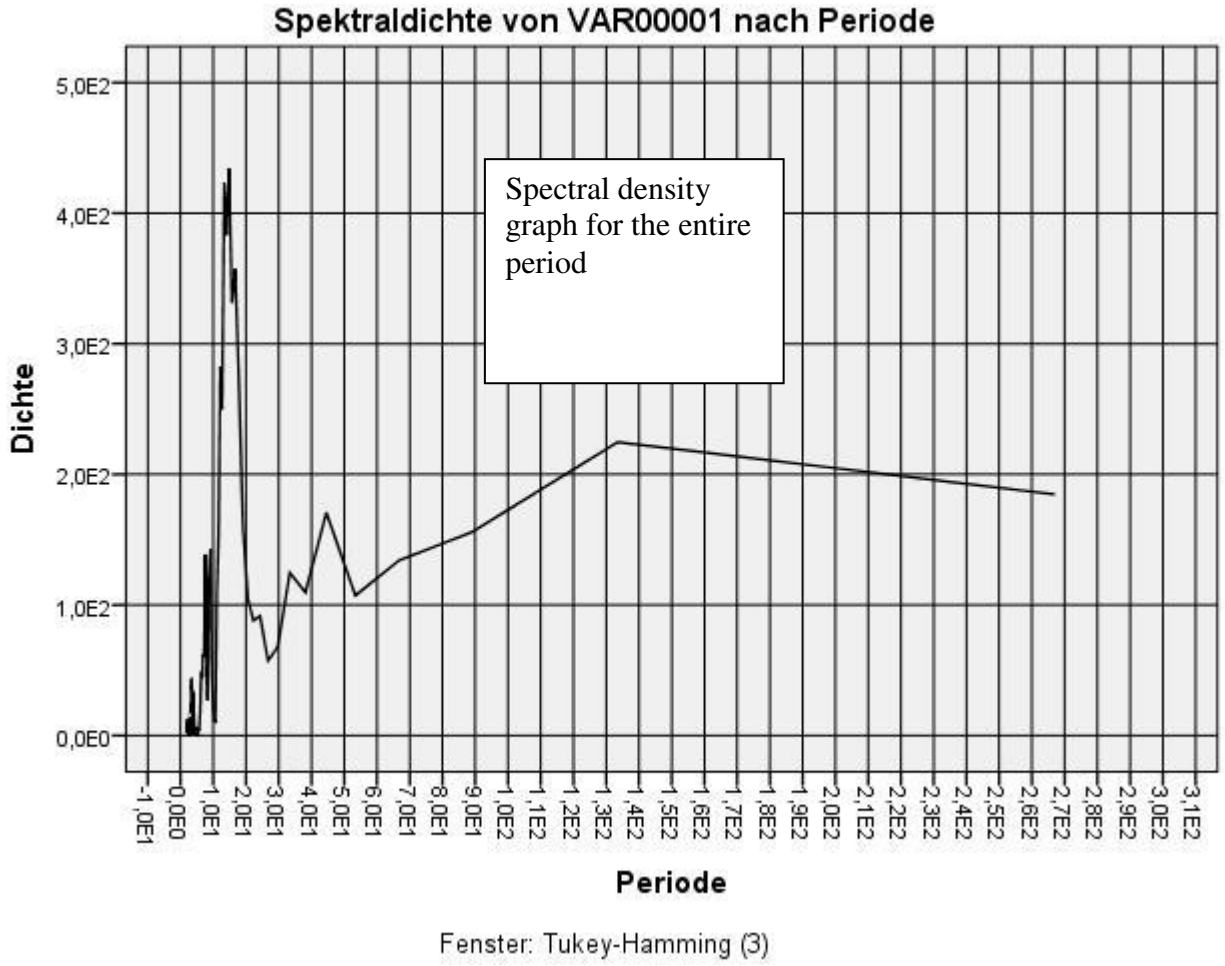
Appendix (3): Replicating Korotayev and Tsirel' s world system analysis of global industrial production growth

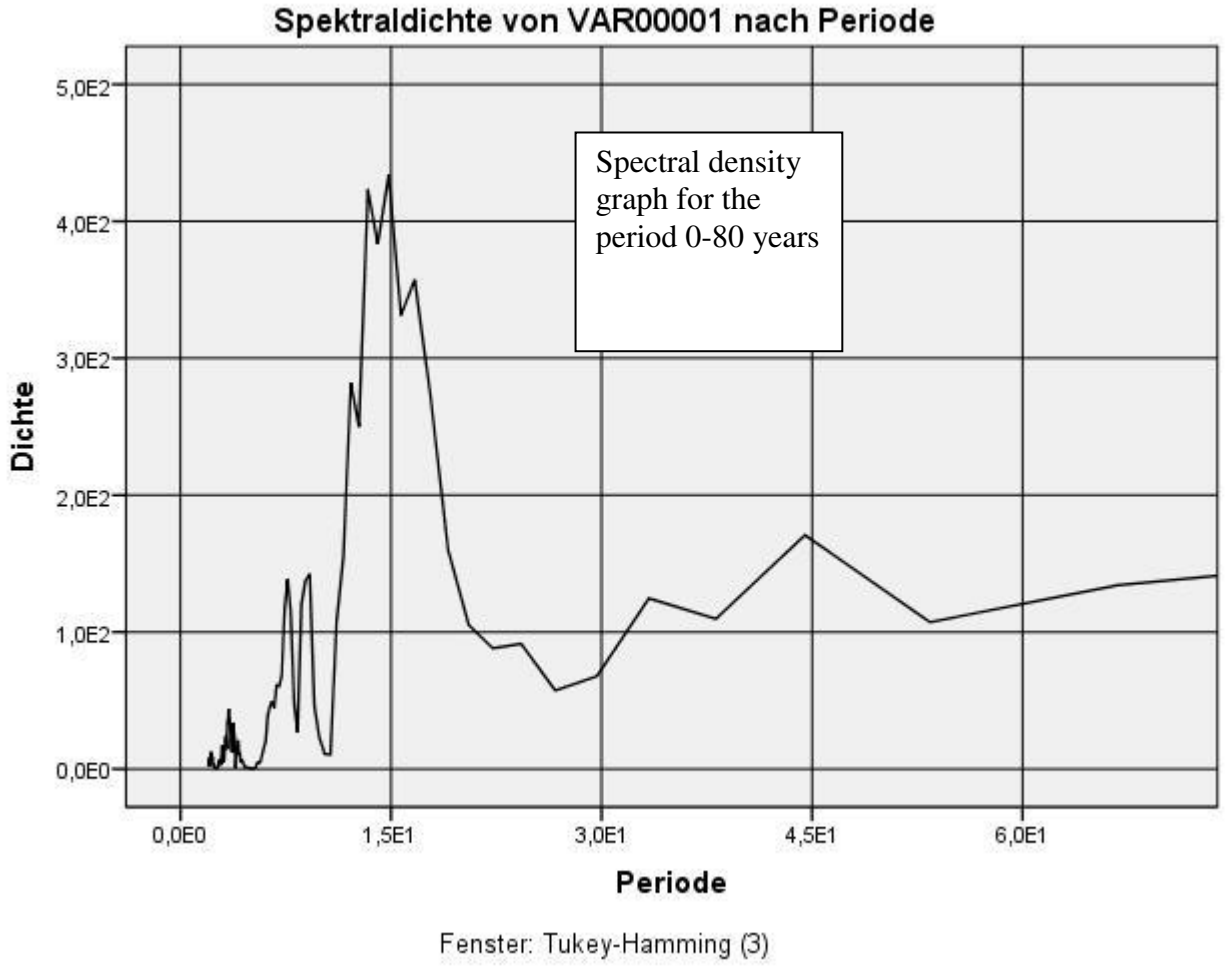
Korotayev and associates recently used a 5-year moving averages procedure. On a world level, we get the following graph of world industrial production growth (DYN WIPG):

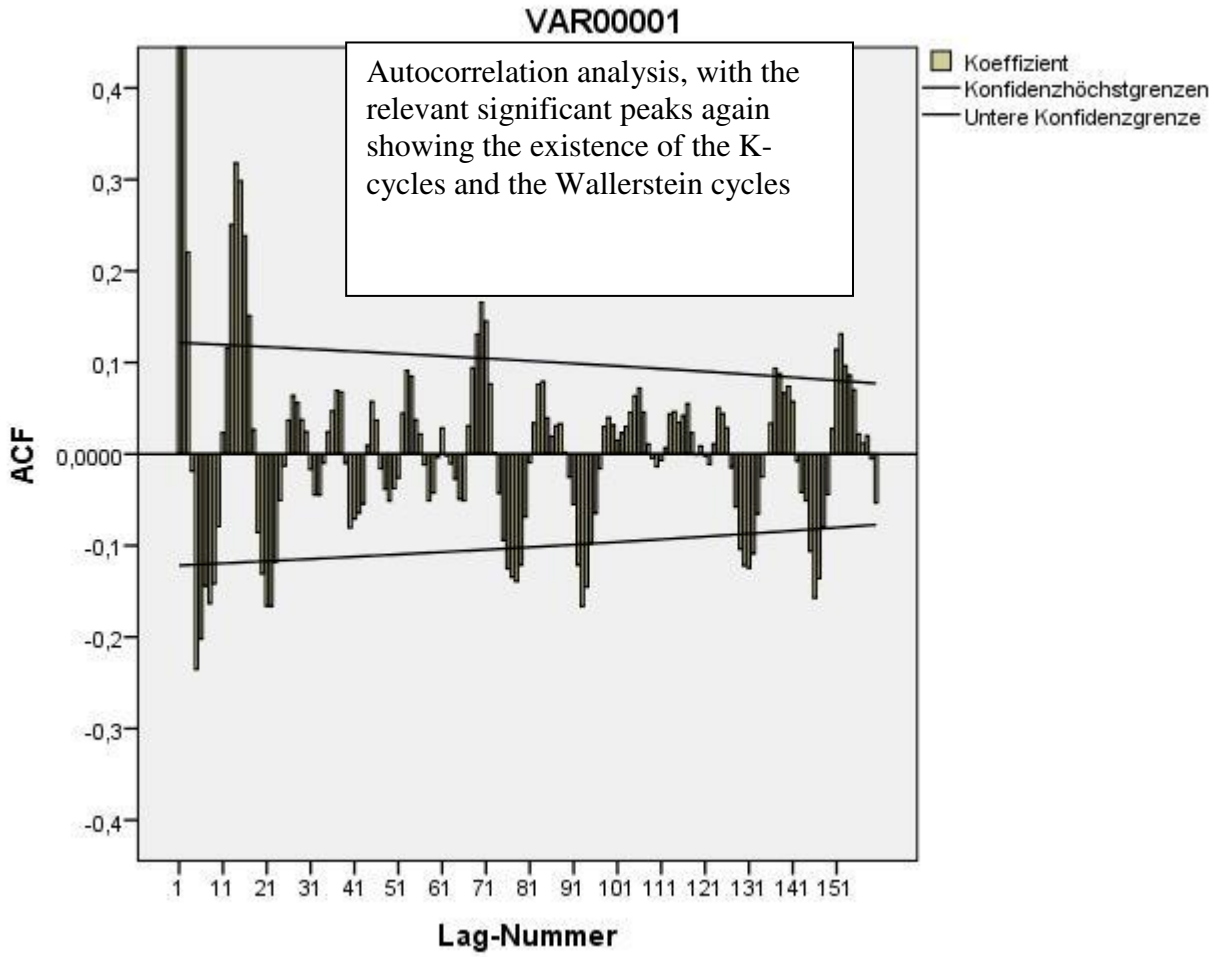



Periodogramm von VAR00001 nach Periode
Periodogram for the entire period
Periodogramm
2,0E2
1,5E2
1,0E2
5,0E1
0,0E0
0,0E0
5,0E1
1,0E2
1,5E2
2,0E2
2,5E2
3,0E2
Periode


Periodogramm von VAR00001 nach Periode
Periodogram for 0-80 years
Periodogramm
2,0E2
1,5E2
1,0E2
5,0E1
0,0E0
0,0E0 5,0E0 1,0E1 1,5E1 2,0E1 2,5E1 3,0E1 3,5E1 4,0E1 4,5E1 5,0E1 5,5E1 6,0E1 6,5E1 7,0E1
Periode

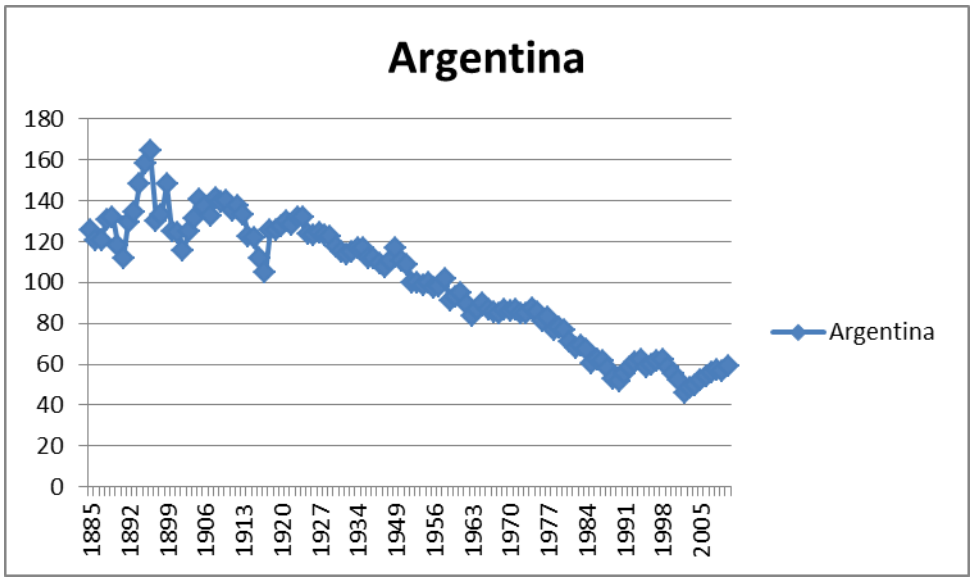

Spektraldichte von VAR00001 nach Periode
Dichte
5,0E2
4,0E2
3,0E2
2,0E2
1,0E2
0,0E0
Spectral density graph for the entire period
-1,0E1
0,0E0
1,0E1
2,0E1
3,0E1
4,0E1
5,0E1
6,0E1
7,0E1
8,0E1
9,0E1
1,0E2
1,1E2
1,2E2
1,3E2
1,4E2
1,5E2
1,6E2
1,7E2
1,8E2
1,9E2
2,0E2
2,1E2
2,2E2
2,3E2
2,4E2
2,5E2
2,6E2
2,7E2
2,8E2
2,9E2
3,0E2
3,1E2
Periode
Fenster: Tukey-Hamming (3)


Spektraldichte von VAR00001 nach Periode
Spectral density graph for the period 0-80 years
Dichte
5,0E2
4,0E2
3,0E2
2,0E2
1,0E2
0,0E0
0,0E0
1,5E1
3,0E1
4,5E1
6,0E1
Periode
Fenster: Tukey-Hamming (3)

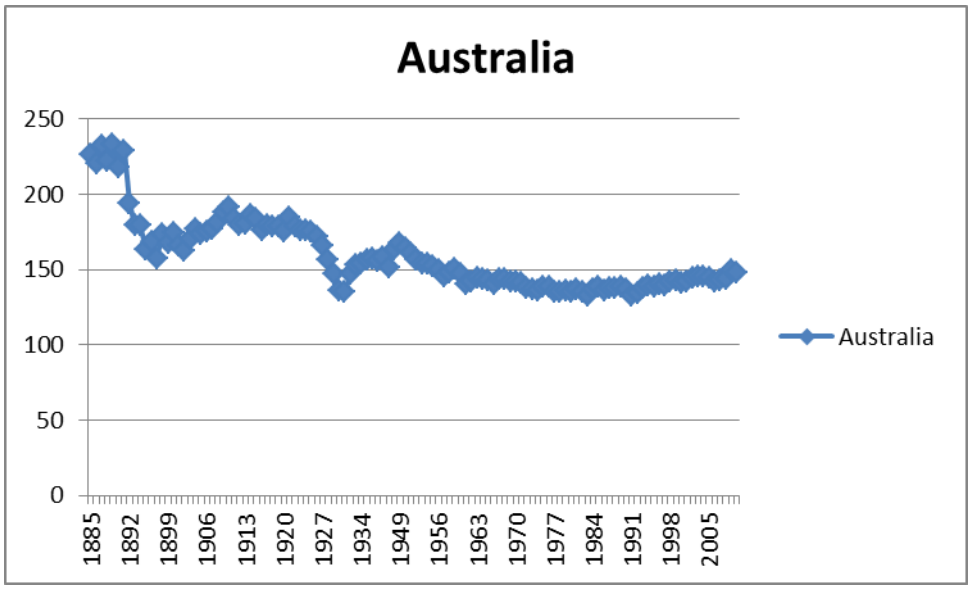

VAR00001
Autocorrelation analysis, with the relevant significant peaks again showing the existence of the K-cycles and the Wallerstein cycles
Koeffizient
Konfidenzhöchstgrenzen
Untere Konfidenzgrenze
ACF
0,4
0,3
0,2
0,1
0,0000
-0,1
-0,2
-0,3
-0,4
1 11 21 31 41 51 61 71 81 91 101 111 121 131 141 151
Lag-Nummer

Appendix (4): The Akamatsu cycles compared: Country GDP per capita in real purchasing power parity as a percentage of the global average for 31 countries in the world system since 1880

