

The European Union economic growth experience, 1830–2000¹

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1. Introduction

There has been a dramatic improvement in the knowledge of European Union member states historical national accounts over the past few decades. Almost all the research effort has been allocated to national – i.e. state-defined – entities. Very few efforts, comparatively speaking, have gone into regional estimates, and even less to supranational entities. There is a simple reason for this lack: it becomes much more difficult to build macro-economic aggregates as their geographical, political and institutional scopes become more diverse. There could even be a more straightforward reason: who cares about supranational entities? The launching of the European Economic Community was a first attempt of any significance to create a supranational entity. There has been a lot of political effort put into building a common EEC spirit. Two recent steps have been of paramount importance in this respect: the approval of the European Union; and the launch of the Euro. In our contribution we will pay particular attention to the European Union as a meaningful historical entity. It was created in 1993, with 12 members, which quickly rose to 15 thanks to the new membership of Austria, Finland and Sweden in 1995. Now the European Union is approximately one decade old, but the ten new accession countries, entering in May 2004, strongly underscore the success of this young supranational entity.

The current borders of the European Union appeal to very much to our taste for two different – but interrelated – reasons. First of all, the EU-15 represents almost exactly what we think of as ‘Western Europe’. There are some countries that could have been part of the EU but chose not to do so: e.g. Norway and Switzerland. But, in population terms, the current EU comprises about 97 per cent of what we consider is Western Europe. Assessing EU macro-economic aggregates has an added value of its own. It brings into focus the entire economic performance of Western Europe. Everybody would agree on how significant this is for a true understanding of the historical roots of the region. Second, the community of researchers in historical national accounting has been, for many years, centred on the current EU member countries. In many conferences, workshops,

research projects and related publications, the academic standards of the EU historical national accounts have been cross-checked many times. A community of people has also arisen that share the same values and common goals. They represent, just as many other similar communities, how far the cultural integration of the European Union has gone. It has now become a much more meaningful exercise to wonder about our common past. We know that there were many differences, but we also realise how abundant the commonalities were.

In this paper we will present the first long-term European Union estimates for the main macro-economic variables that serve for quick analytical use in historical national accounting: GDP, population, GDP per capita, investment, investment rate, foreign trade, openness to foreign trade, and prices. There are many more that could be of great interest, but all of these are essentially of the same kind and they are built out of quite comparable sets of national data. In the appendix to our paper we provide detailed reference to the sources, to the aggregation methods and to the criteria used. To limit the length of this paper, we will provide only a preliminary reading and interpretation of the newly available information.

2. The new data

Fourteen countries are surveyed – only Luxembourg has been omitted . The chronological coverage is quite diverse. The following table sketches the main features of our data set –we only use published figures.

Table 1. Chronological coverage.

Country	GDP	GFCF	Foreign Trade	Prices
Austria	1870-	1924-37; 1948-	1925-35; 1948-	1874- (excl.1914)
Belgium	1850-	1920-39; 1948-	1850-1913; 1920-39; 1947-	1840- (excl.1914)
Denmark	1830-	1850-1914; 1921-	1850-1914; 1921-	1840-
Finland	1860-	1861-	1861-	1870-
France	1830-	1830-1913; 1922-38; 1949-	1850-1913; 1920-38; 1949-	1840-
Germany	1850-	1850-1913; 1925-38; 1950-	1880-1913; 1925-38; 1950-	1840-
Greece	1833-1939; 1945-	1946-	1929-39; 1947-	...
Ireland	1947-	1947-	1947-	...
Italy	1861-	1861-	1861-1942; 1947-	1861-
Netherlands	1830-	1830-1913; 1921-39; 1948-	1830-1939; 1948-	1870-
Portugal	1865-	1953-	1870-	1870-
Spain	1850-	1850-	1850-1935; 1940-	1840-
Sweden	1861-	1861-	1861-	1860-
United Kingdom	1830-	1830-	1850-	1840-

Sources: See appendix.