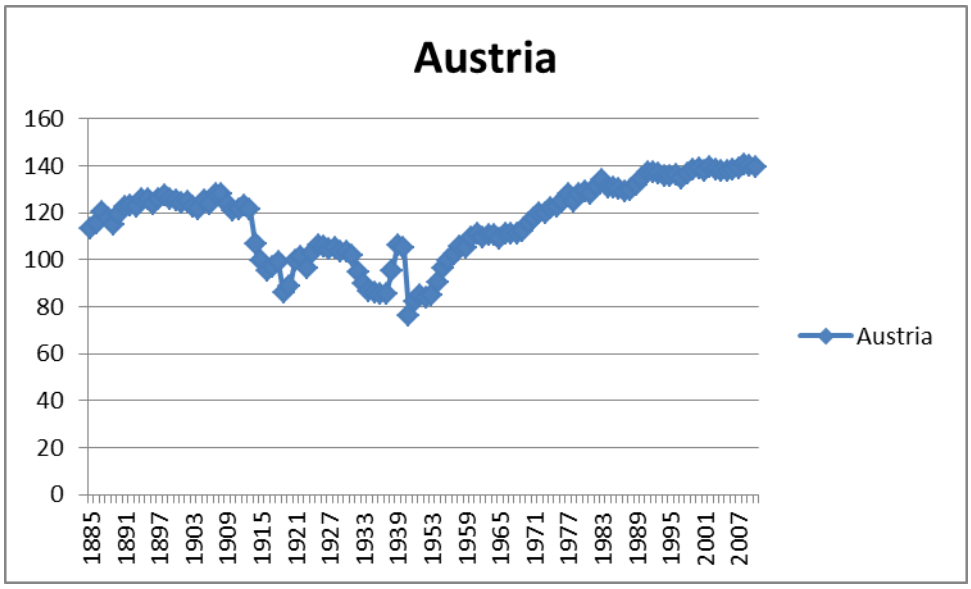
Argentina



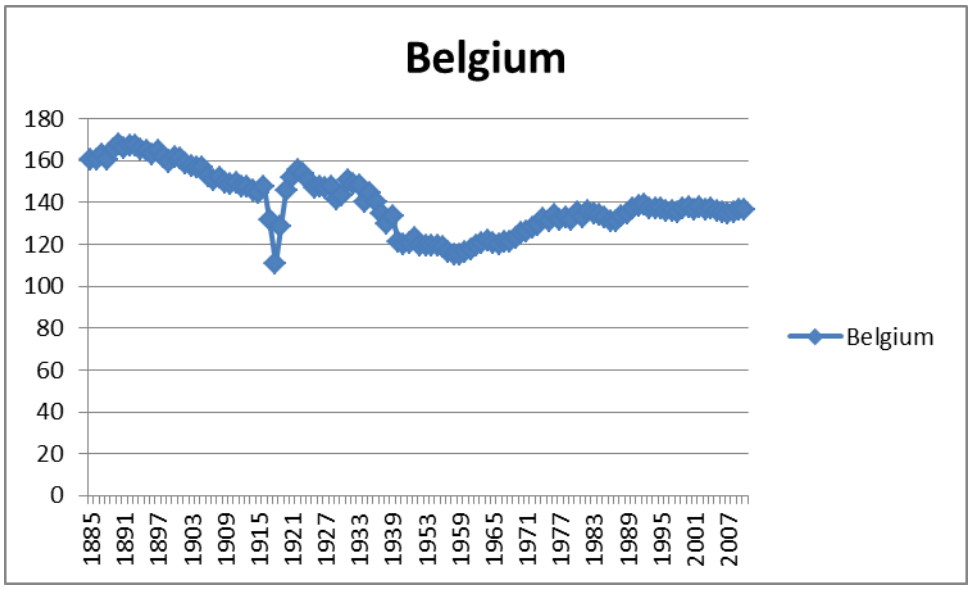
Australia



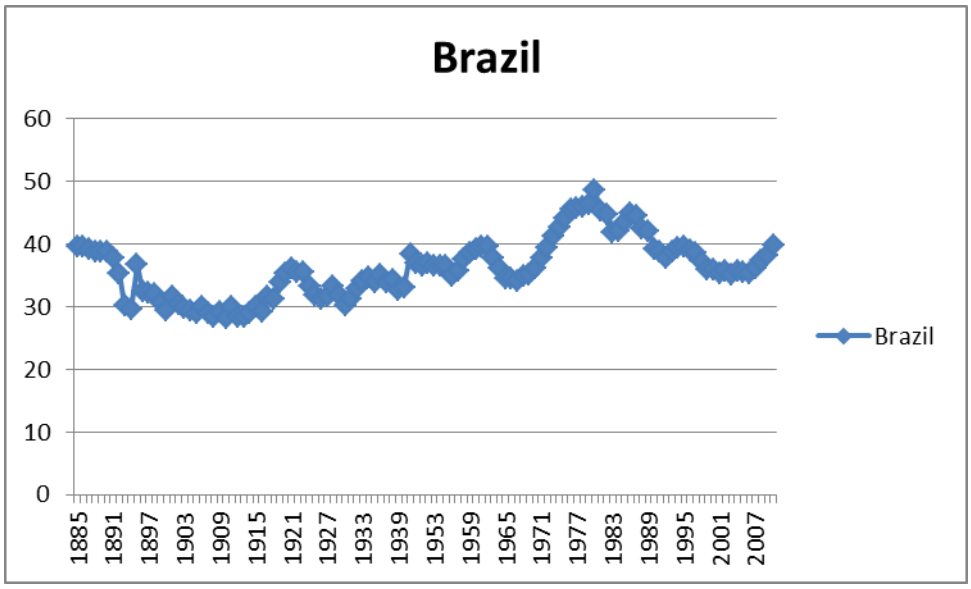
Austria



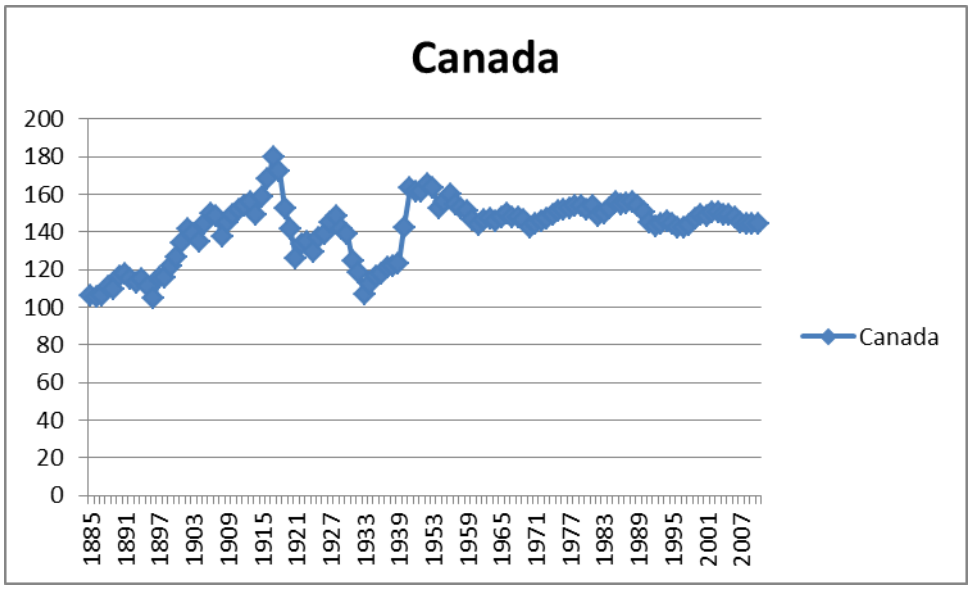
Belgium



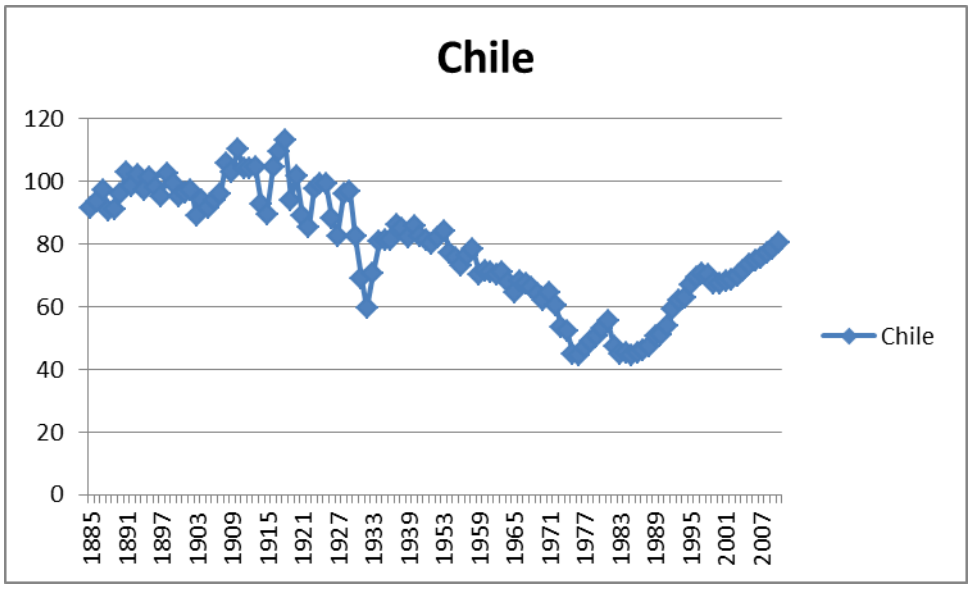
Brazil



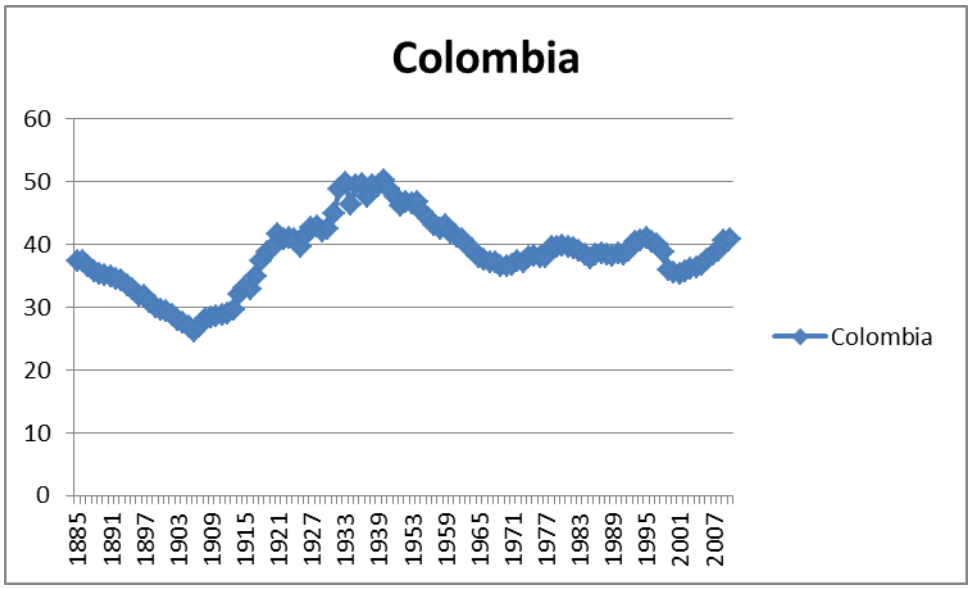
Canada



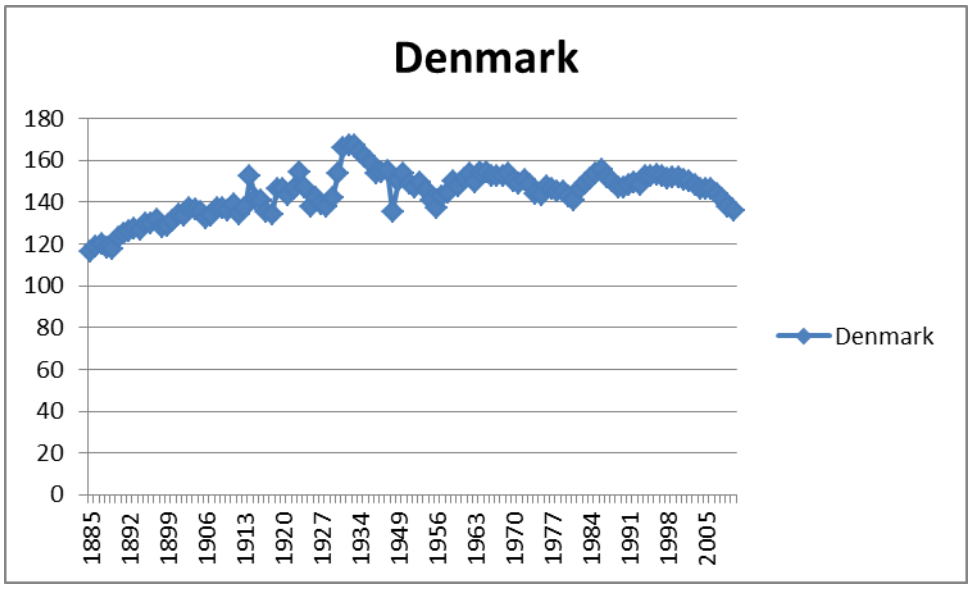
Chile



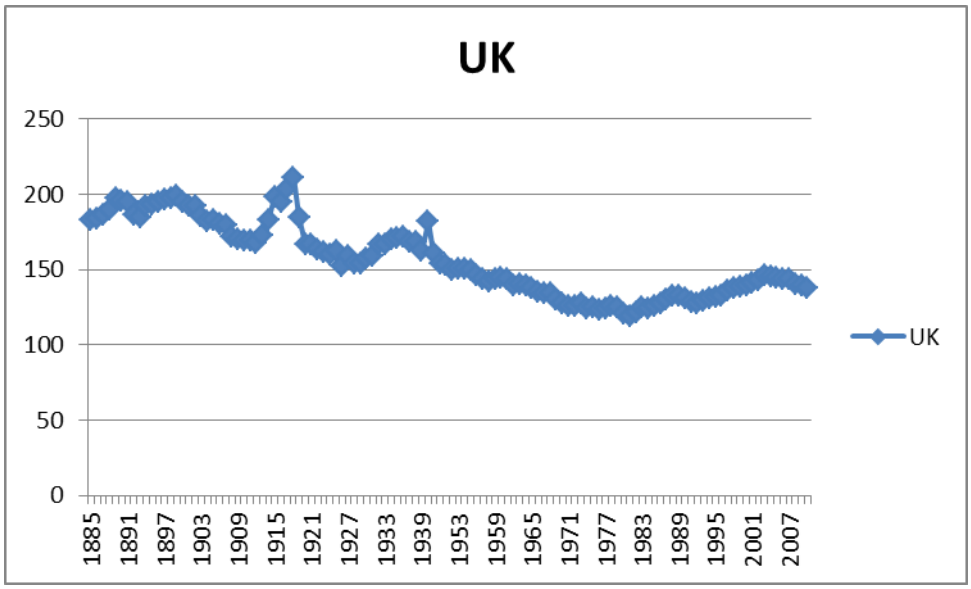
Colombia



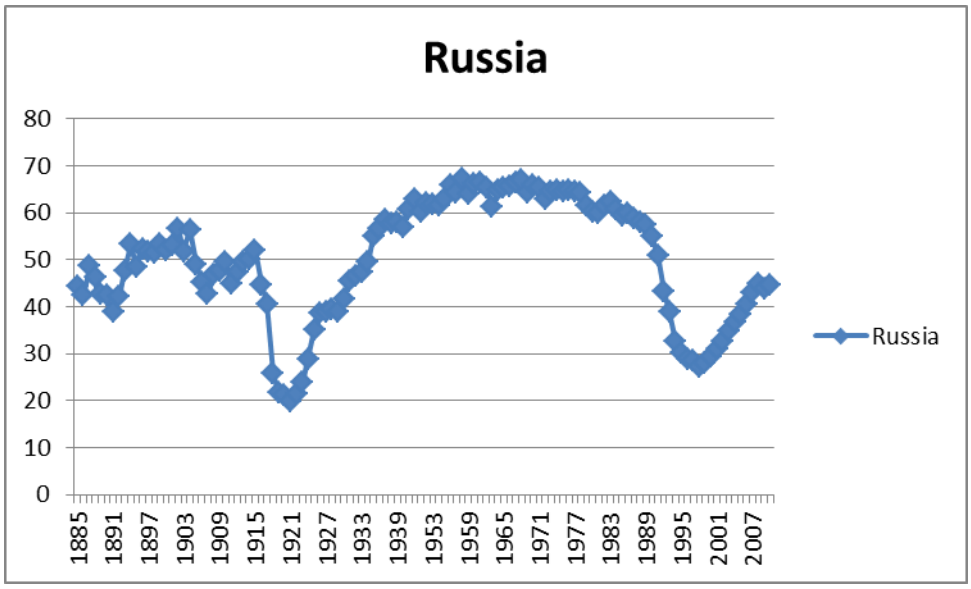
Denmark


Denmark
180
160
140
120
100
80
60
40
20
0
1885
1892
1899
1906
1913
1920
1927
1934
1949
1956
1963
1970
1977
1984
1991
1998
2005
Denmark

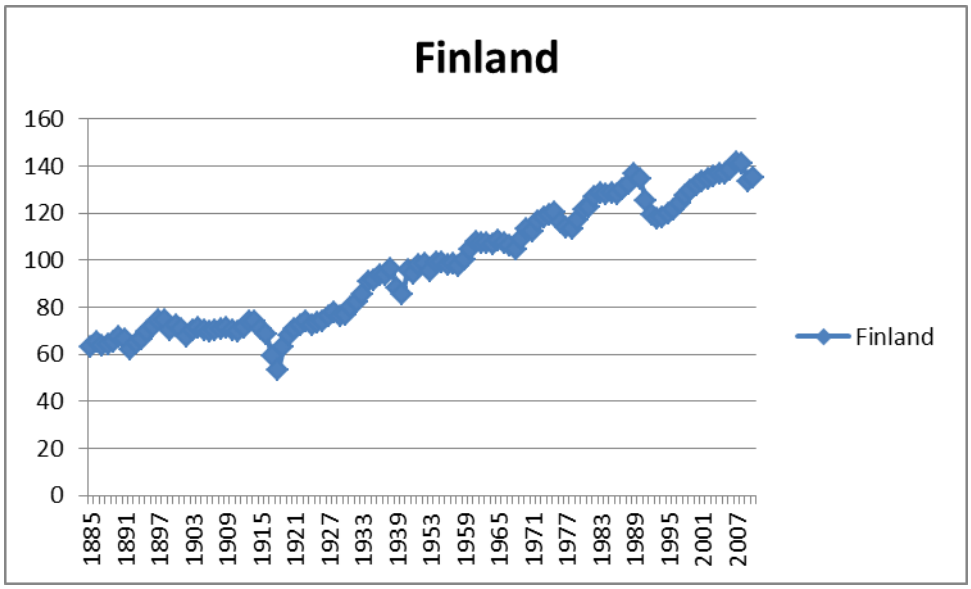
UK


UK
250
200
150
100
50
0
1885
1891
1897
1903
1909
1915
1921
1927
1933
1939
1953
1959
1965
1971
1977
1983
1989
1995
2001
2007
UK

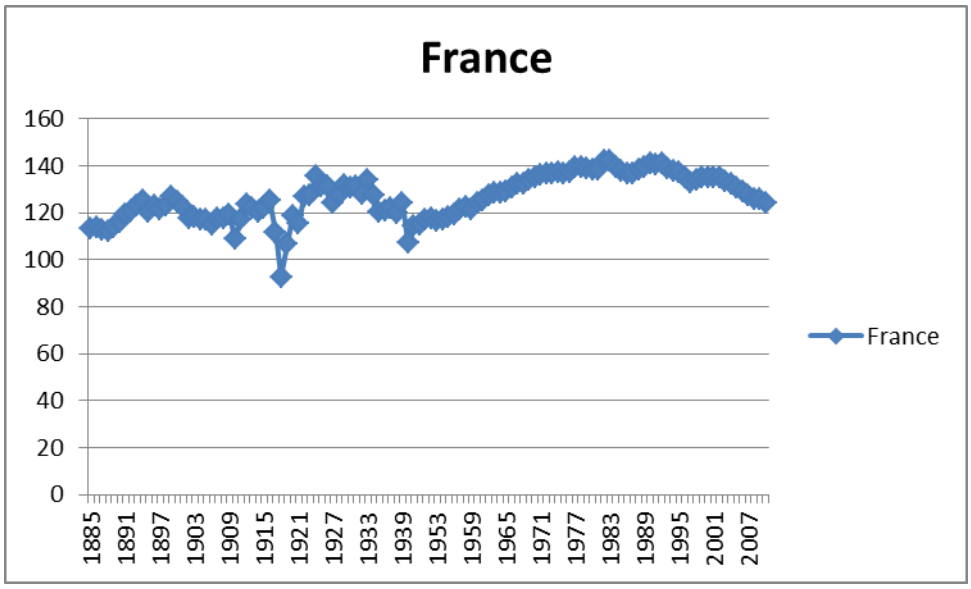
Former USSR/Russia



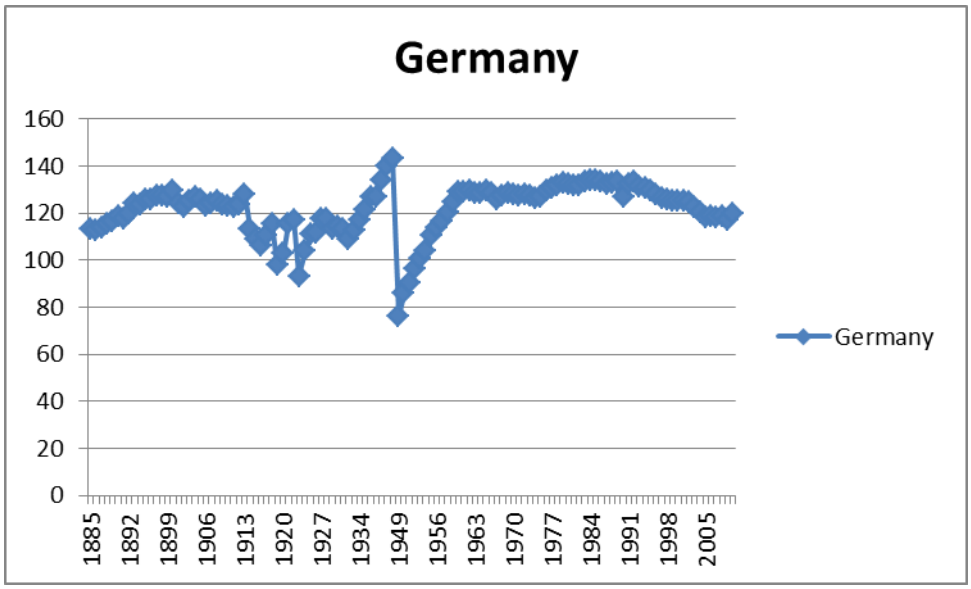
Finland



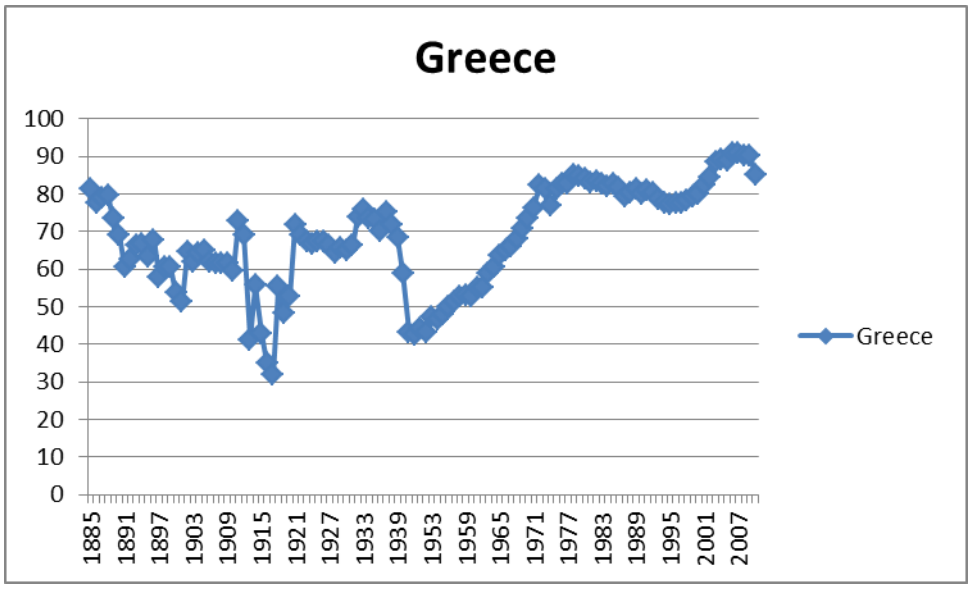
France



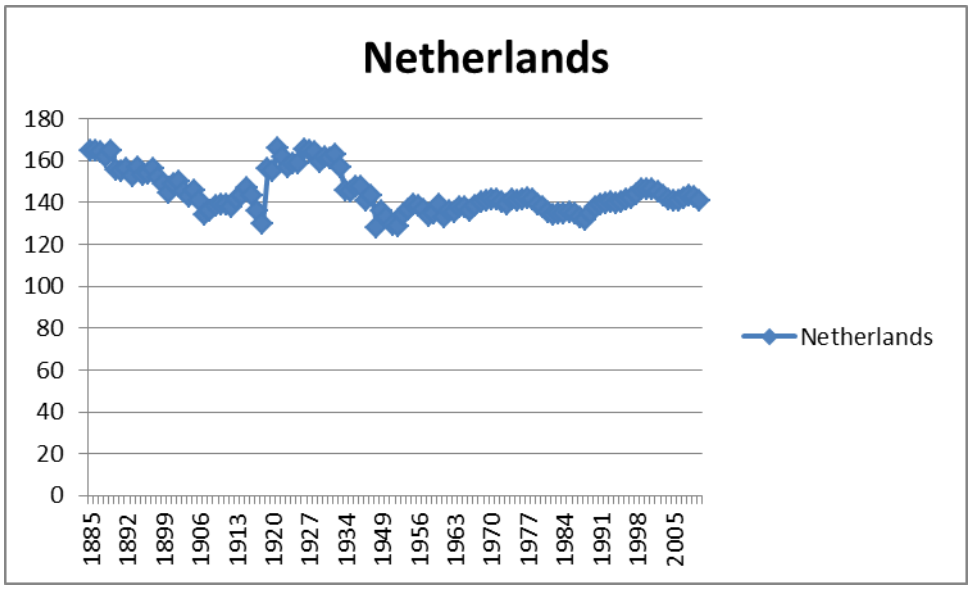
Germany



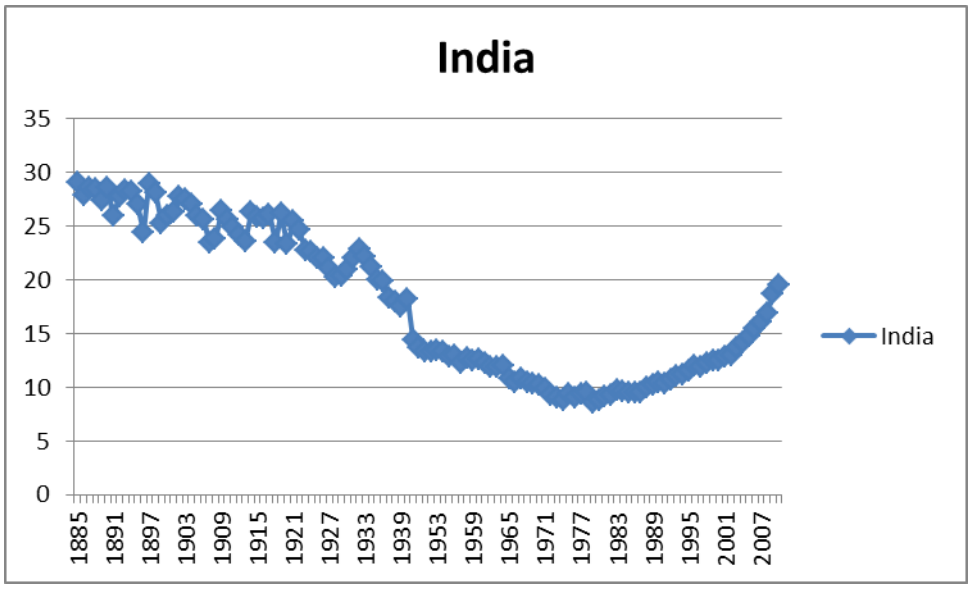
Greece



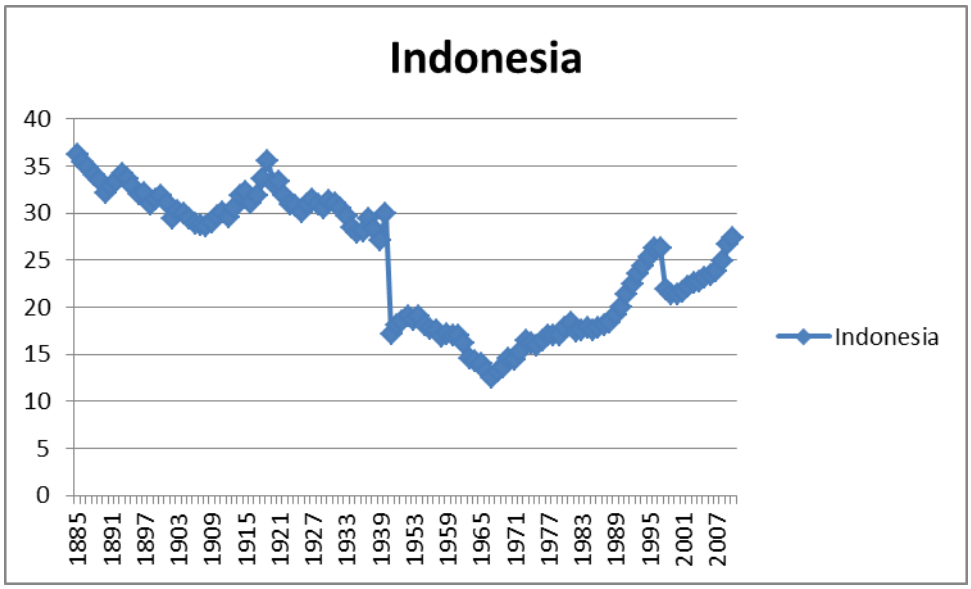
Netherlands



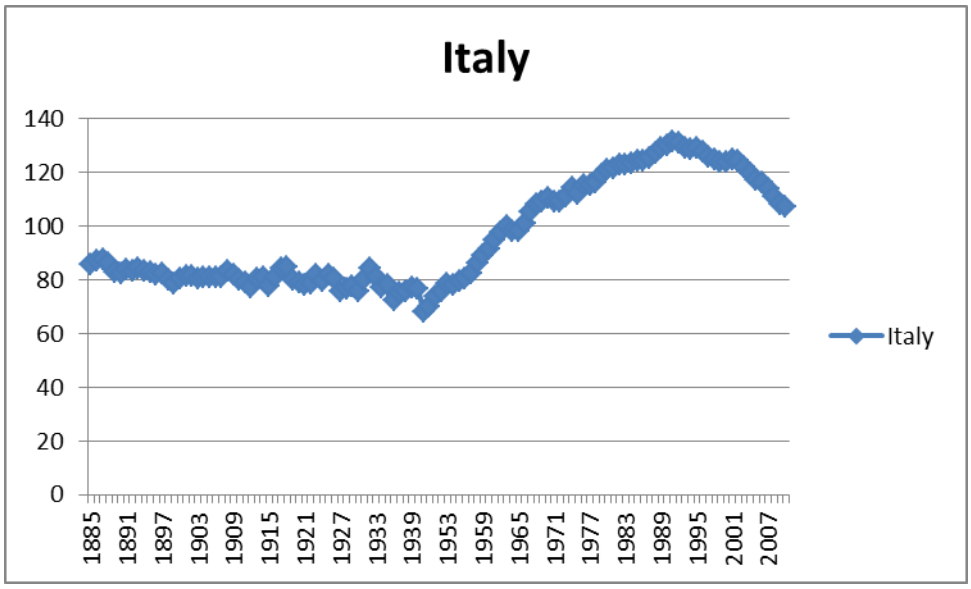
India



Indonesia



Italy


Italy
140
120
100
80
60
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0
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1903
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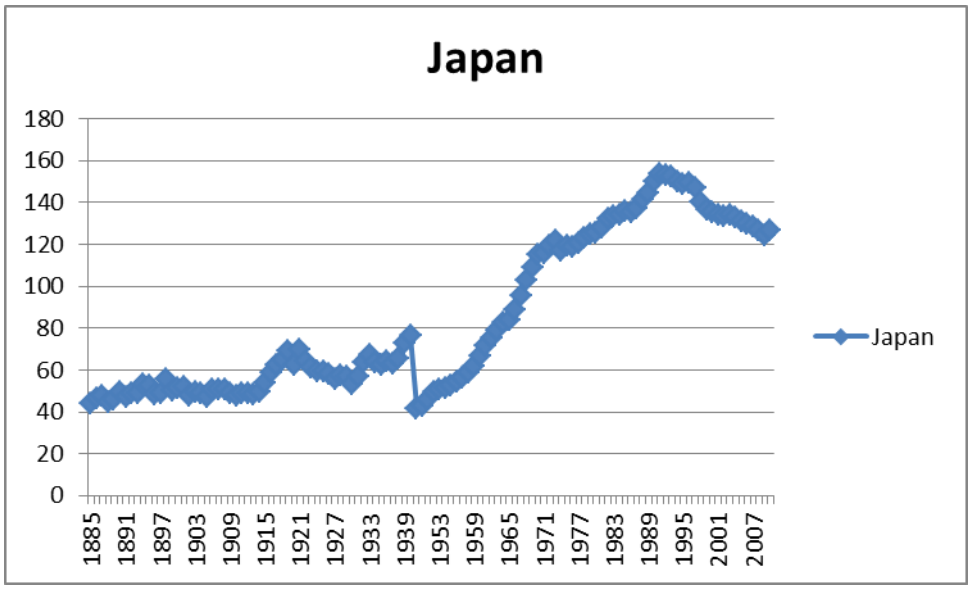
1933
1939
1953
1959
1965
1971
1977
1983
1989
1995
2001
2007
Italy

Japan


Japan
180
160
140
120
100
80
60
40
20
0
1885
1891
1897
1903
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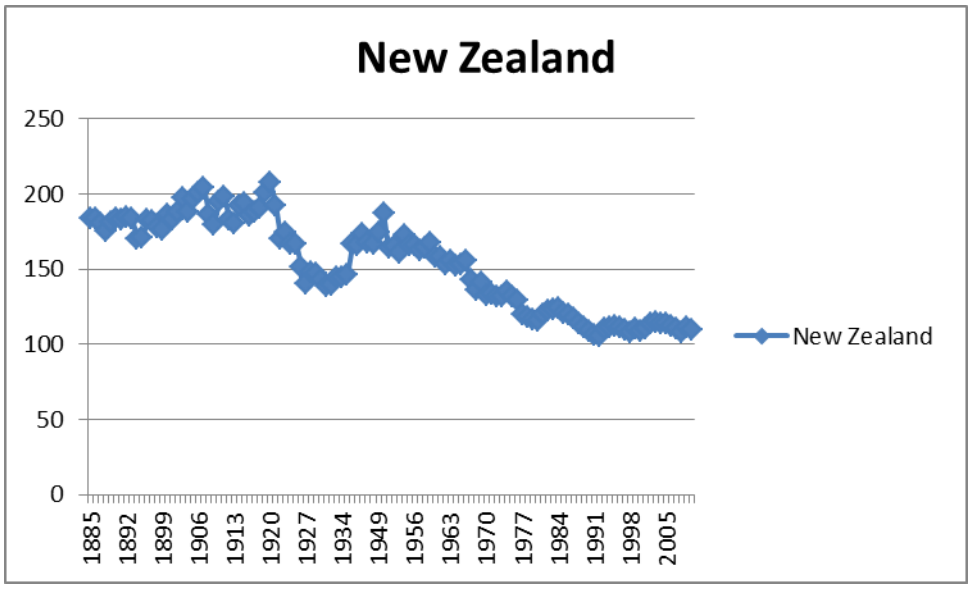
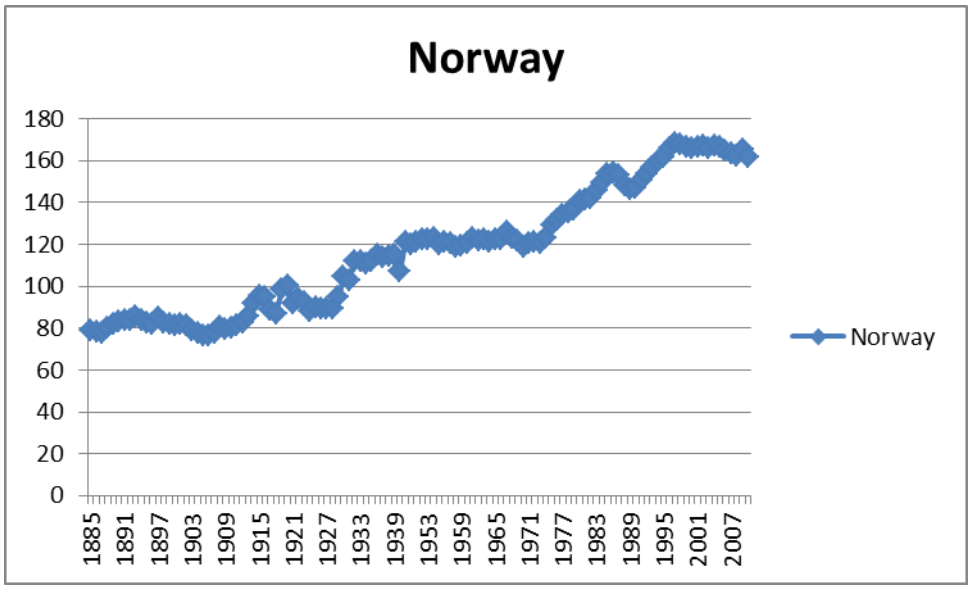
1927
1933
1939
1953
1959
1965
1971
1977
1983
1989
1995
2001
2007
Japan