As will be obvious, there are some major shortcomings in terms of coverage. For the first two decades, from 1830 to 1850, data is only available for five countries : United Kingdom, France, the Netherlands, Denmark and Greece (from 1833). We decided to proceed with these five countries – mainly the first three – as they represent a substantive share of all the variables, and they were diverse enough. By 1850, three more countries enter into the sample: Belgium, Germany and Spain. They provide a consistent array of countries: from the Northern European Denmark to the Southern European Greece and Spain; plus the three largest European economies and two small but important and rich countries. By 1860 and 1861, Finland, Italy and Sweden join the other eleven to enhance

the basic features of the 1850 sample. Portugal is added from 1865 on, and Austria is included from 1870 on. Ireland is only included after the Second World War. In fact, it is only missing, as an independent state, for the interwar years.

The world wars are the cause of another major weakness of the series. Currently, GDP is available for all years for most of the countries, but that is not the case for investment and foreign trade for a number of countries, including Belgium, France, Germany and the Netherlands. Substantial damage during the world wars also introduced underreporting for several countries. Gross fixed capital formation is lacking, before 1947, for Greece, Ireland and Portugal. Prices, on the other hand, are more readily available.

3. A first picture: GDP, population and GDP per capita

No major discoveries were made from our first series. European Union GDP is highly dependent on the four major economies – United Kingdom, Germany, France and Italy – and the estimates for the individual countries are quite stable, academically speaking. There have only been significant changes in the French series. The research innovations of the last few years have mainly come from middle-sized countries like the Netherlands and Spain, and even more so from small countries like Greece and Portugal. The addition of more individual, nation-based, series has largely stabilised the overall profile. The individual series happen to be quite similar. The European profile resulting from the aggregation of national profiles is interesting as it is consistent with the current state of academic knowledge.

Graph 1.

Source: See appendix.

To make a long history short, we recognize a long period of quite stable growth, reaching as far back as 1830 and continuing until 1913. This much has been clear at least since Paul Bairoch's 1976 European GDP estimate were made known, but more generally speaking European economic historians were fully aware of the progressiveness, generality and smoothness of the aggregate growth experienced in the nineteenth century. Any doubts that still remain can, in our opinion, be laid to rest. There is still a lot of data for the pre-1830 period missing, but the data available from U.K., France, the Netherlands and Sweden (unpublished although partly anticipated by Bohlin, 2003) tend to confirm that the trend started before 1830, in fact around the end of the Napoleonic

wars. The early nineteenth century is still a period inviting further research as the evidence gathered until now is focused on the more economically advanced countries, and there could be some growth bias if we attempt to build a European-wide estimate out of the available data. To be fair, this could even be the case for the 1830–1850 data, which is why it is worthwhile to emphasise the continuity in growth rates from the 1830s and 1840s to the 1850s and 1860s.

The average yearly growth rate from 1830 to 1880 still suffers from a lot of volatility. The EU may attain growth rates as high as 5.7 per cent, but they also may fall as low as -2.5 per cent. The ‘bad’ years – those with negative growth rates – numbered as many as ten during the first half a century (1830 to 1880). Something fundamental changes around 1880. The GDP series becomes smoother in its growth trend, i.e. the growth rate reduces its variability. The ‘highs’ are less frequent but, much more important, the ‘lows’ disappear. It is not a matter of disappearance of the business cycle, of course. It is, rather, its smoothing. Fluctuations change in their very nature. Before 1880 they were as irregular as harvests. After 1880 they seem much more like business cycles. There is less variability while cycle-like movements appear. It is an outstanding change. It can be explained by a wide variety of reasons, which can be reduced to two: a) the diffusion of industrialization makes economies less dependent on agricultural output, and b) European Union economies have become increasingly integrated, allowing for the smoothing of economic fluctuations – as Craig and Fisher (1997) have shown. There is some evidence of an accelerating trend from the mid-1890s on.

Graph 2.

Source: See appendix.

National GDP performances can be better assessed within this European wide framework. Early starters and latecomers are easy to distinguish. The countries with quick growth early in the century typically switch to a slow growth path after two or three generations of high growth rates. In contrast, countries showing low growth rates at the beginning of the series are those that, by the turn of the century, are growing quicker: i.e. Germany, Italy, and Sweden. Of course, there are also countries that fail to achieve significant growth before 1913. Some of the Southern Europe ‘failures’ can now be better assessed against the European Union norm.