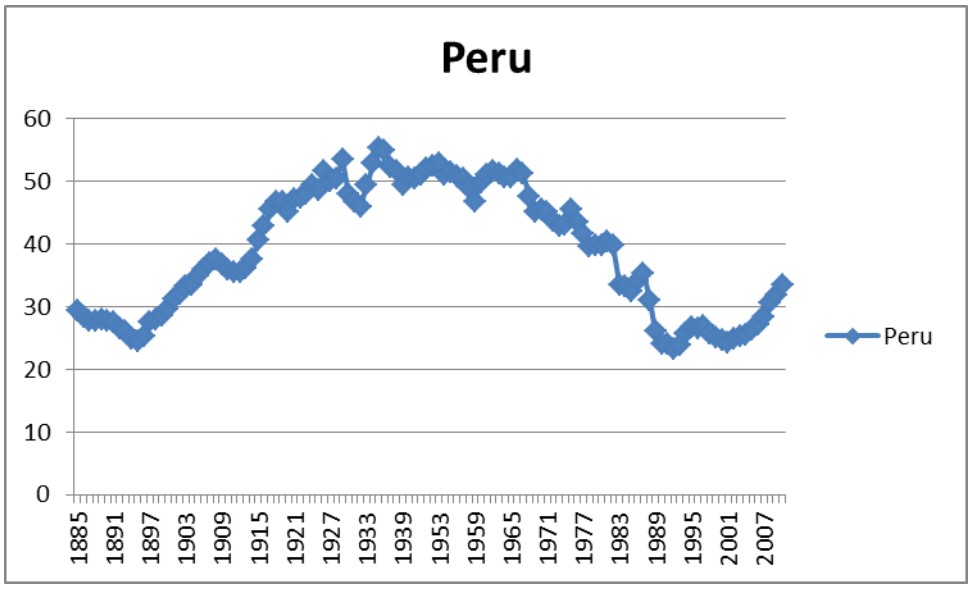
New Zealand



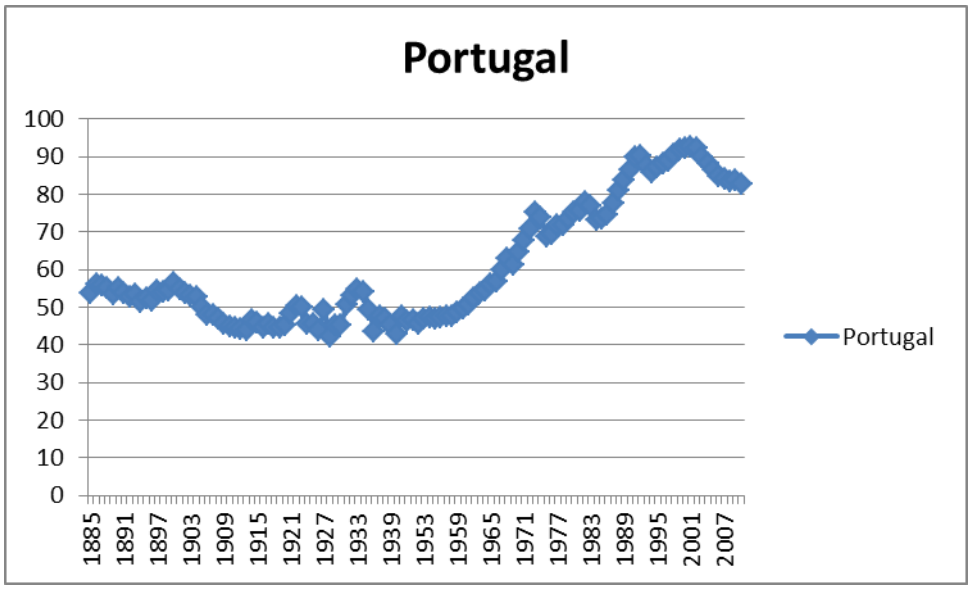
Norway



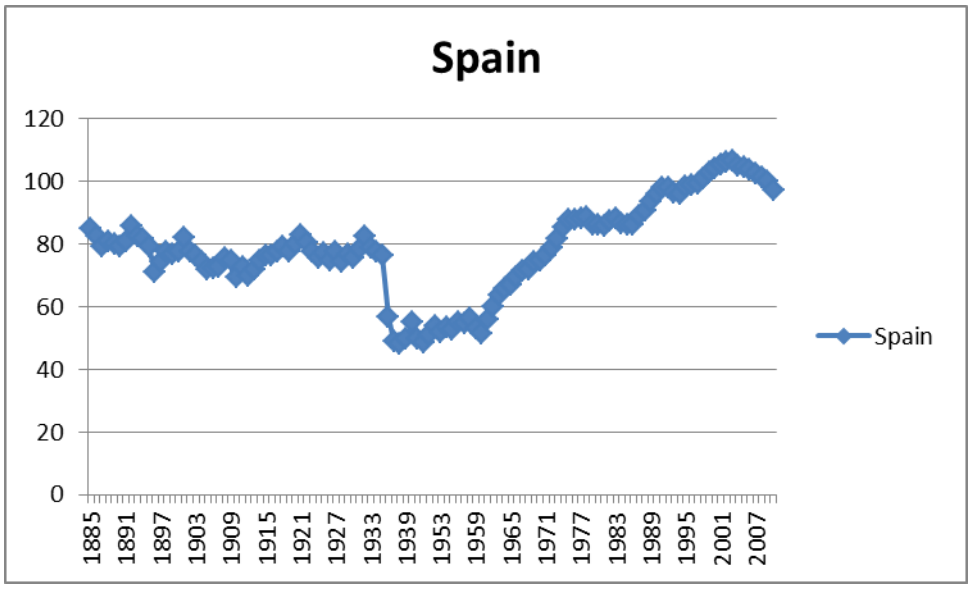
Peru



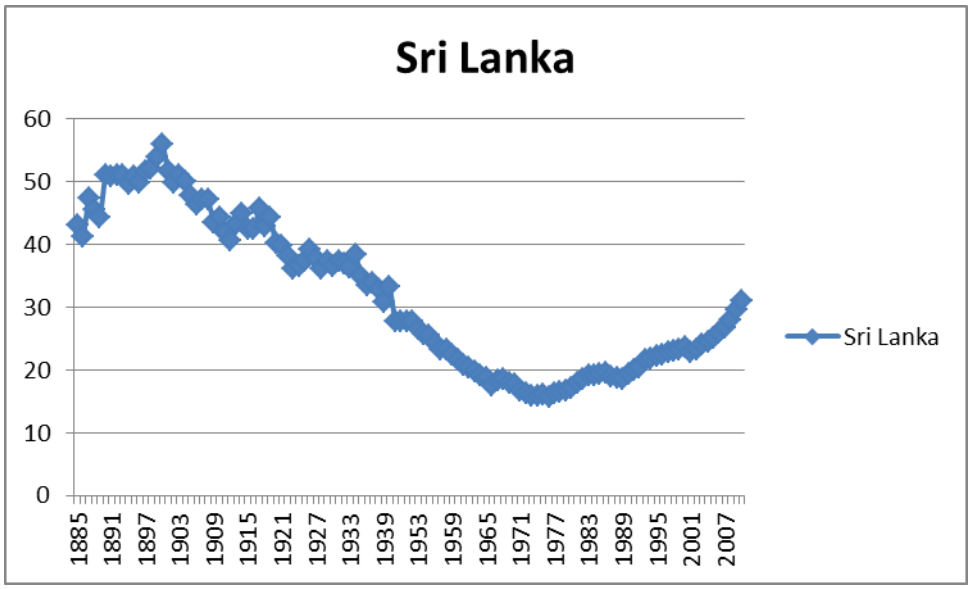
Portugal



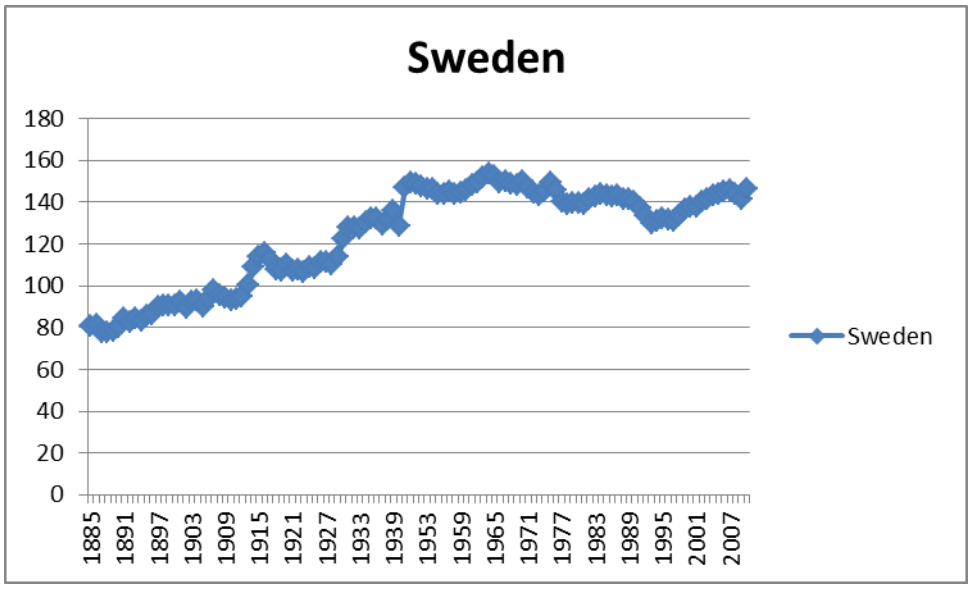
Spain



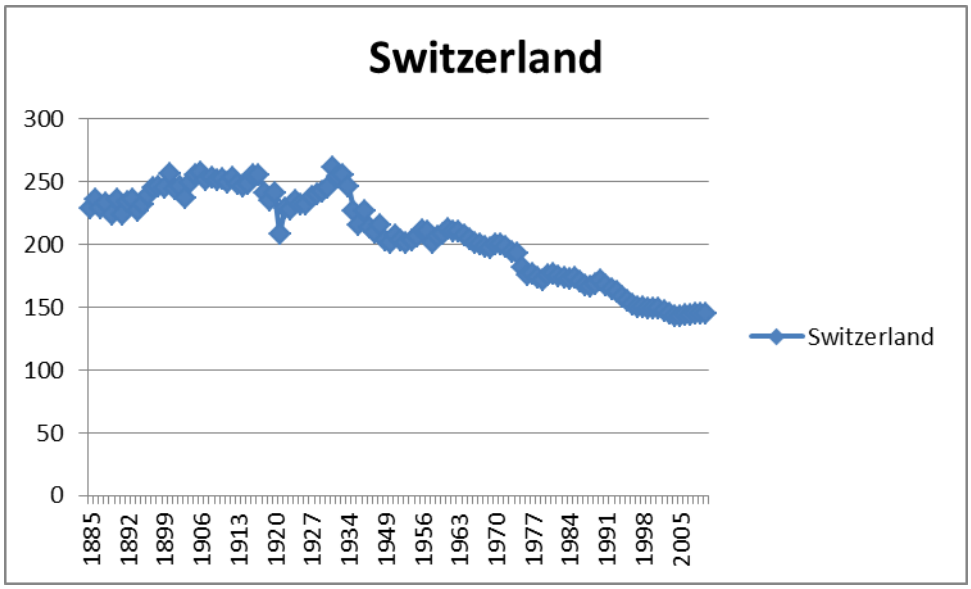
Sir Lanka



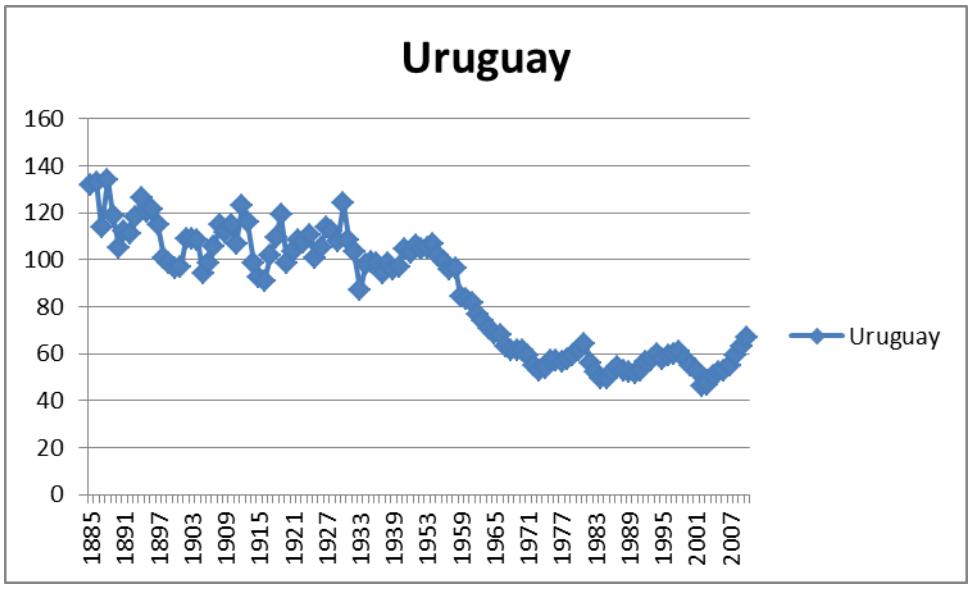
Sweden



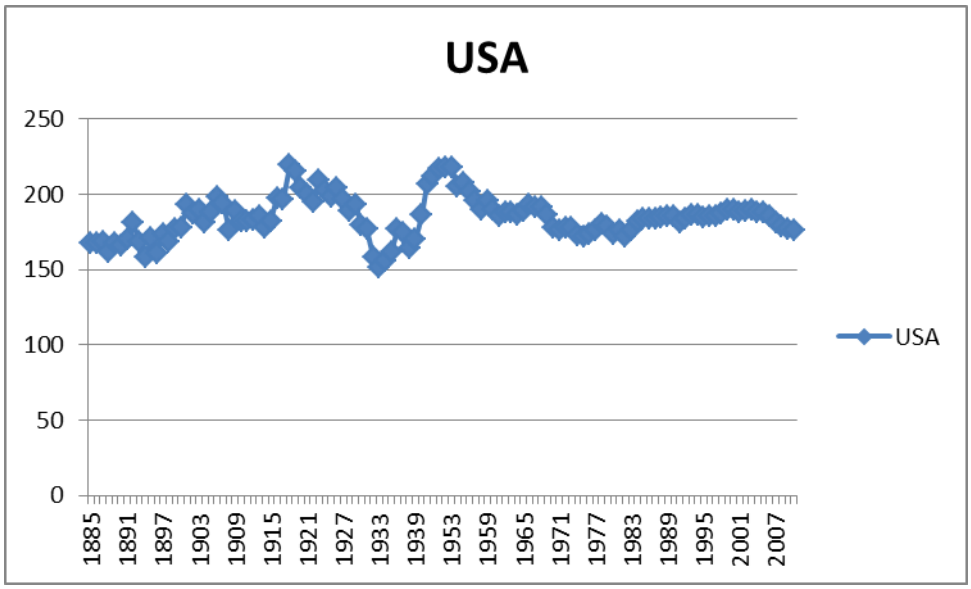
Switzerland



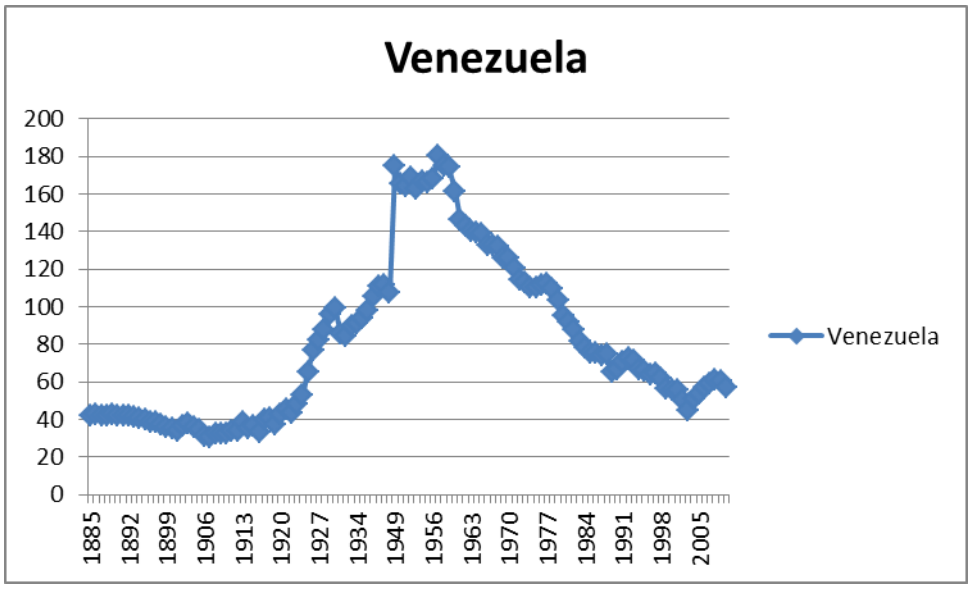
Uruguay



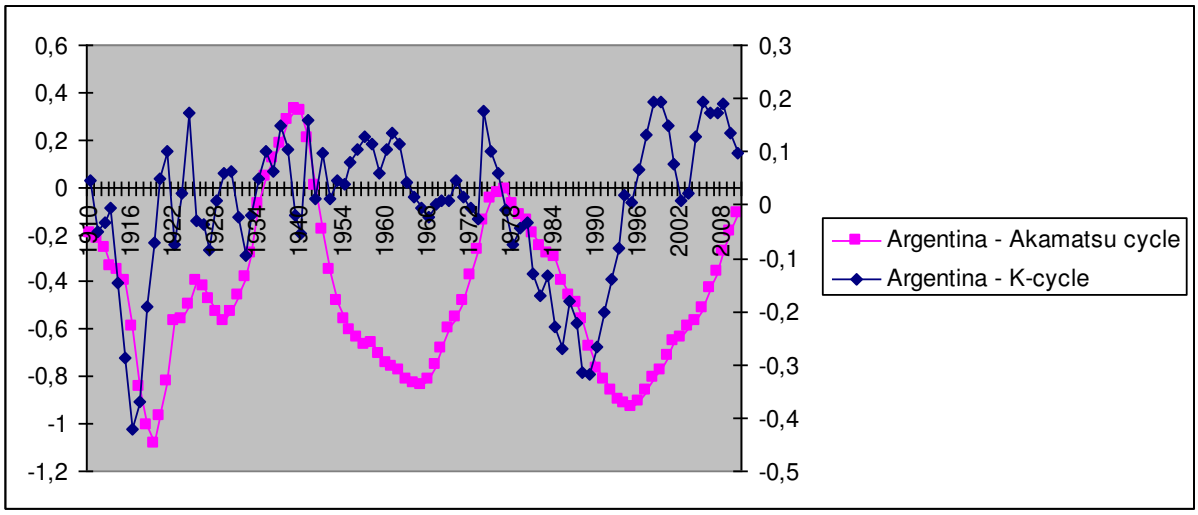
United States

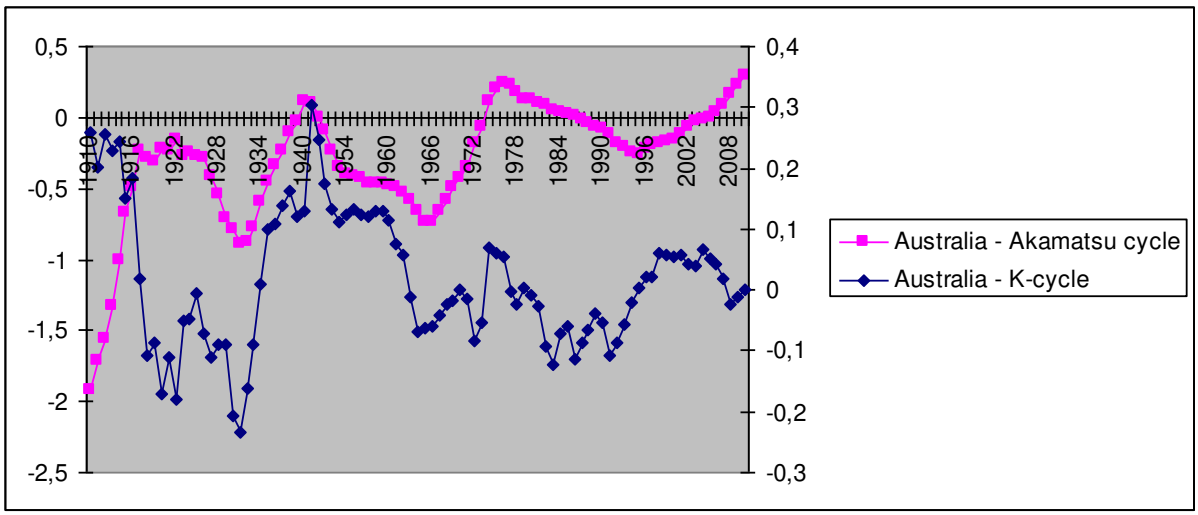


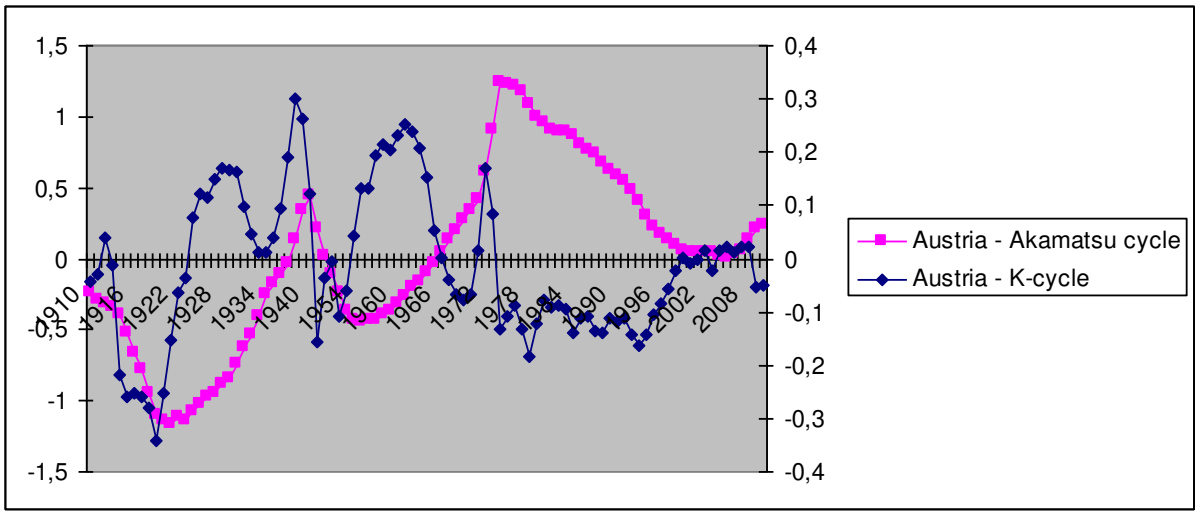
Venezuela

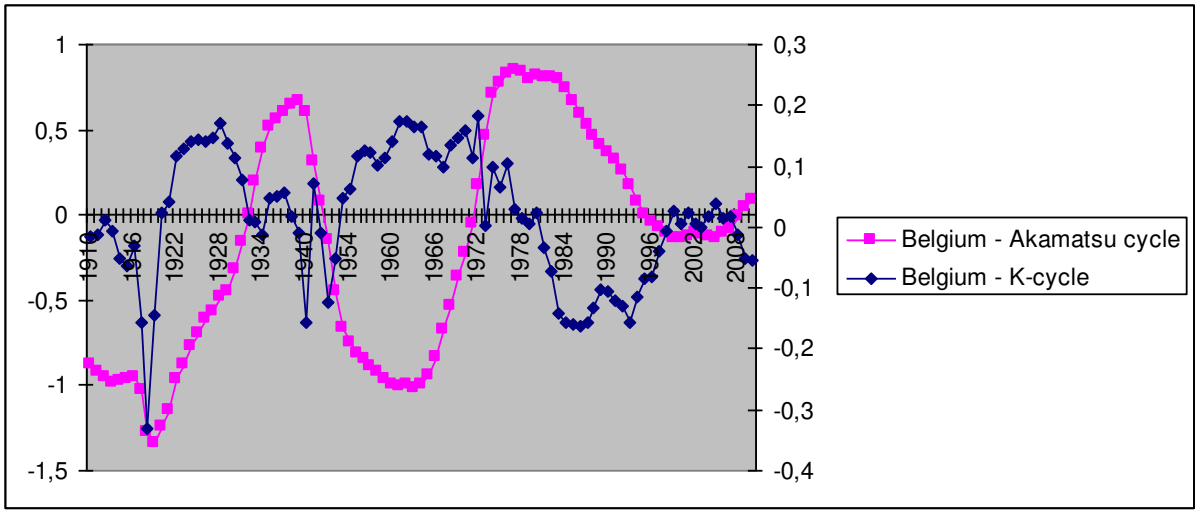

Venezuela
200
180
160
140
120
100
80
60
40
20
0
1885
1892
1899
1906
1913
1920
1927
1934
1949
1956
1963
1970
1977
1984
1991
1998
2005
Venezuela

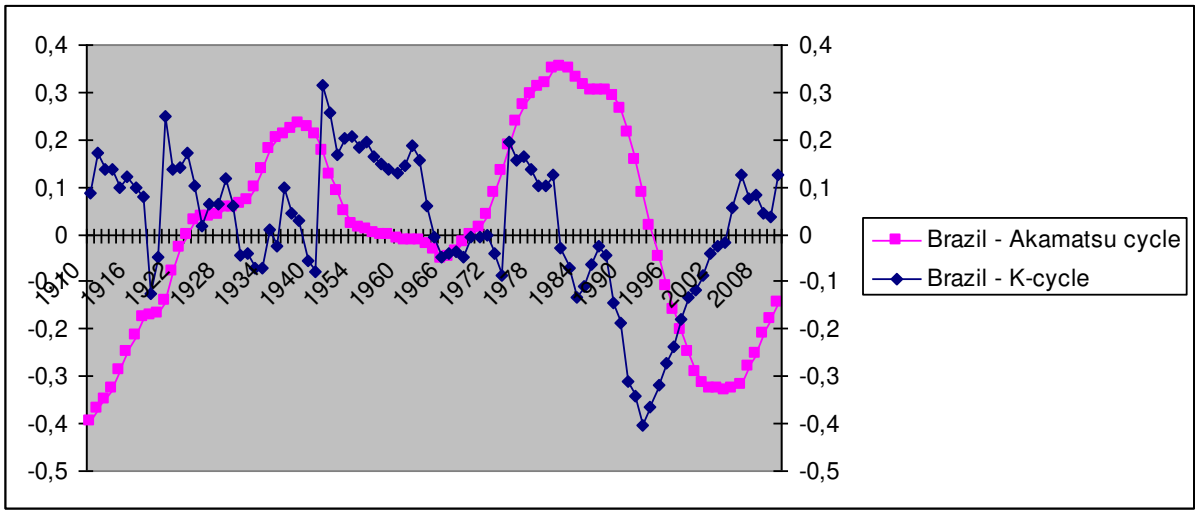
Appendix (5): Rolling regressions – 25 year rolling regression slopes. Akamatsu cycle (–cycle of income convergence with the capitalist center, USA; left hand scale); Kondratiev/Kondratieff cycles: right hand scale






1,5
1
0,5
0
-0,5
-1
-1,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Austria - Akamatsu cycle
Austria - K-cycle


1
0,5
0
-0,5
-1
-1,5
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Belgium - Akamatsu cycle
Belgium - K-cycle


0,4
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
-0,5
1910
1916
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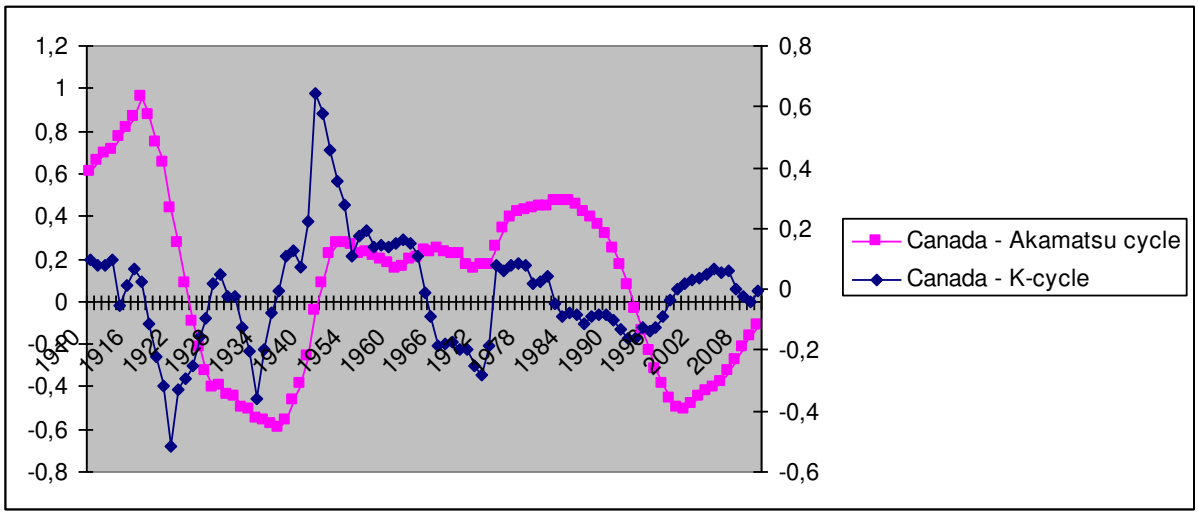
2002
2008
Brazil - Akamatsu cycle
Brazil - K-cycle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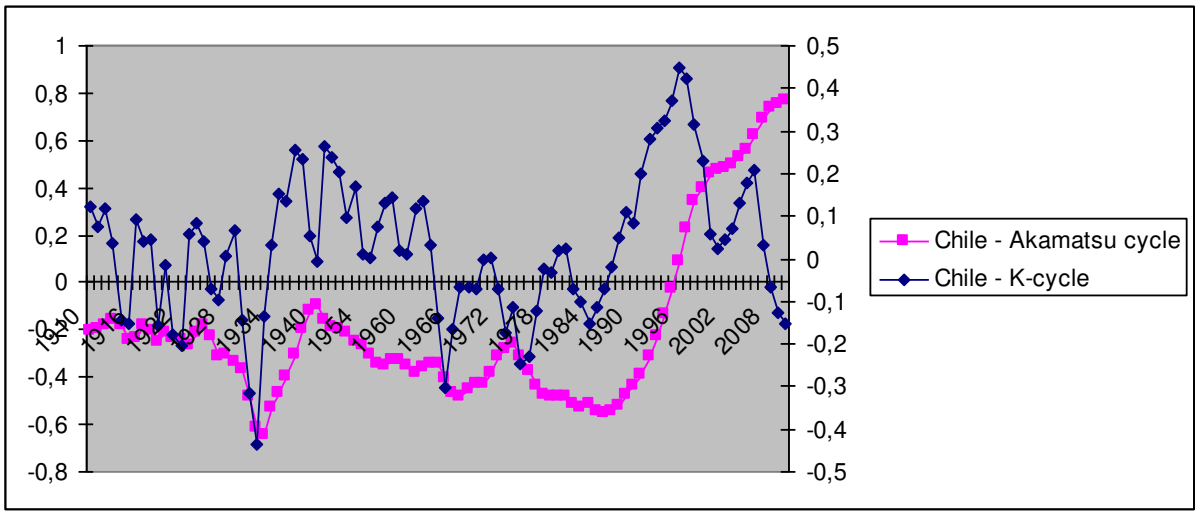
2002
2008
Canada - Akamatsu cycle
Canada - K-cycle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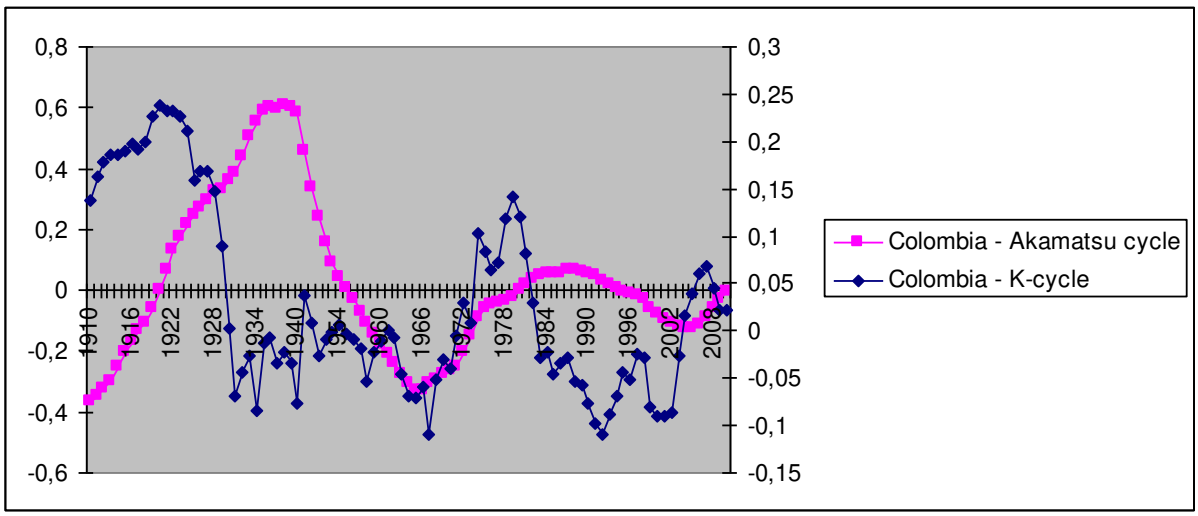
1996
2002
2008
Chile - Akamatsu cycle
Chile - K-cycle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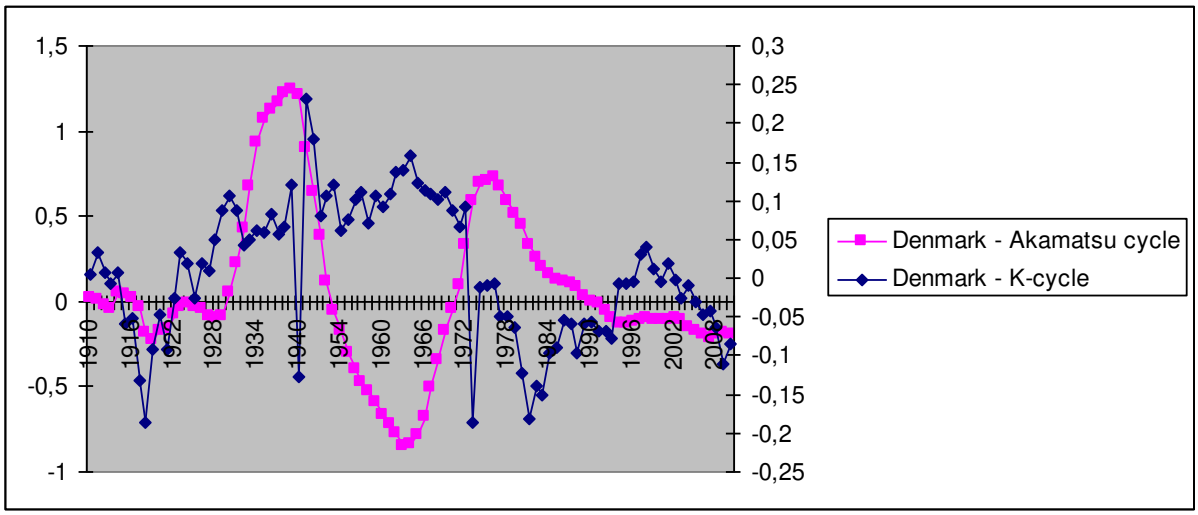
1990
1996
2002
2008
Colombia - Akamatsu cycle
Colombia - K-cycle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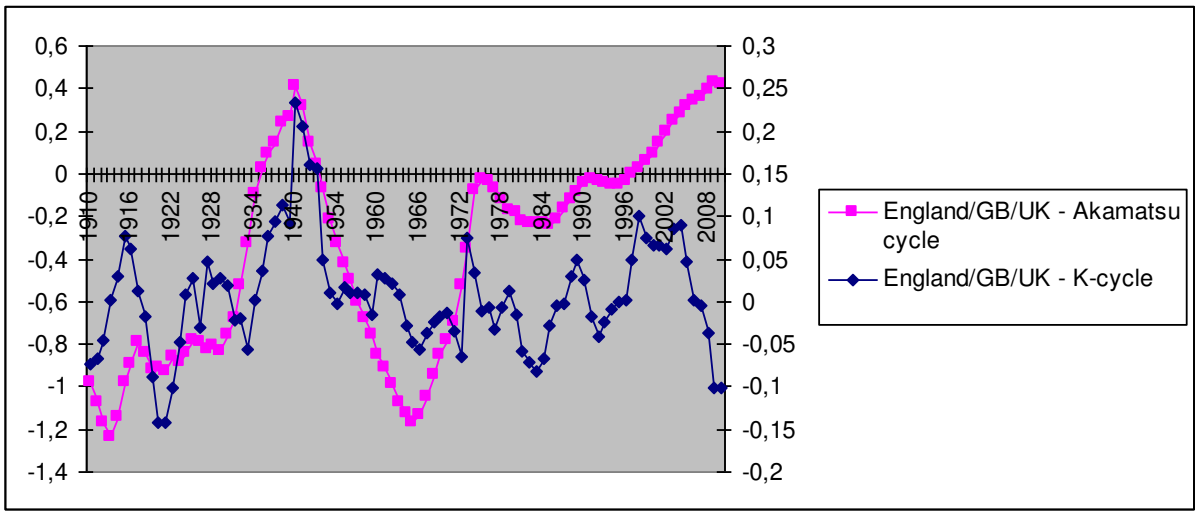
1996
2002
2008
Denmark - Akamatsu cycle
Denmark - K-cycle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1910
1916
1922
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1954
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1966
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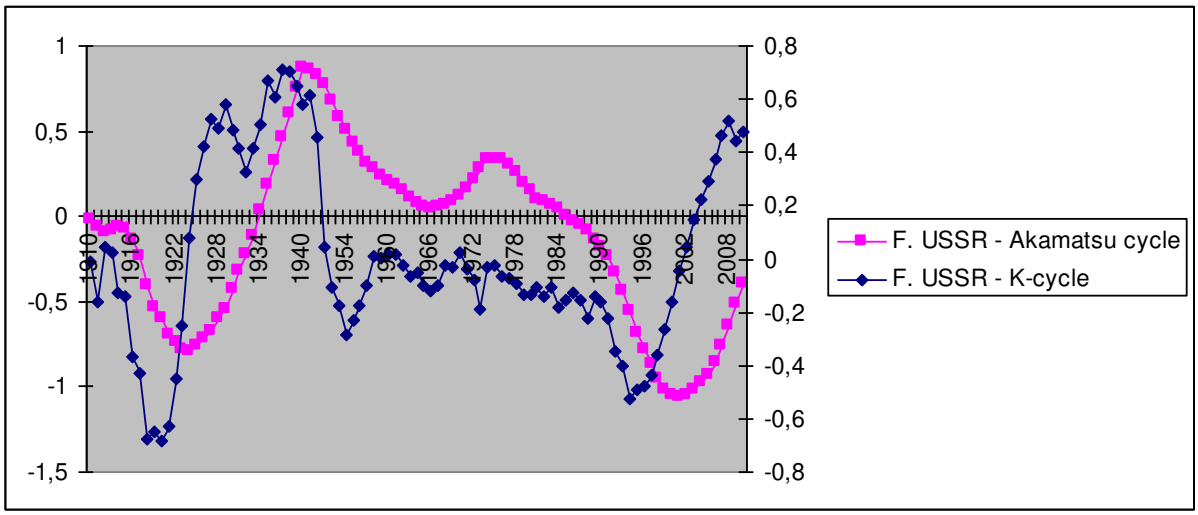
1978
1984
1990
1996
2002
2008
England/GB/UK - Akamatsu cycle
England/GB/UK - K-cycle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1910
1916
1922
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1954
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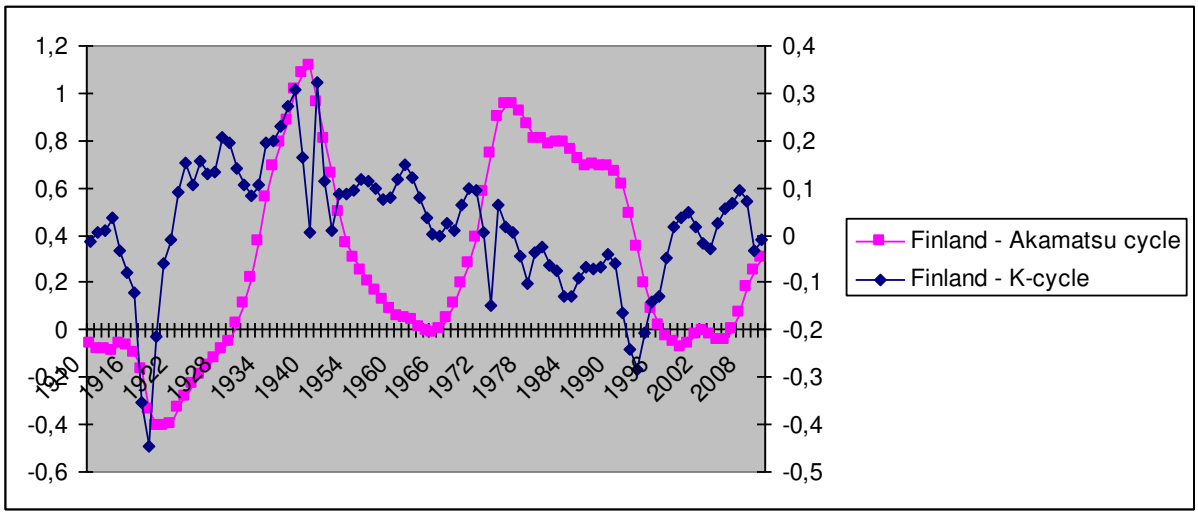
1966
1972
1978
1984
1990
1996
2002
2008
F. USSR - Akamatsu cycle
F. USSR - K-cycle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1916
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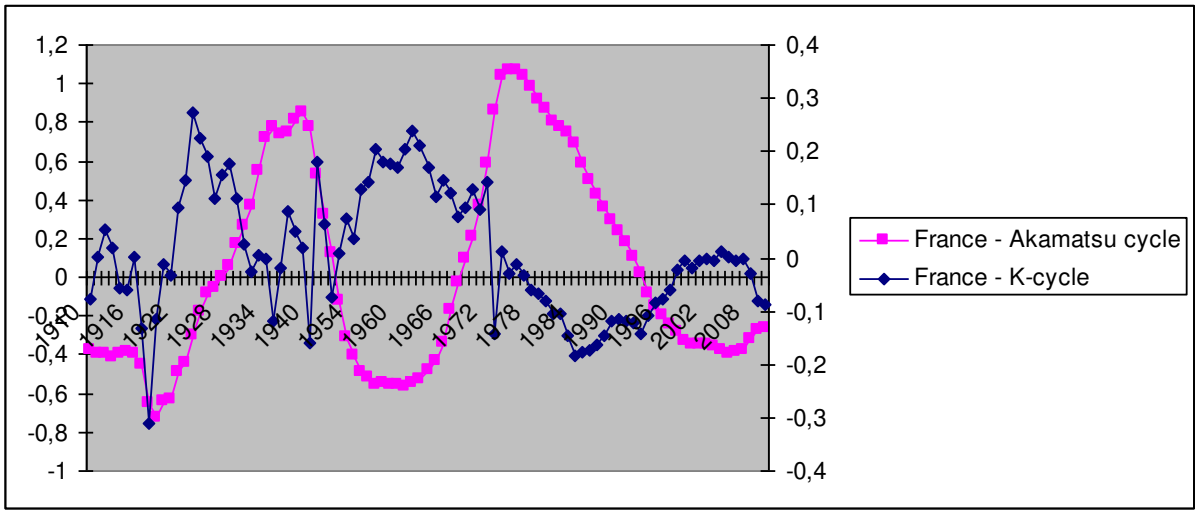
1966
1972
1978
1984
1990
1996
2002
2008
Finland - Akamatsu cycle
Finland - K-cycle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-0,3
-0,4
1910
1916
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1940
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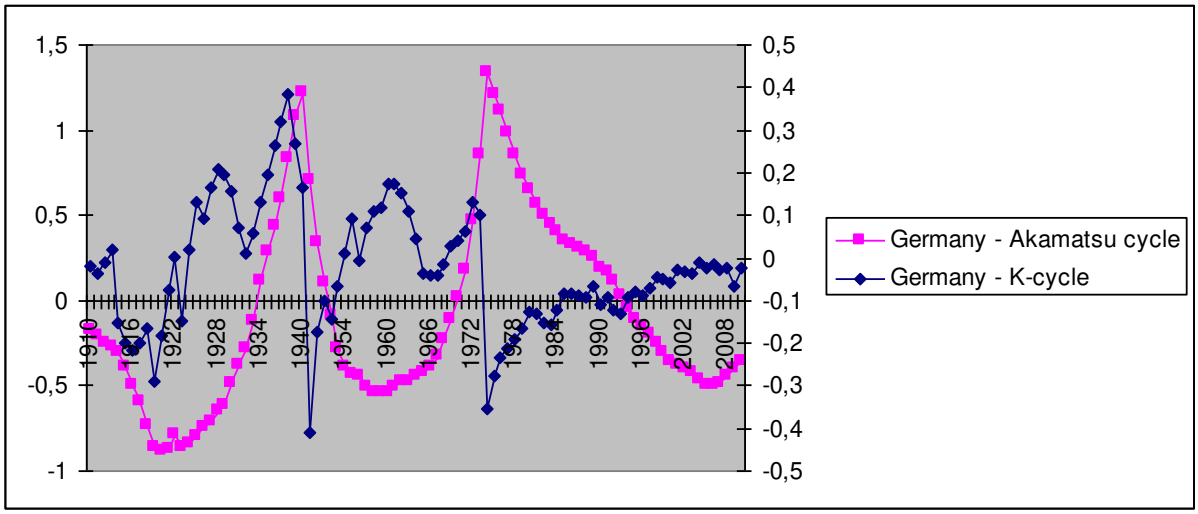
1960
1966
1972
1978
1984
1990
1996
2002
2008
France - Akamatsu cycle
France - K-cycle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-0,5
1910
1916
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1928
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1954
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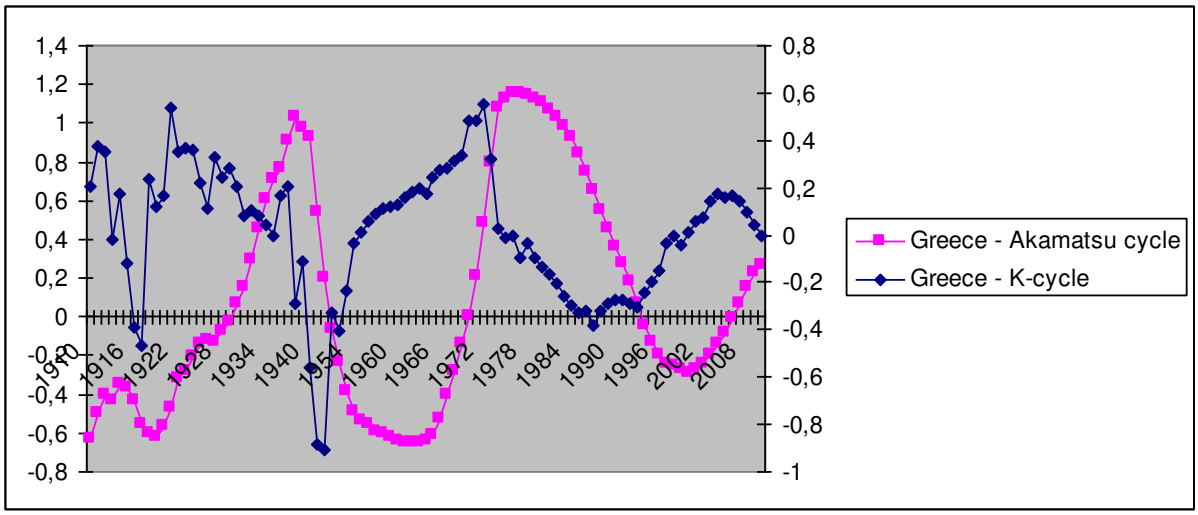
1966
1972
1978
1984
1990
1996
2002
2008
Germany - Akamatsu cycle
Germany - K-cycle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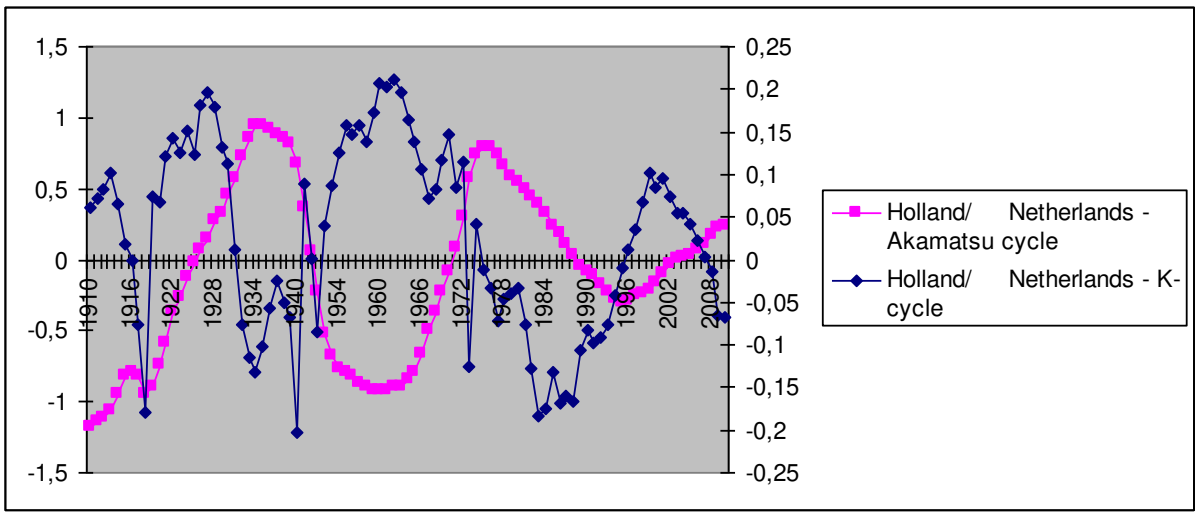
-0,6
-0,8
-1
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Greece - Akamatsu cycle
Greece - K-cycle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1910
1916
1922
1928
1934
1940
1954
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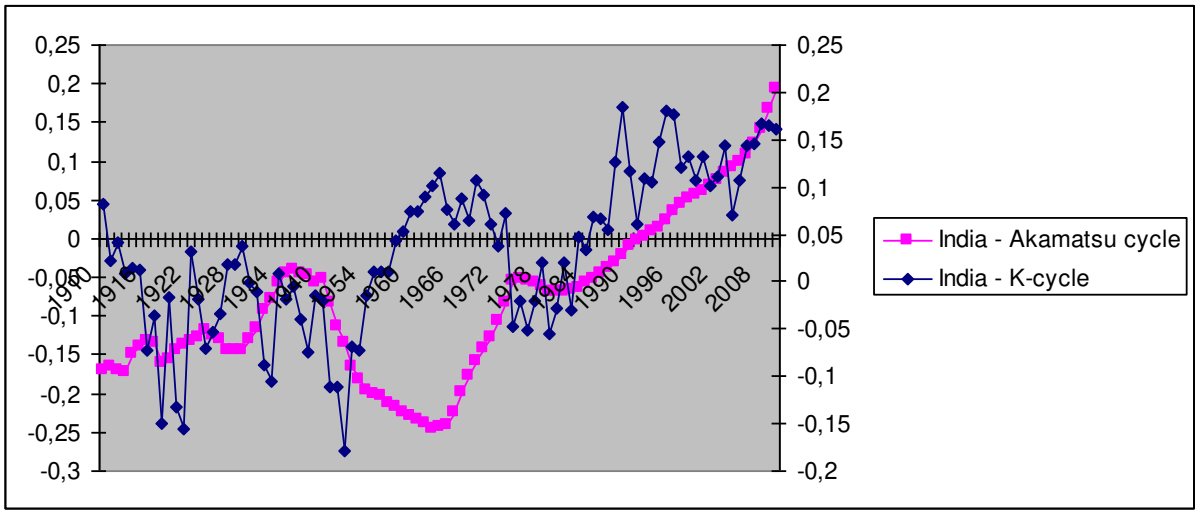
1966
1972
1978
1984
1990
1996
2002
2008
Holland/ Netherlands - Akamatsu cycle
Holland/ Netherlands - K-cycle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1910
1916
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1928
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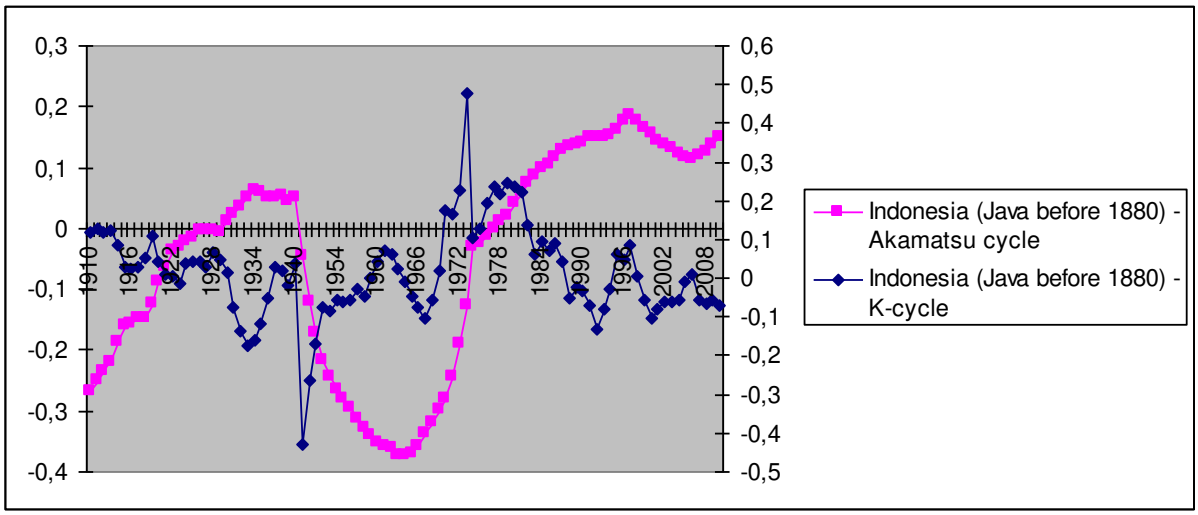
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
India - Akamatsu cycle
India - K-cycle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1916
1922
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1934
1940
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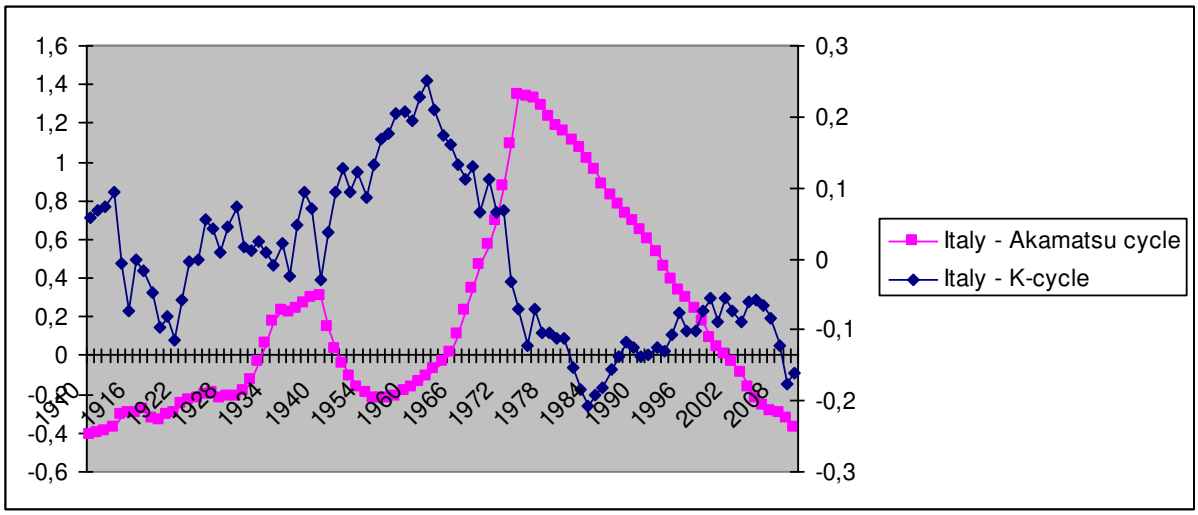
1960
1966
1972
1978
1984
1990
1996
2002
2008
Indonesia (Java before 1880) - Akamatsu cycle
Indonesia (Java before 1880) - K-cycle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-0,3
1910
1916
1922
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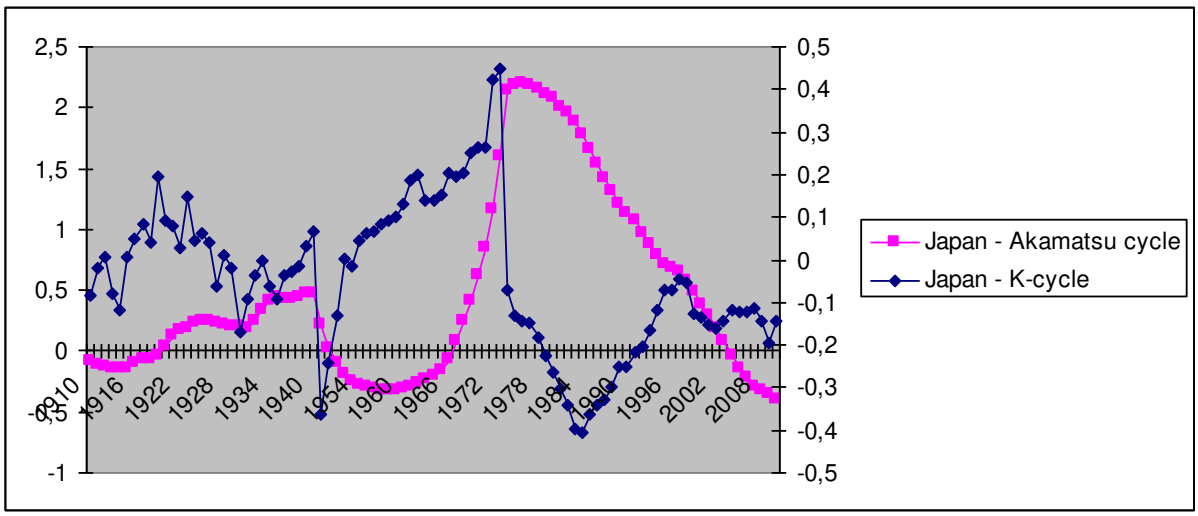
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Italy - Akamatsu cycle
Italy - K-cycle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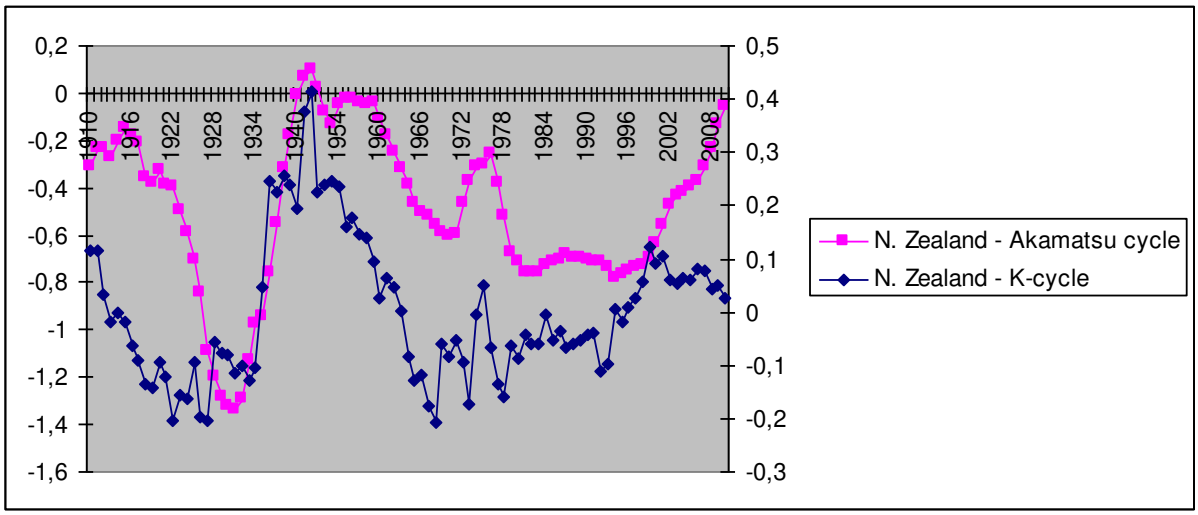
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Japan - Akamatsu cycle
Japan - K-cycle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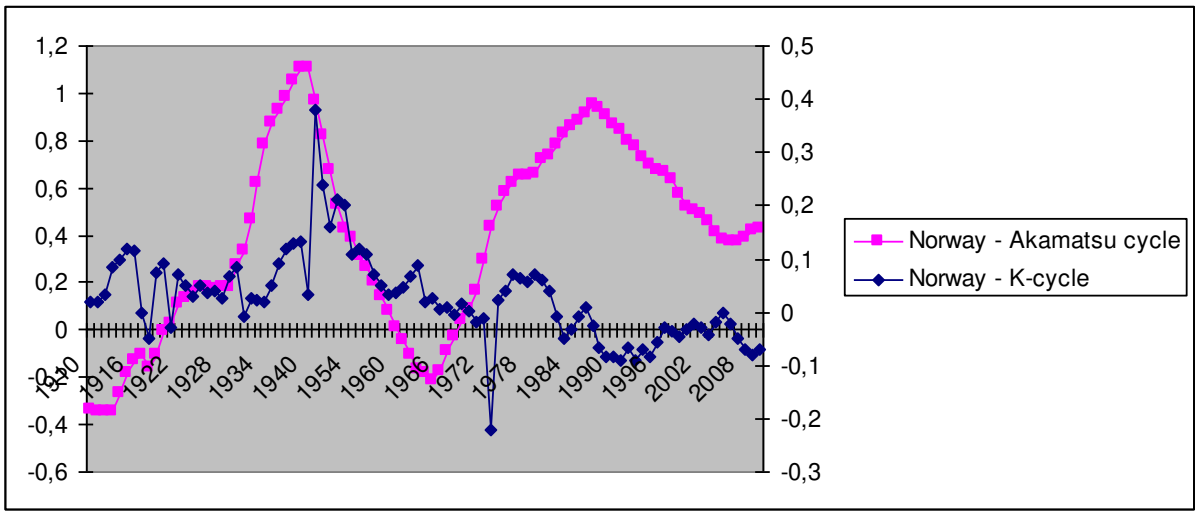
-0,2
-0,3
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
N. Zealand - Akamatsu cycle
N. Zealand - K-cycle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0,4
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-0,4
-0,6
0,5
0,4
0,3
0,2
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0
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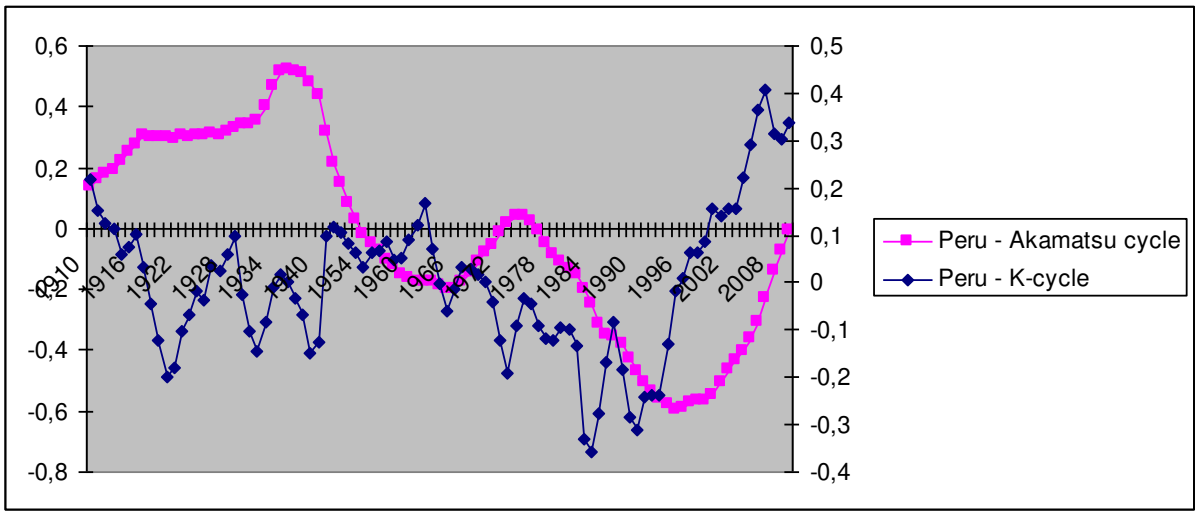
-0,2
-0,3
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Norway - Akamatsu cycle
Norway - K-cycle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0,5
0,4
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-0,2
-0,3
-0,4
1910
1916
1922
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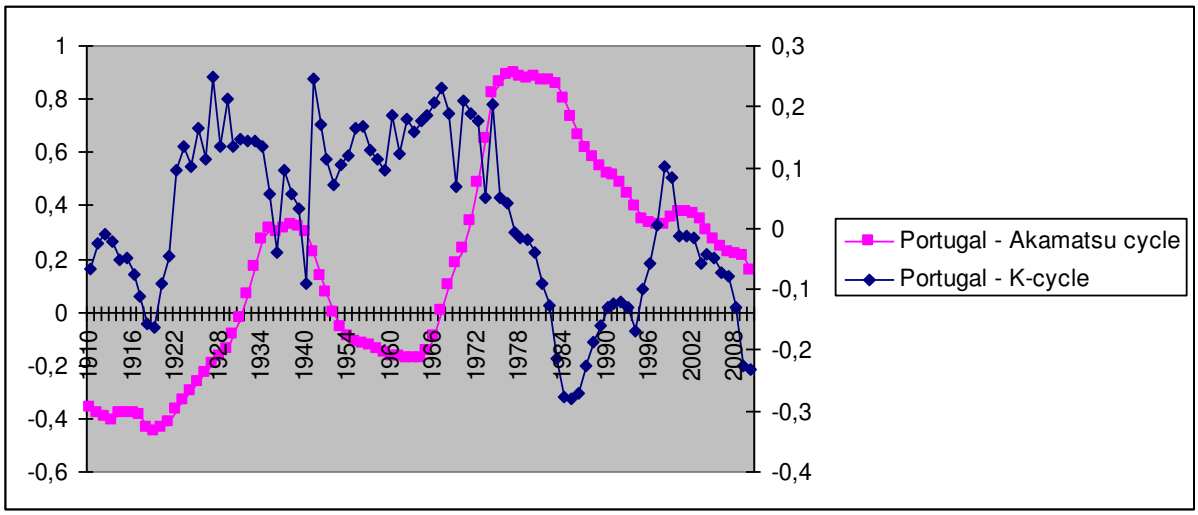
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Peru - Akamatsu cycle
Peru - K-cycle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-0,6
0,3
0,2
0,1
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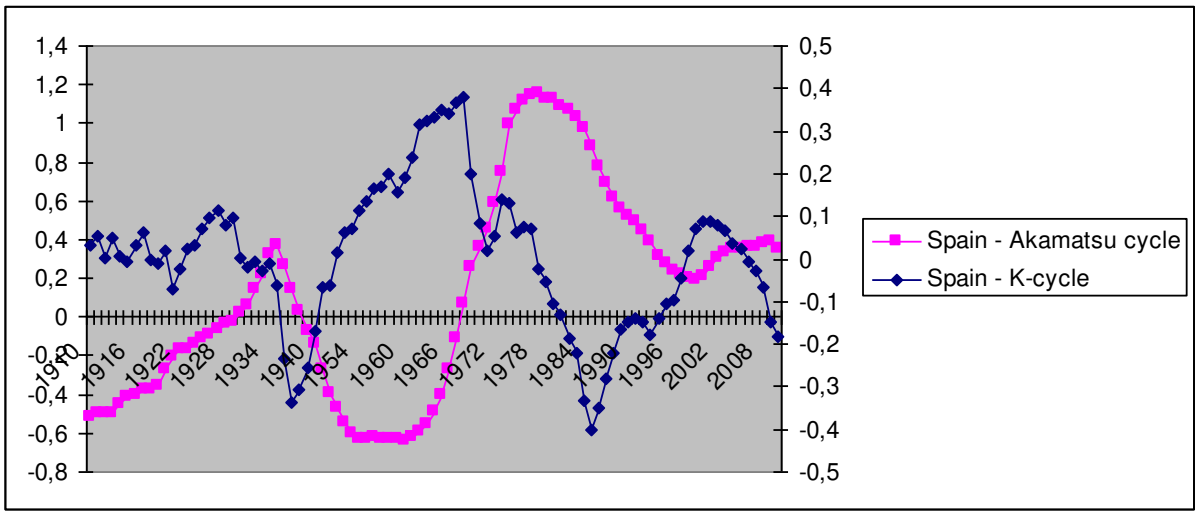
-0,2
-0,3
-0,4
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Portugal - Akamatsu cycle
Portugal - K-cycle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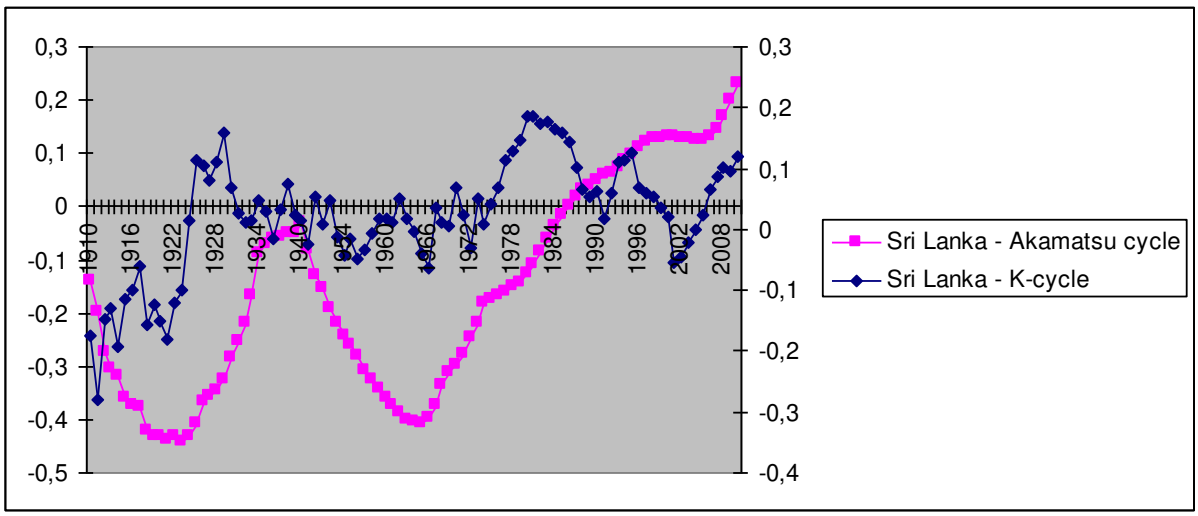
-0,4
-0,6
-0,8
0,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
-0,5
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Spain - Akamatsu cycle
Spain - K-cycle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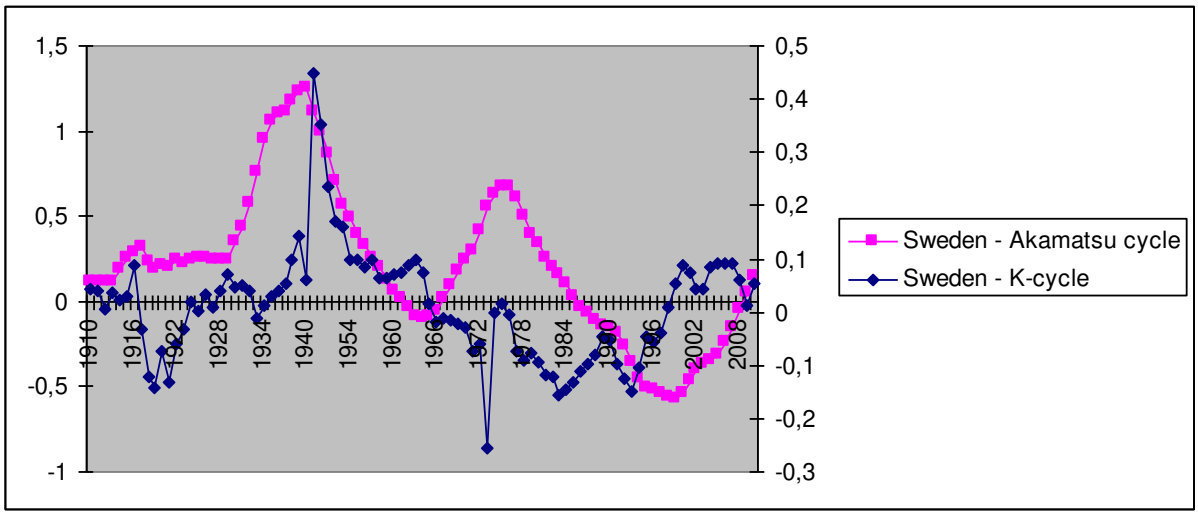
-0,4
-0,5
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Sri Lanka - Akamatsu cycle
Sri Lanka - K-cycle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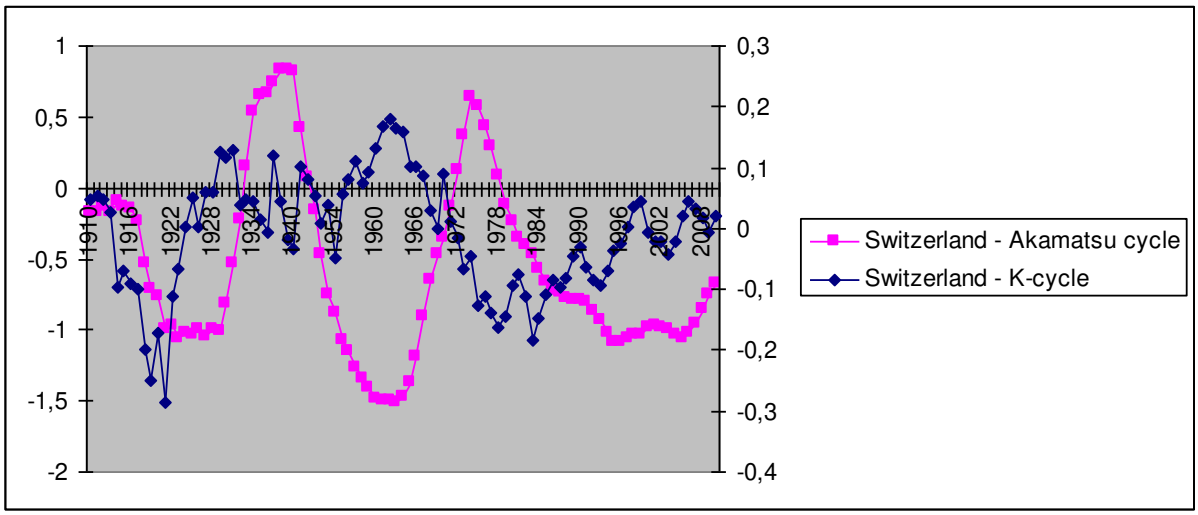
0,2
0,1
0
-0,1
-0,2
-0,3
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Sweden - Akamatsu cycle
Sweden - K-cycle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0,3
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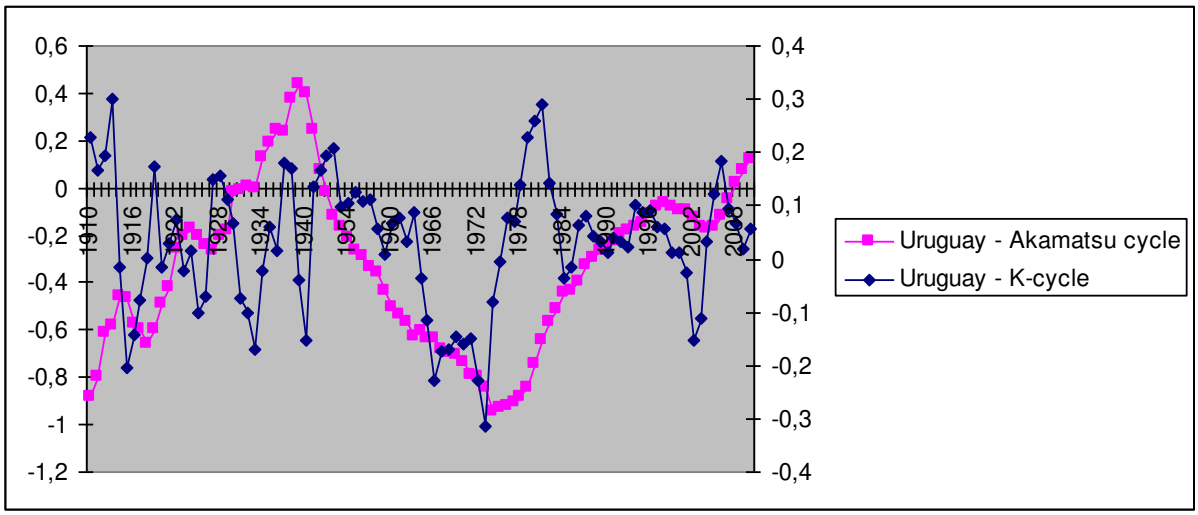
-0,1
-0,2
-0,3
-0,4
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Switzerland - Akamatsu cycle
Switzerland - K-cycle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-0,6
-0,8
-1
-1,2
0,4
0,3
0,2
0,1
0
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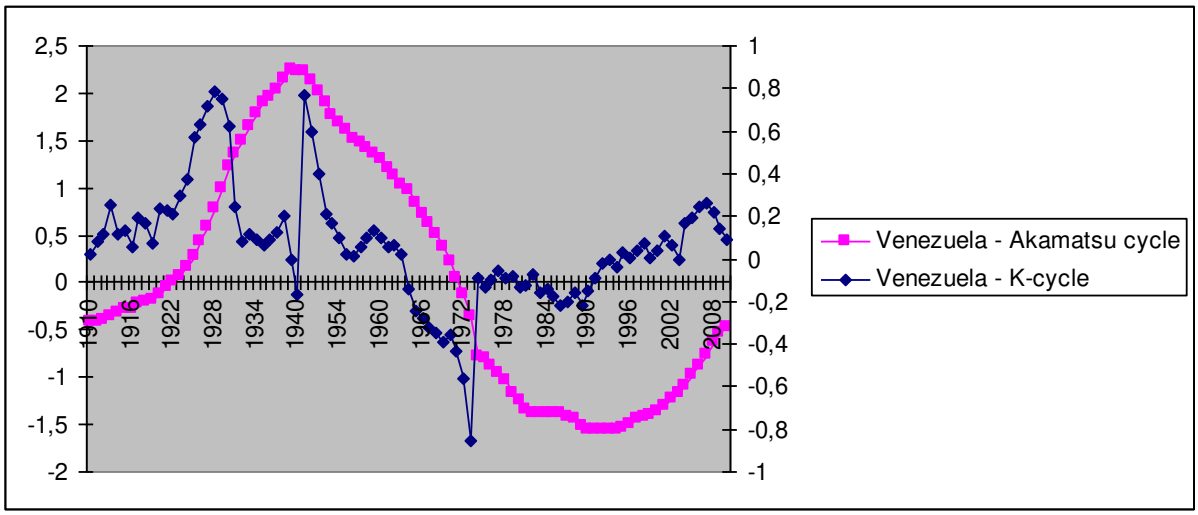
-0,2
-0,3
-0,4
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Uruguay - Akamatsu cycle
Uruguay - K-cycle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1
0,8
0,6
0,4
0,2
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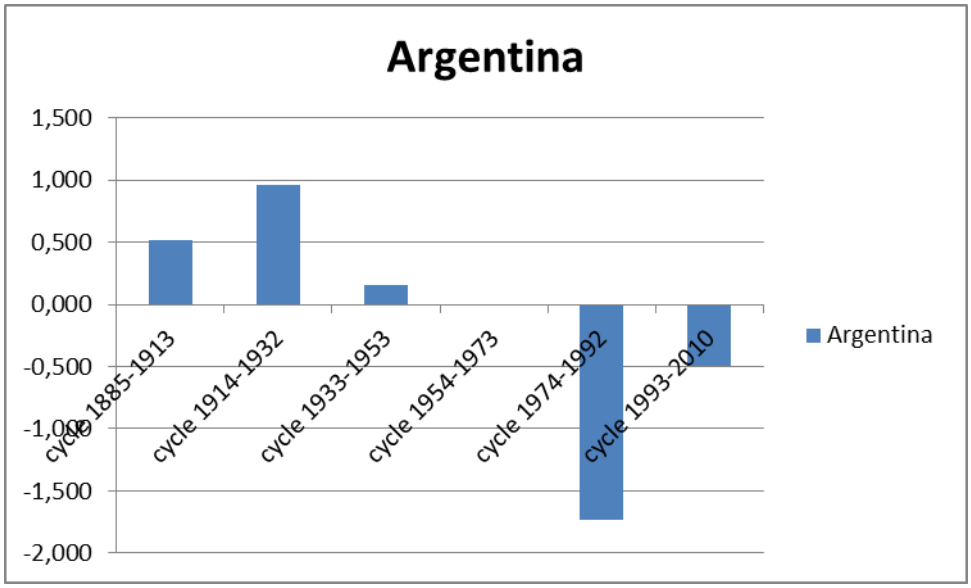
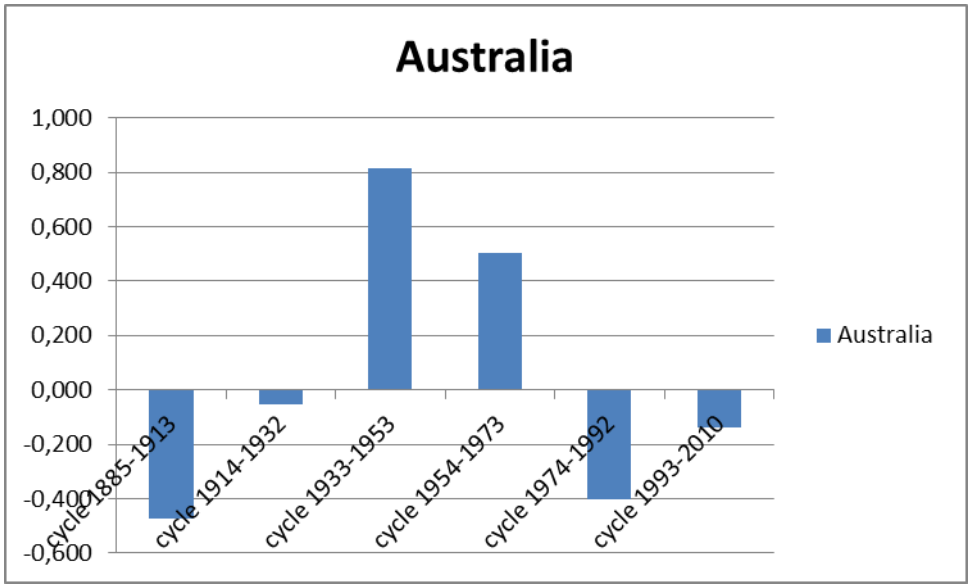
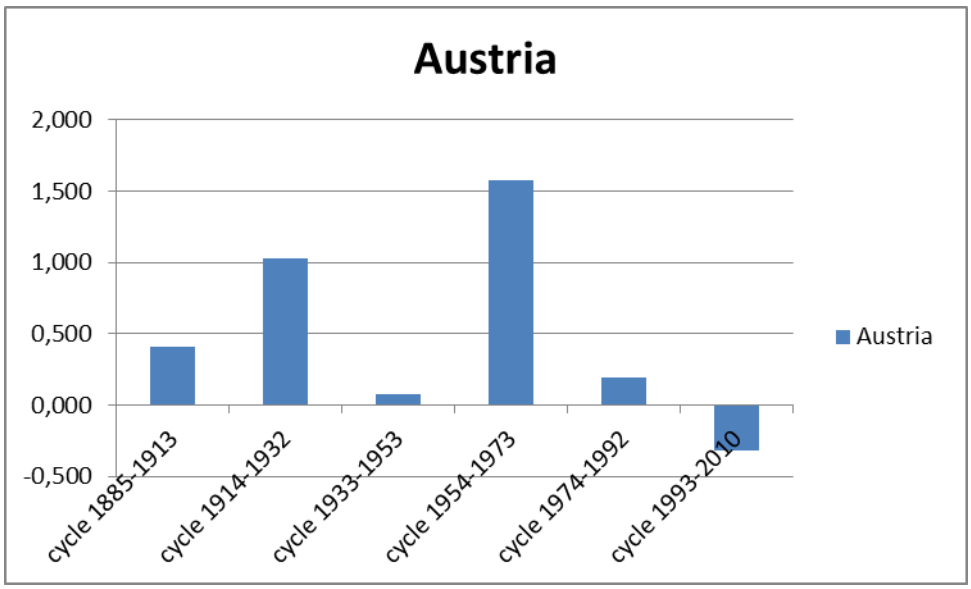
-0,4
-0,6
-0,8
-1
1910
1916
1922
1928
1934
1940
1954
1960
1966
1972
1978
1984
1990
1996
2002
2008
Venezuela - Akamatsu cycle
Venezuela - K-cycle