Obviously, the whole picture changes after 1913. Everybody can conclude that we are looking at a European GDP estimate because of the three cuts in the growth path during the first part of the twentieth century: the two world wars and the depression of the early 1930s. Many European Union countries suffered the three shocks. Some of them were luckier and suffered only one or two. There is no one country, however, that escaped facing any of these shocks during the

century. Neutral countries also suffered, albeit much more slightly, during the world wars. The Great Depression had an impact – big or small – on all of them.

Recovery efforts after the First World War and the Great Depression were important but they failed to create a path back to the long-term growth trend. Only the third attempt – post-Second World War reconstruction – was successful. For the period 1913 to 1945 the amplitude of the fluctuations increases a lot. The First World War assisted at tough falls of GDP. The recovery efforts produced extraordinary achievements – up to 8.2 per cent growth in 1922 – but they did not last. The Great Depression hit the EU countries even harder than the First World War, but for a shorter period. The Second World War was even worse than the Great Depression. Fortunately the recovery was also more exceptional, reaching the highest aggregate growth rates in 150 years: in 1949 as much as 8.9 per cent.

Graph 3 is crystal clear in showing how exceptional the post-war boom was. Growth rates were high and sustained for a bit more than a quarter of a century, i.e. 1946 to 1973. It is also clear that the years of high growth display an overall declining trend that came to an end by the late 1970s. The 1974 oil crisis brought growth rates to a sudden halt, but the declining trend continued on until much later. The 1980s and 1990s appear, in the light of long historical experience, to be more similar to the period 1880–1913 than to any other period in the last century and a half.

Graph 3.

Source: See appendix

Of the graphs on population and GDP per capita, the latter is very similar in its trends and fluctuations to GDP. Nevertheless, it is worth emphasising that the slight evidence of an accelerating GDP trend in the pre-1913 period disappears when looking at the per capita GDP. Indeed, the similarity in GDP figures between the last quarter of a century and the pre-1913 period is nowhere to be found in the per capita GDP. The deceleration of European population growth since the 1970s has produced a better per capita GDP performance than for the period 1890–1913 (see Graph 4).

Graph 4.

Source: See appendix.

All of this is quite well known. Our exercise does not pretend to add anything special to knowledge on this matter but, rather, is meant to confirm, on the European Union dimension, what has emerged from previous exercises in national accounting and in regional aggregation, as for example those performed by Angus Maddison on a number of occasions.

4. Gross Fixed Capital Formation (GFCF) and the Investment rate

In this section we aggregate the available information on the historical series for gross fixed capital formation of the EU countries to arrive at a new – EU wide – estimate of GFCF. It is statistically less robust than the GDP as it is poorly documented for some countries and for the war periods (see the appendix on “Sources and methods”). Even so, we think that there is so much to learn.

Graph 5.

Source: See appendix.

Graph 5 provides the GFCF estimate in international Geary-Khamis 1990 dollars for the period 1830–2000. Prima facie, there are not so many differences compared to the GDP or the per capita GDP series. Major breaks are the same, as are the major continuities. So, the ‘EU’ series for GFCF seems really reasonable. The long nineteenth century provided steady growth. The ‘trans-war’ years show strong fluctuations. The Golden Age registered GFCF at rates higher than before World War I. The 1974 oil crisis meant a turn in investment trends, and so on. It is nice to see particular details, like the jump in investment in the 1830s, probably related to the first British railway boom, the investment cycle centred on the 1847 peak, or the 1894–1901 cycle, and many others episodes, all easy to distinguish and running through to the even recent years.

The major news comes from Graph 6. It displays the European Union investment rate, i.e. the GFCF series divided by GDP. In our reading of the graph, the major break is the change in levels of investment effort after World War II. There are two clear-cut periods, before and after WWII.

Graph 6.

Source: See appendix.