Appendix (6): Linear time-series convergence regression slopes of the countries of the world system in terms of the GDP per capita of the United Kingdom



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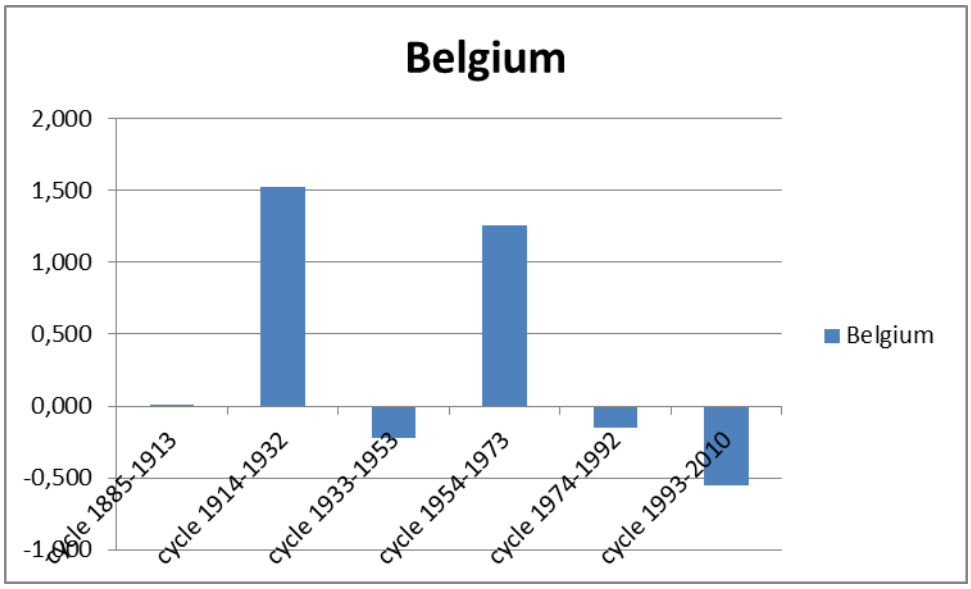
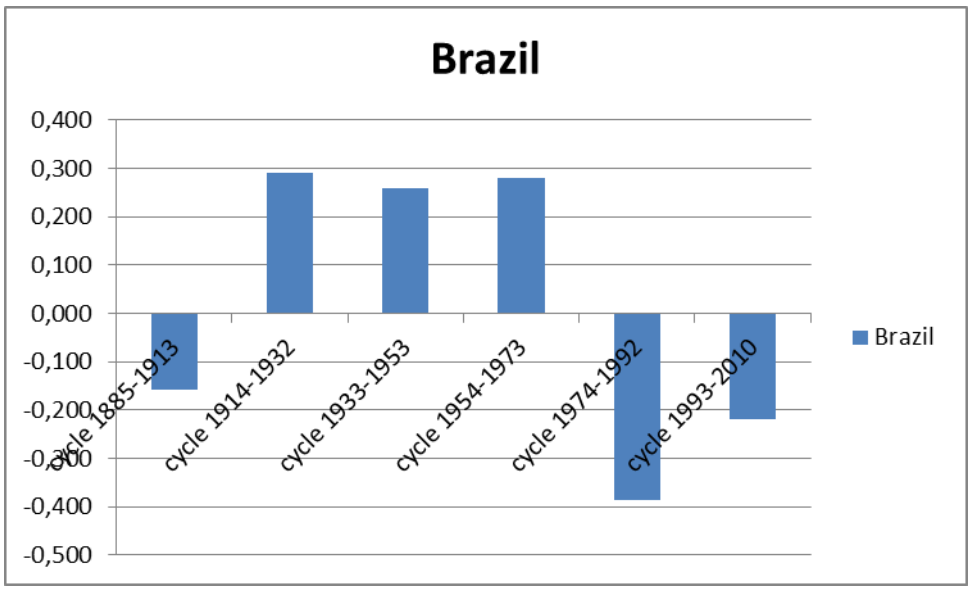
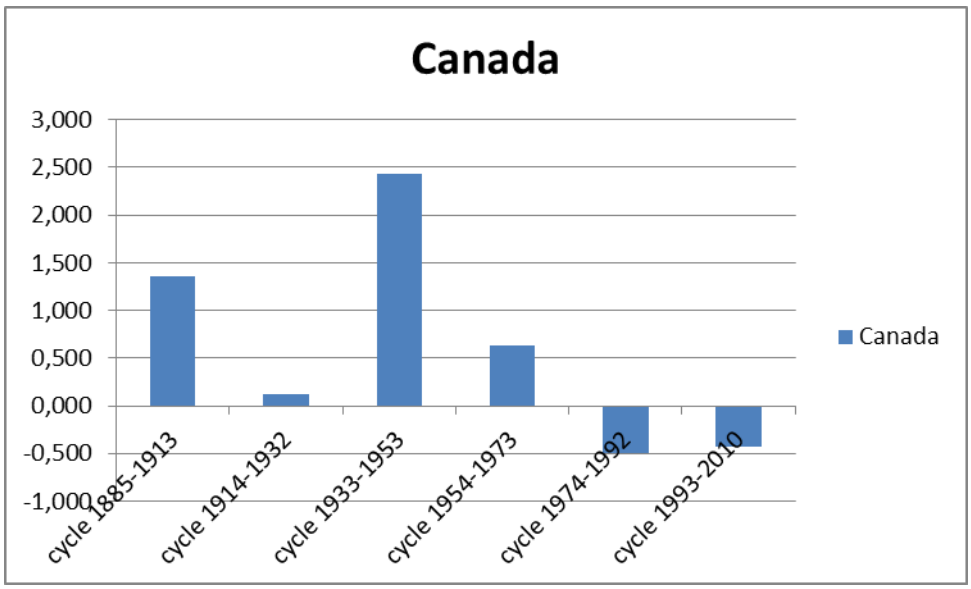
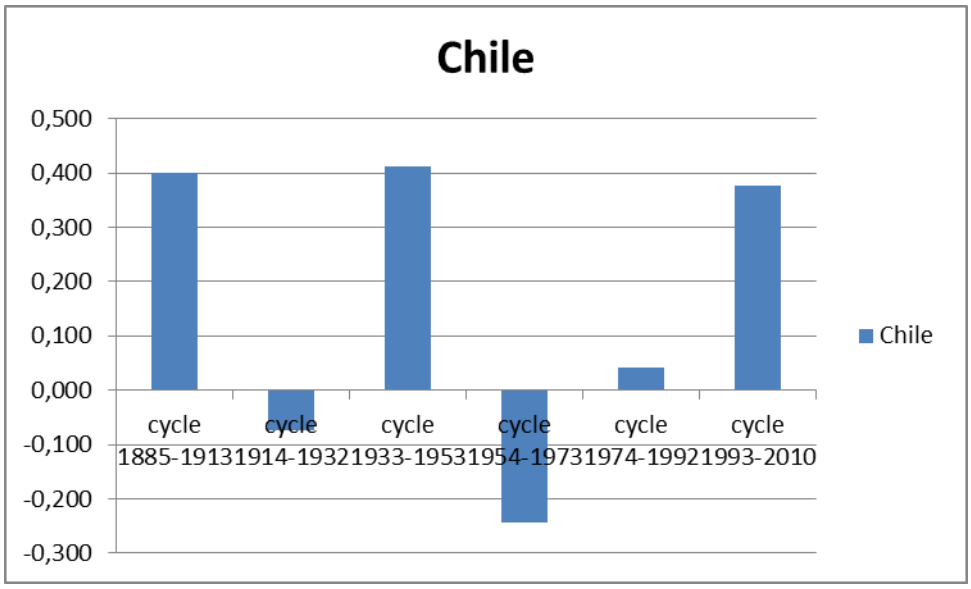
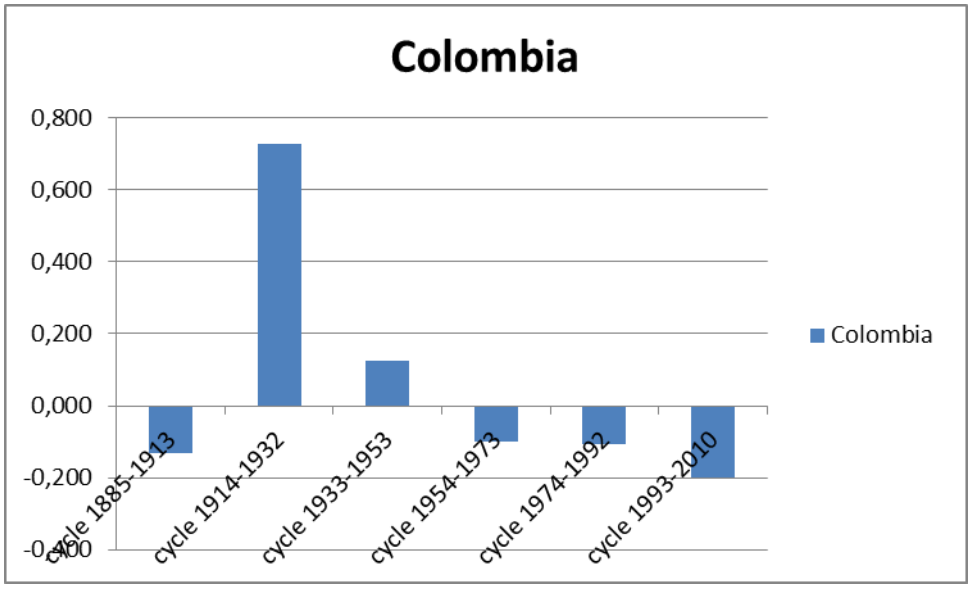
2,000
1,500
1,000
0,500
0,000
-0,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Austria

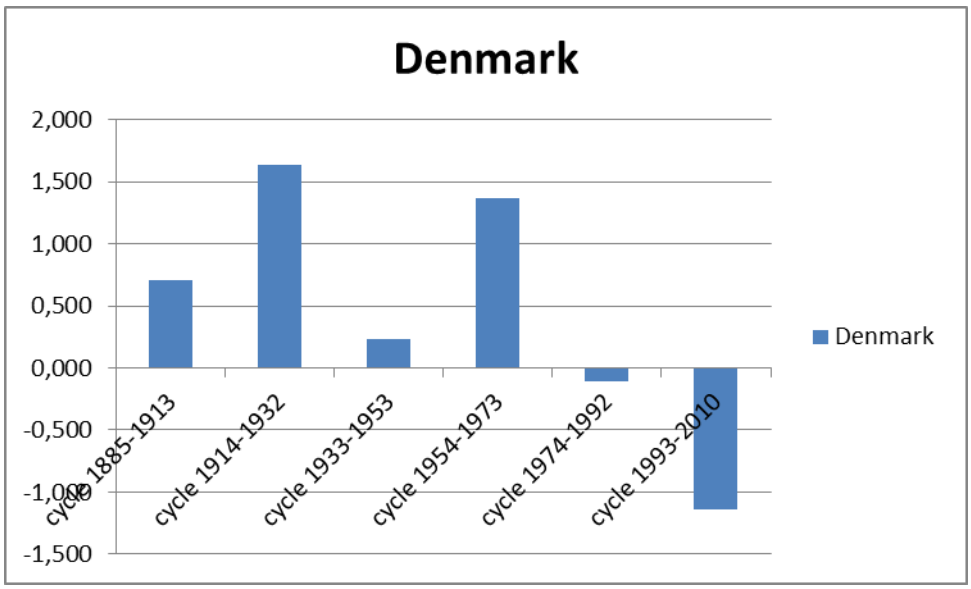

Belgium
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Belgium

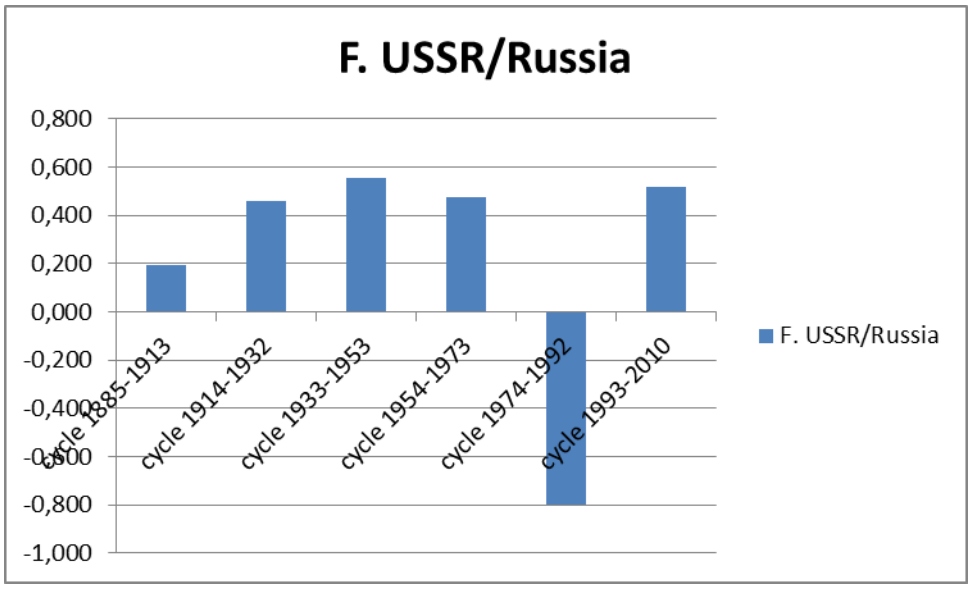

Brazil
0,400
0,300
0,200
0,100
0,000
-0,100
-0,200
-0,300
-0,400
-0,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Brazil

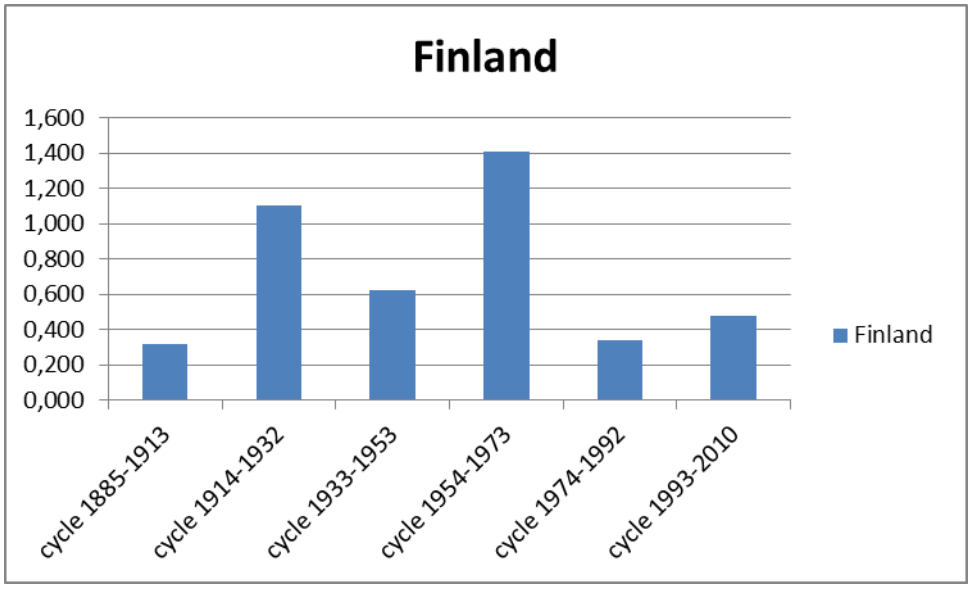

Canada
3,000
2,500
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Canada

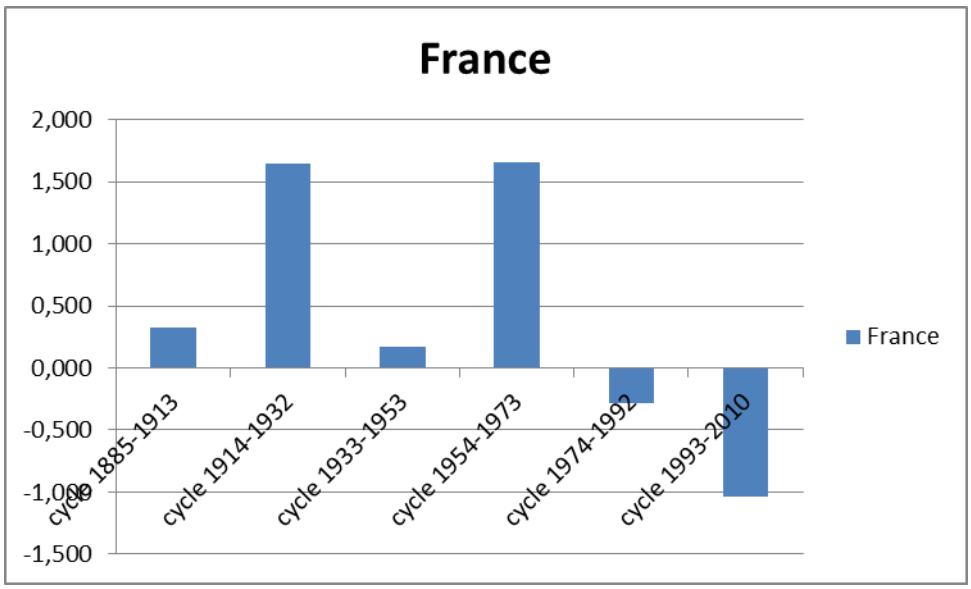

Chile
0,500
0,400
0,300
0,200
0,100
0,000
-0,100
-0,200
-0,300
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Chile

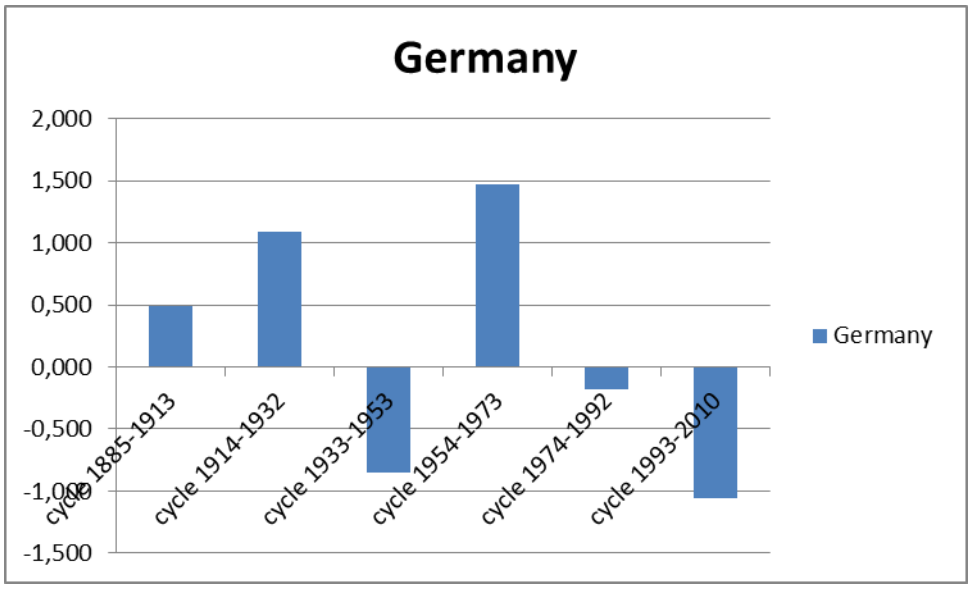

Colombia
0,800
0,600
0,400
0,200
0,000
-0,200
-0,400
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Colombia

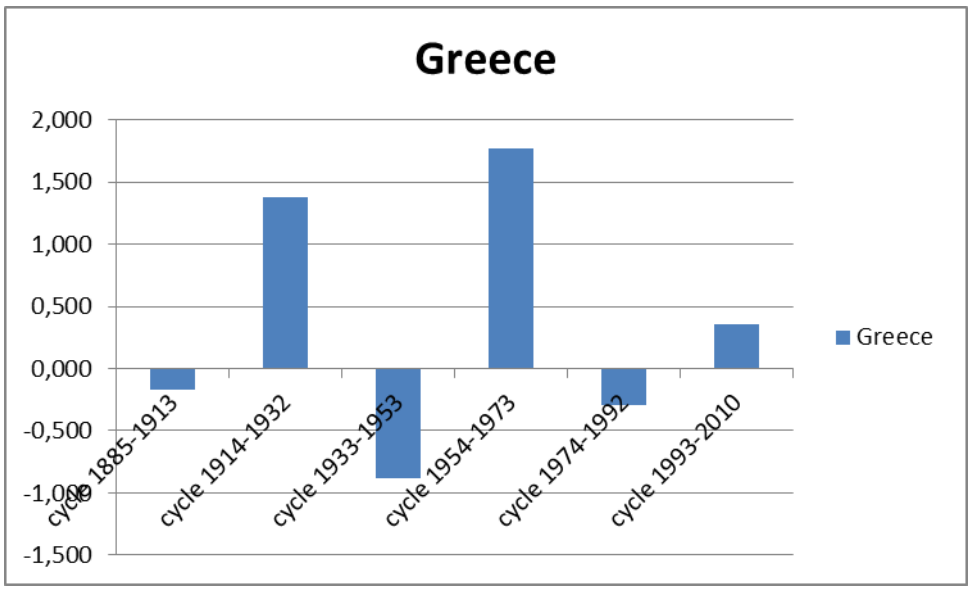

Denmark
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Denmark

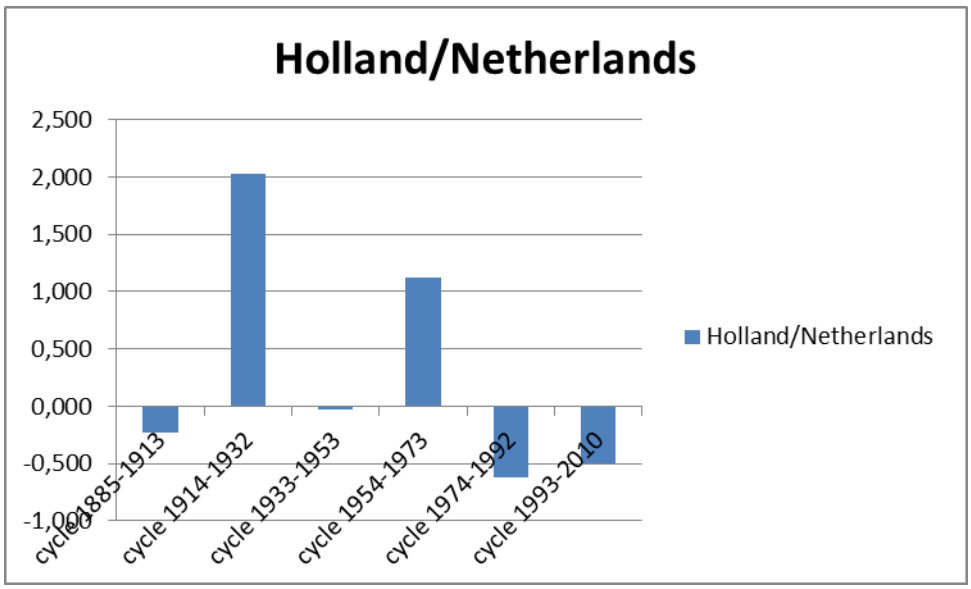

F. USSR/Russia
0,800
0,600
0,400
0,200
0,000
-0,200
-0,400
-0,600
-0,800
-1,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
F. USSR/Russia

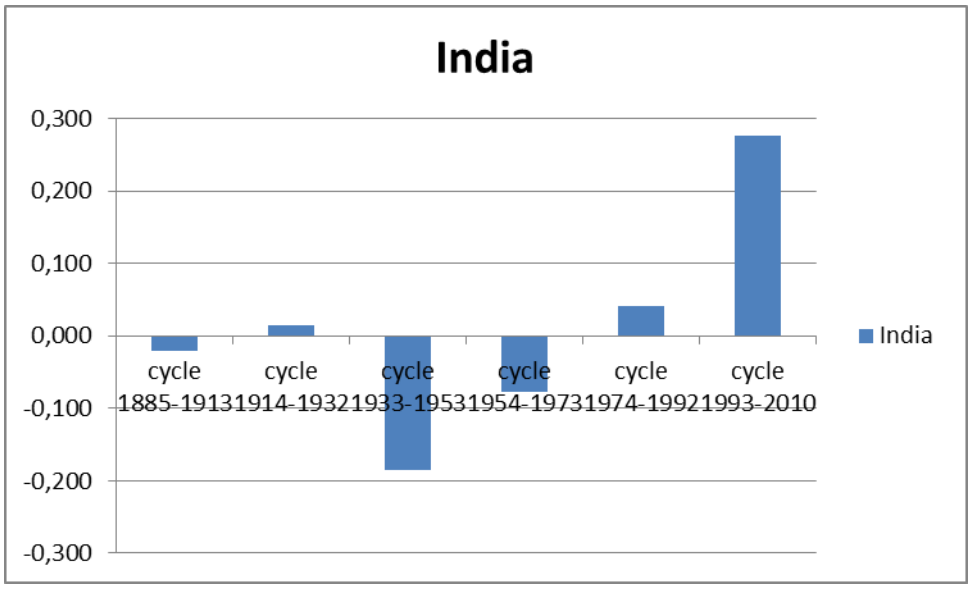

Finland
1,600
1,400
1,200
1,000
0,800
0,600
0,400
0,200
0,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Finland

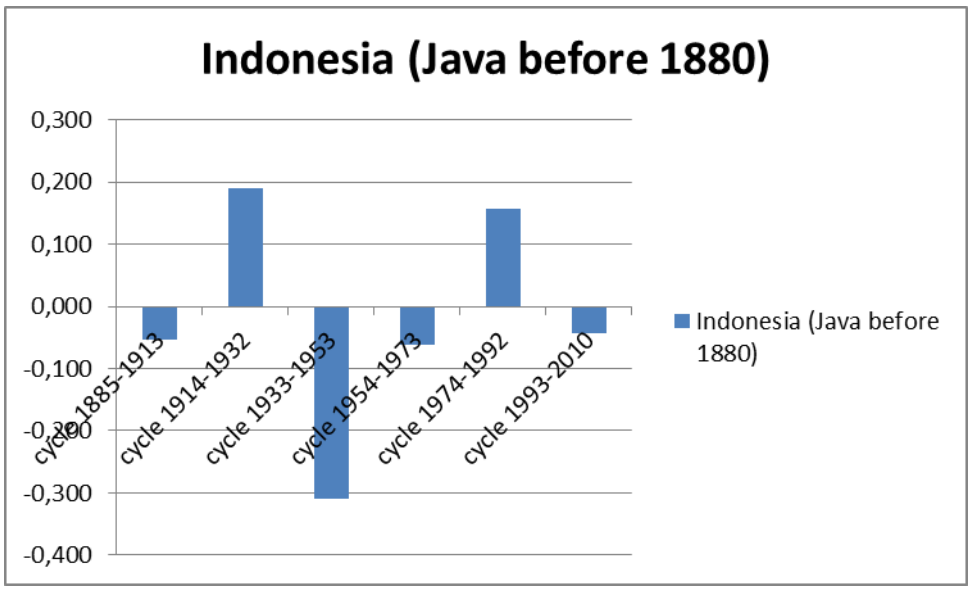

France
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
France

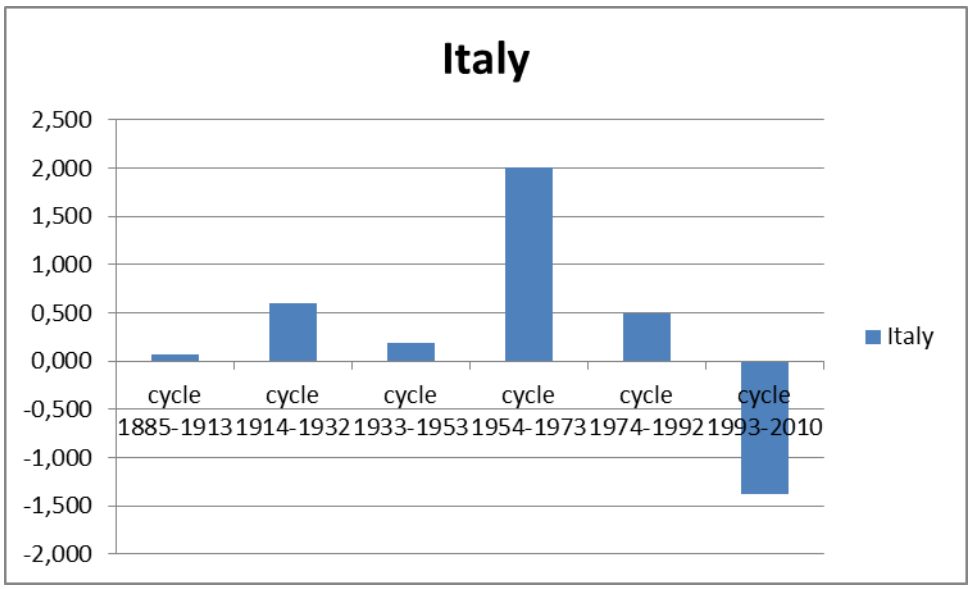

Germany
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Germany

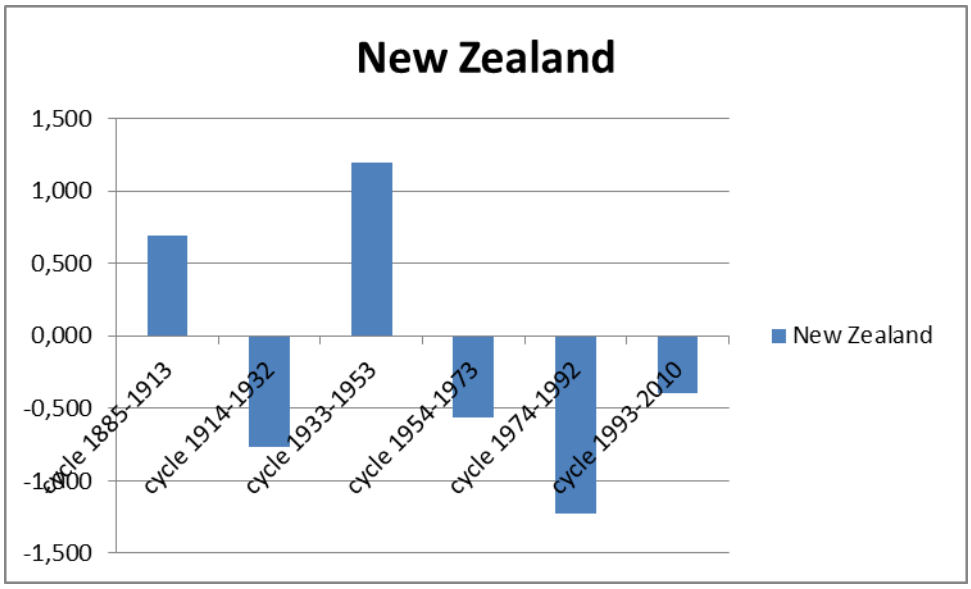

Greece
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Greece

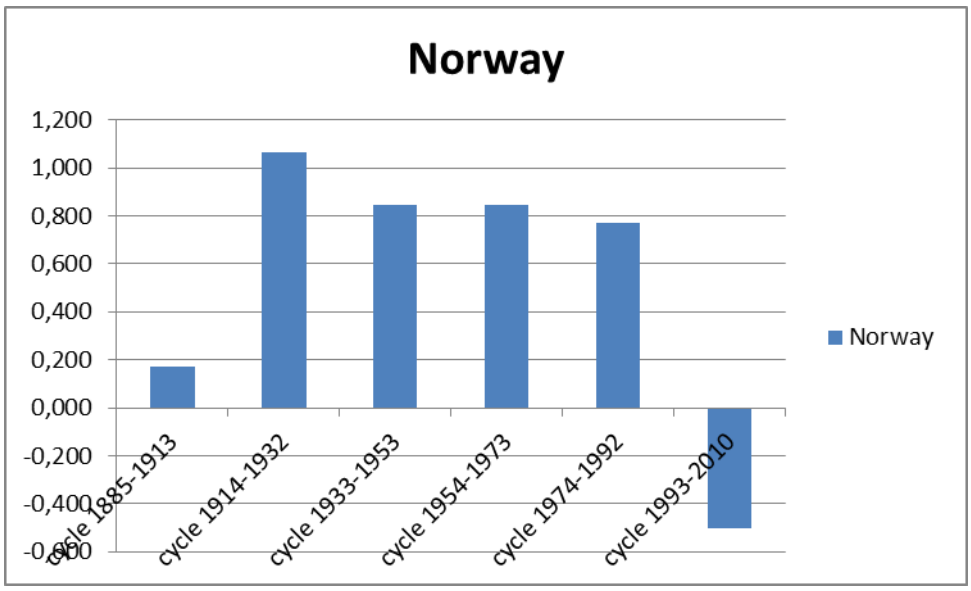

Holland/Netherlands
2,500
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Holland/Netherlands

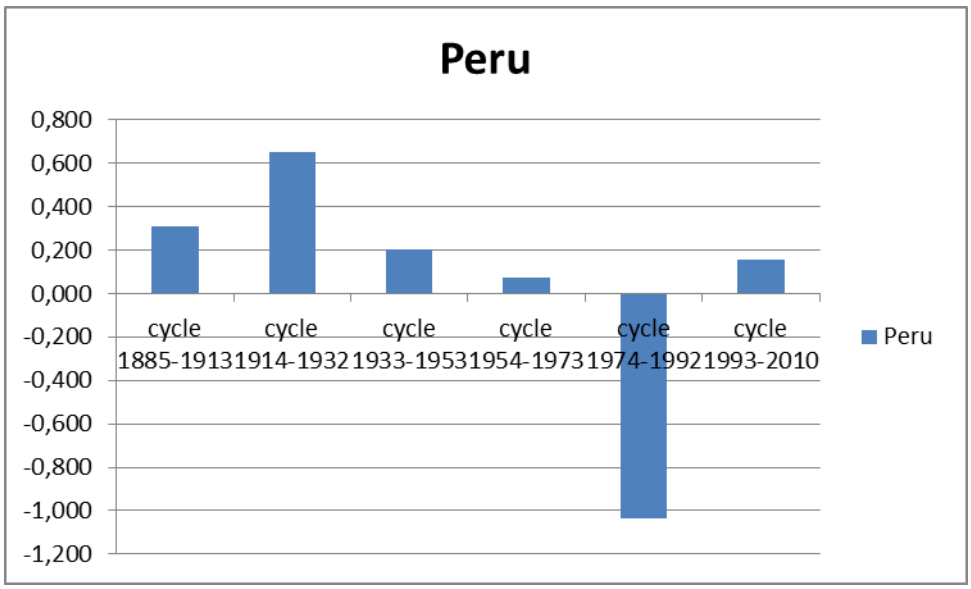

India
0,300
0,200
0,100
0,000
-0,100
-0,200
-0,300
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
India

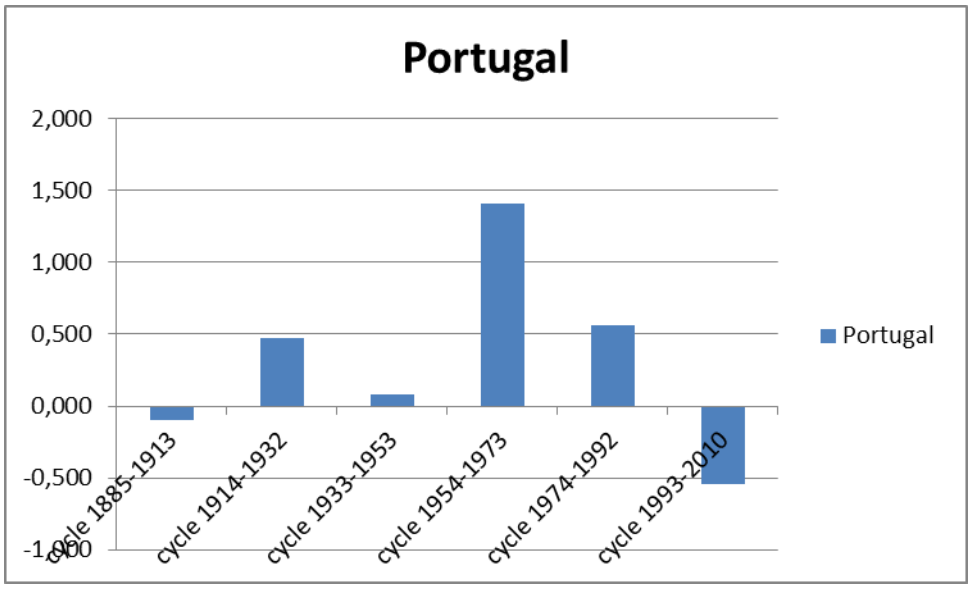

Indonesia (Java before 1880)
0,300
0,200
0,100
0,000
-0,100
-0,200
-0,300
-0,400
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Indonesia (Java before 1880)

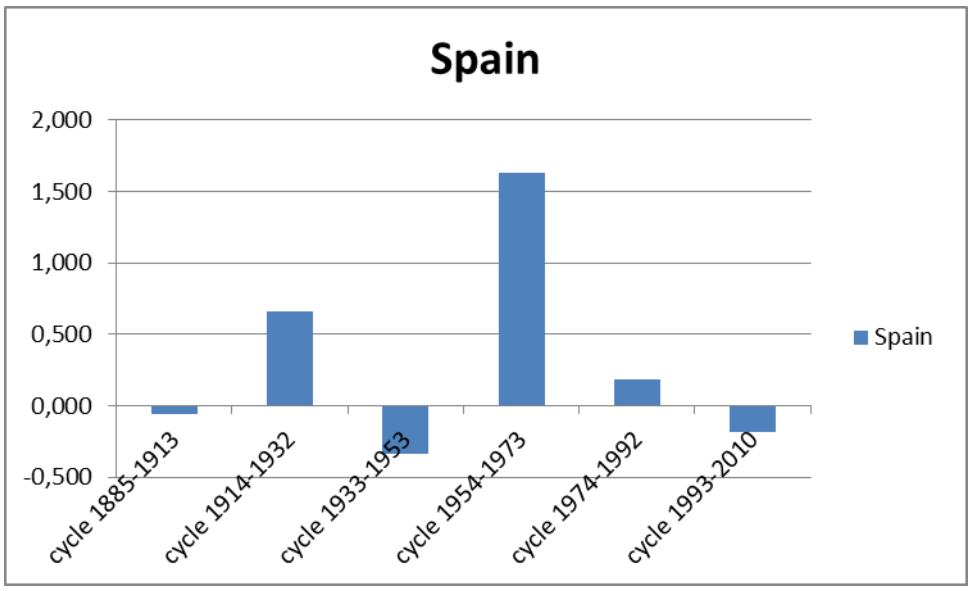

Italy
2,500
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
-2,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Italy

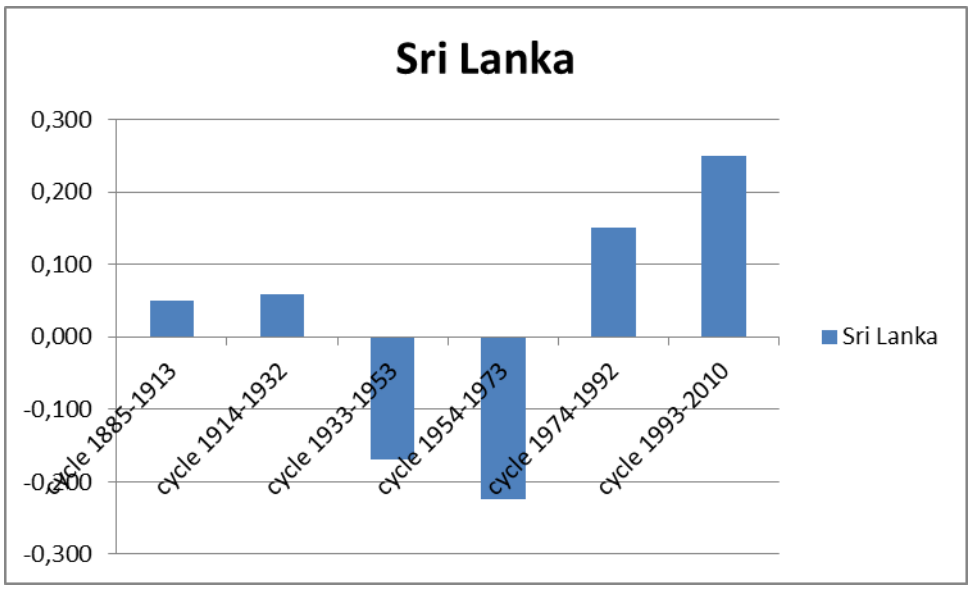

New Zealand
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
New Zealand

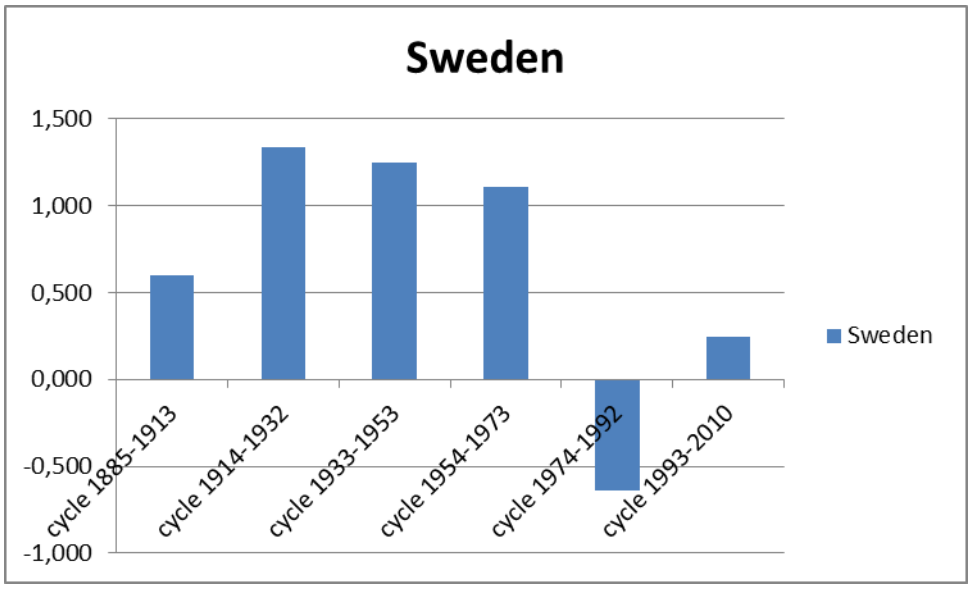

Norway
1,200
1,000
0,800
0,600
0,400
0,200
0,000
-0,200
-0,400
-0,600
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Norway

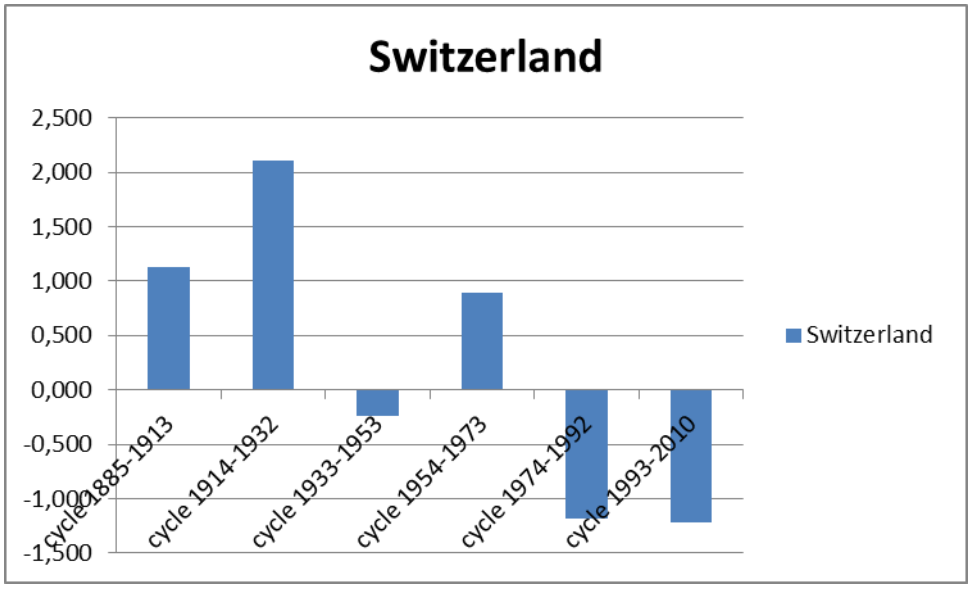

Peru
0,800
0,600
0,400
0,200
0,000
-0,200
-0,400
-0,600
-0,800
-1,000
-1,200
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Peru

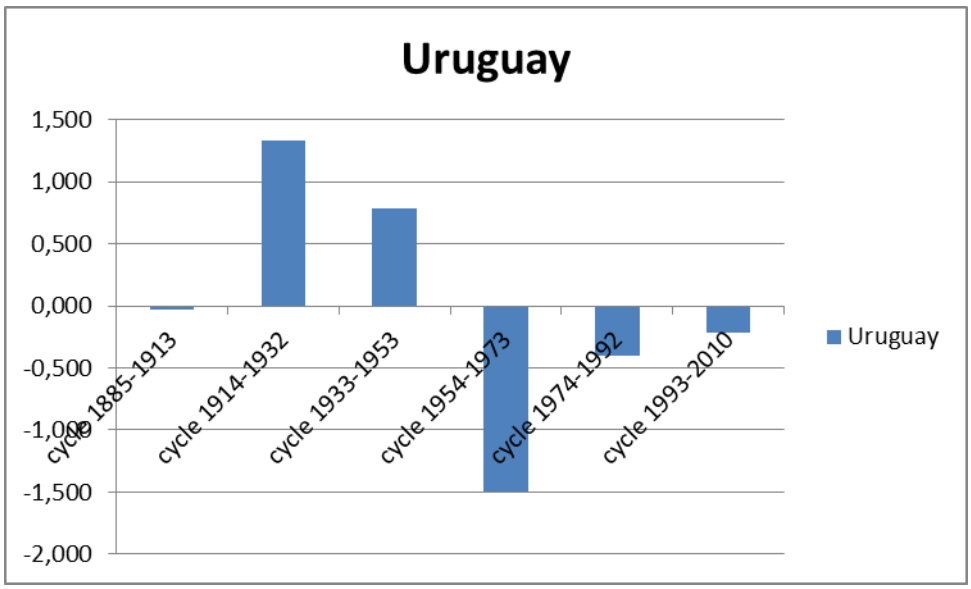

Portugal
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Portugal

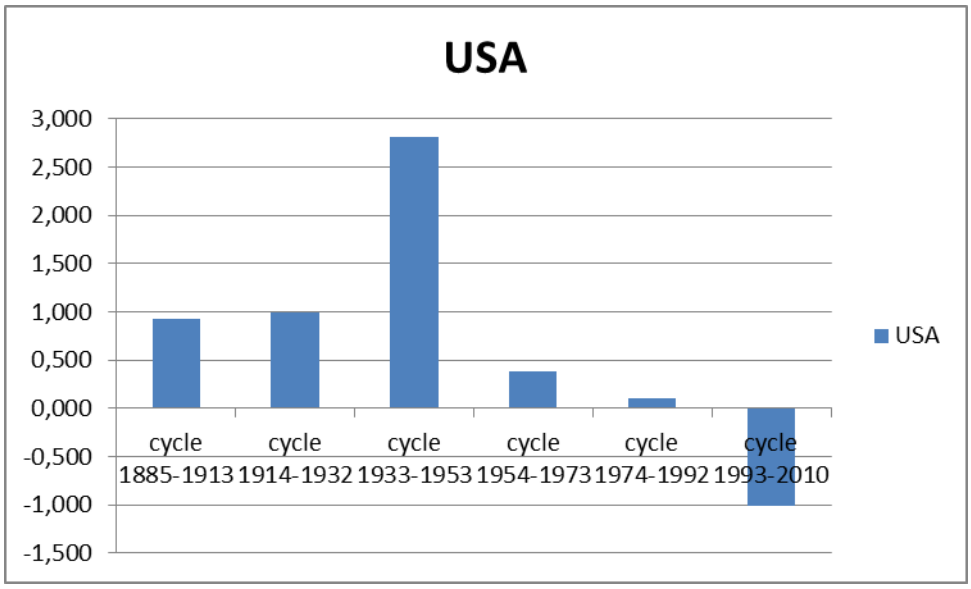

Spain
2,000
1,500
1,000
0,500
0,000
-0,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Spain

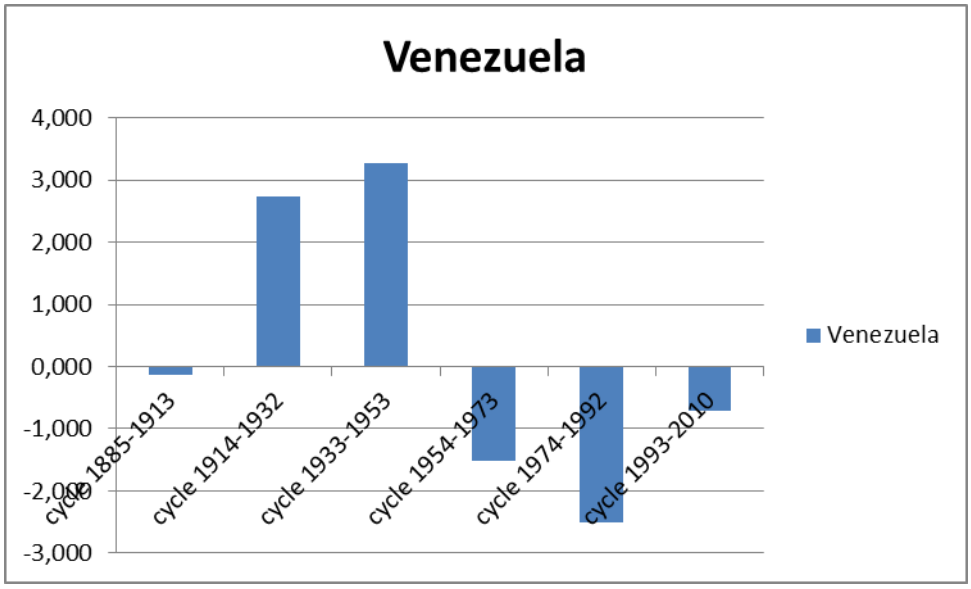

Sri Lanka
0,300
0,200
0,100
0,000
-0,100
-0,200
-0,300
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Sri Lanka


Sweden
1,500
1,000
0,500
0,000
-0,500
-1,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Sweden

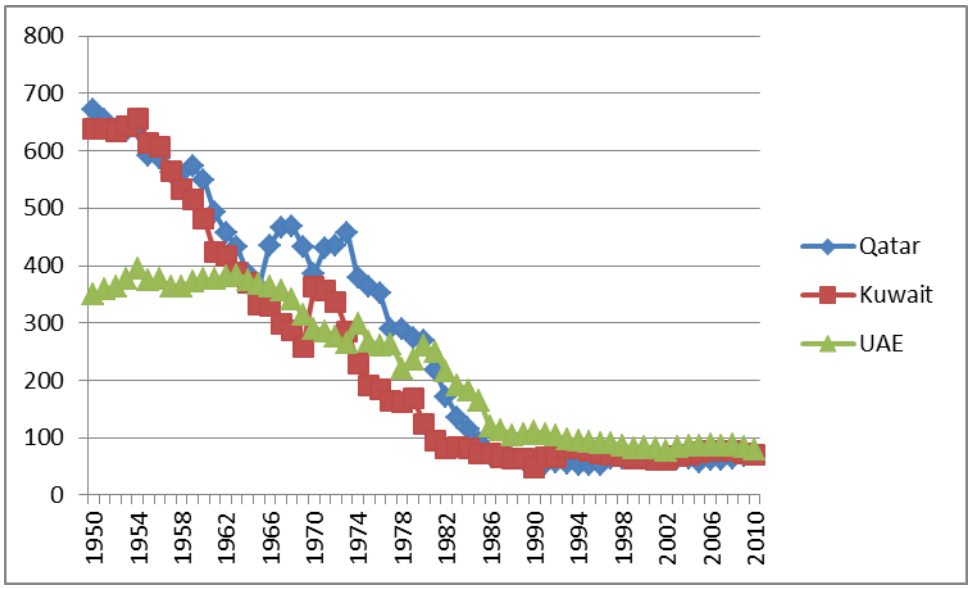

Switzerland
2,500
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Switzerland

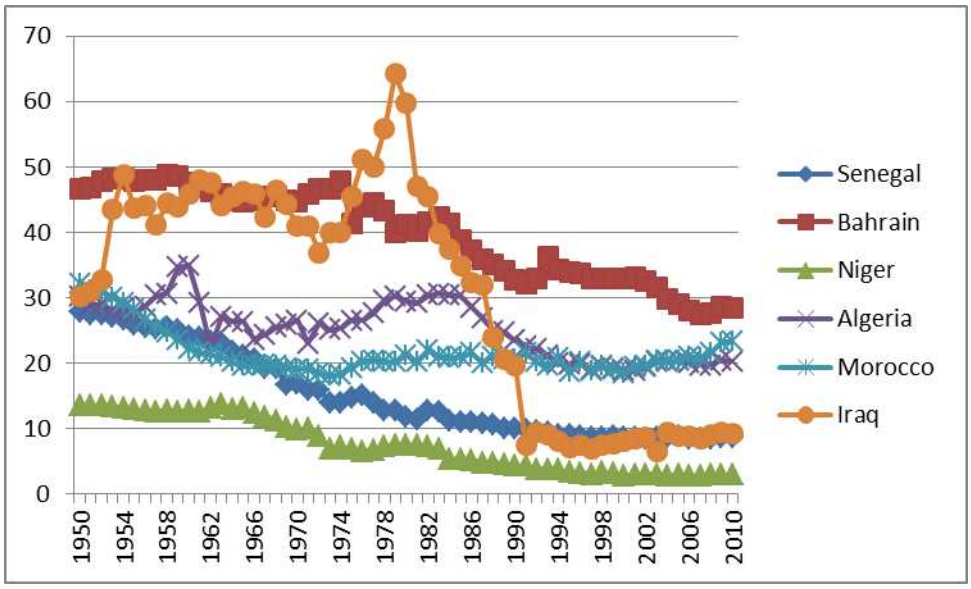

Uruguay
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
-2,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Uruguay

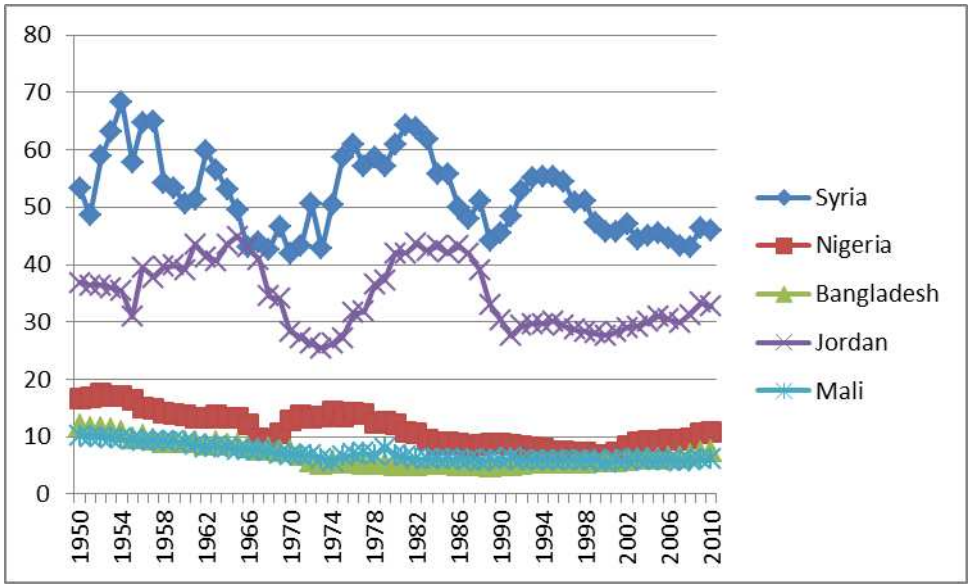

USA
3,000
2,500
2,000
1,500
1,000
0,500
0,000
-0,500
-1,000
-1,500
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
USA

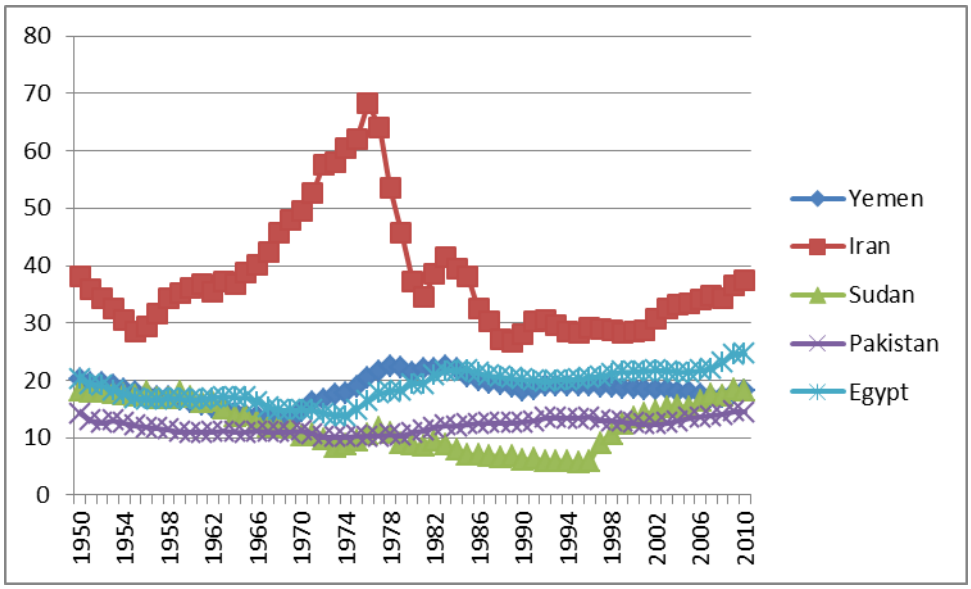

Venezuela
4,000
3,000
2,000
1,000
0,000
-1,000
-2,000
-3,000
cycle 1885-1913
cycle 1914-1932
cycle 1933-1953
cycle 1954-1973
cycle 1974-1992
cycle 1993-2010
Venezuela

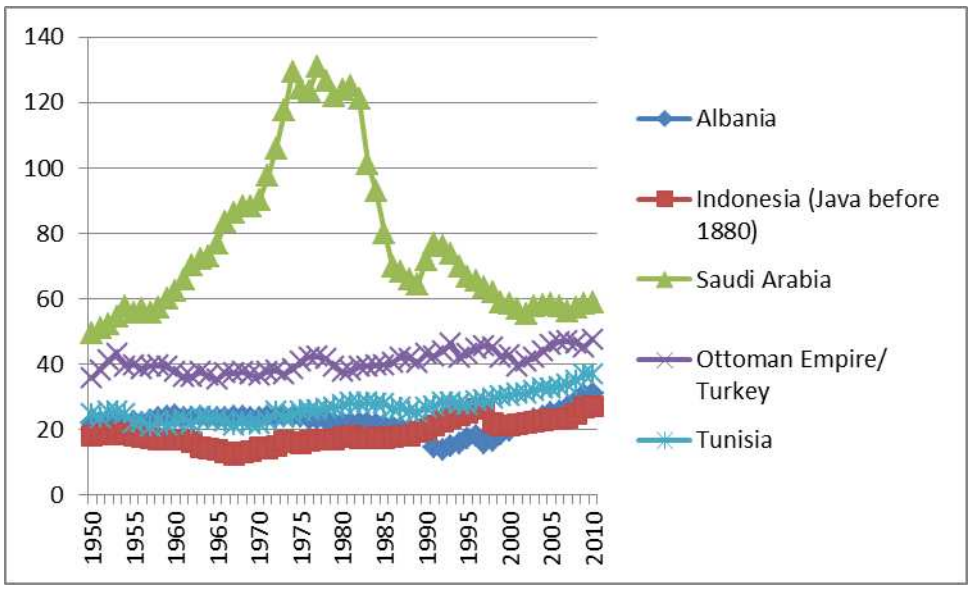
Appendix (7) The Akamatsu cycle in the entire Muslim world since 1950. GDP per capita purchasing power in % of the world average of 31 countries

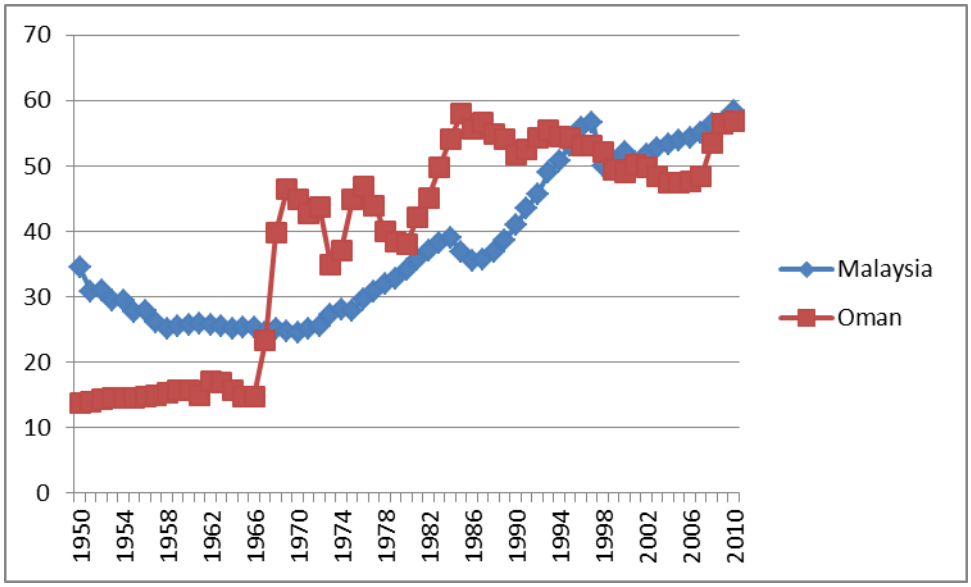





80
70
60
50
40
30
20
10
0
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
Syria
Nigeria
Bangladesh
Jordan
Mali


80
70
60
50
40
30
20
10
0
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
Yemen
Iran
Sudan
Pakistan
Egypt


140
120
100
80
60
40
20
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
Albania
Indonesia (Java before 1880)
Saudi Arabia
Ottoman Empire/ Turkey
Tunisia


70
60
50
40
30
20
10
0
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
2010
Malaysia
Oman

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