Looking at the first century, many things appear to happen. In the first place, the European investment rate started, by 1830, at roughly 5 per cent. It should be remembered that this was the level indicated by Rostow (1961) as the critical investment effort for a ‘take-off’ to occur. In very few years, from the early 1830s to the 1846 and 1847 peak values, the European investment rate jumps to the 10 per cent level. For some fifty years it was to remain dramatically higher than the 1830 level, fluctuating between 8.0 and 11.3 per cent. As far as we know, the jump is to be explained by the huge railway investment effort all across current European Union countries. Investment rising up to a 9–10 per cent range was a major success for European economies as it allowed them to build extensive railway networks and also many factories, carry out public works and land improvements, as well as construct private buildings. The chronology is very much the one advocated by early scholars of nineteenth century industrialisation, and by all the classic works of the period. From the early 1830s to the mid-1840s, an investment revolution took place in Europe that has left its footprints all over the economic map and much of economic history. It is good to see that all our historical national accounting efforts fully capture good old economic history. It is also satisfying to perceive the smooth increasing trend in investment rate from the late 1830s to the mid-1890s. Within this long, sixty-year period the central part, i.e. from 1862 to 1877, is clearly visible, and fits nicely with the well-known efforts to diffuse the railways across the countries of the current European Union.

Another major break in the series can be seen for the end of the nineteenth century. From 1894 to 1899 the investment rate increases from 9.6 to 13.8. Interestingly enough, this investment boom remains. Investment levels continued in the range of 11.4 to 13.8 per cent until the outbreak of WWI. This new increase can be easily related to the second technological revolution: electrification, mainly, but also to new urban development, the start of motorisation, the launching of new industries, and so on. The ‘Belle Époque’ years or the ‘Edwardian era’ was a distinctive period in European history by many reasons, among them because investment efforts were clearly higher than before. In this context a number of countries ‘took off’. The increase in the investment rate is visible in many national figures. It can also be related to a time of historically low interest rates and to exceptionally high rates of profit. Of course, the gold standard, working to the complete satisfaction for everybody, was instrumental in this sustained economic success.

As can be expected, WWI put an end to this evolution. Investment rate fell as far as 6 per cent (as in 1833, more than eighty years before); this might well be a maximum, as the countries suffering the most during the war do not have data on this item. WWII brought a similar experience, with investment rate reaching the same depths as for WWI and for a similar length of time. The interwar years were ones of strong, but delayed recovery. The heights of 1899 and 1906 (13.8 per

cent) were surpassed as from 1924 until 1930, reaching a high of 15.2 by 1929. Nevertheless, the Great Depression, for all the harm it brought, was not as destructive as the world wars. The investment rate fell a lot, but only to 10.4 per cent, and recovery pushed it up again to 15.3 by 1937. Looking at Graph 6, there appears to be an increasing trend at work from the late nineteenth century to the late nineteen thirties. But had this trend really existed, it would have produced our current investment rates, not the post-war rates.

Investment efforts after WWII were by all means extraordinary. By 1947 the investment rate had reached 21.1 per cent. The equivalent, earlier experience was in 1920, with a high of 13.7. The investment reaction was quicker after WWII than after WWI, and it was much stronger. Investment efforts by 1947 were almost 40 per cent higher than the highest pre-war rates. In 1920 they were the same. The exceptional 1947 experience did not last longer than that of 1920. They fell the following year, but did not decline back to normal levels. The investment rate from 1948 to 1953 remained at an astonishingly high 19 per cent or more. To everybody's surprise what came next was not an investment crisis but a further investment boom. The 19.0 per cent rate of 1953 increased to 24.3 per cent in 1964, and it remained around the height of 24 per cent until 1974! The European economic miracle did very much exist, and it was founded on allocating resources to gross fixed capital formation. After 1974, investment rates went down quite quickly. By 1986 they were at the same early 1950s level: 19 per cent. A lower level was reached in 1994, at 18.6, the lowest level since WWII. Compared to the interwar years, these are still very high rates. They only seem low when compared to the achievements of the Golden Age.

5. Foreign trade and openness

We have been unable to gather sufficient foreign trade data (value of imports plus value of exports in 1990 Geary-Khamis dollars) before 1850. But the European foreign trade series is quite robust even at the very beginning. What we can see in Graph 7 is substantive enough. The 1850–1913 period gave sustained growth with three different sub-periods: from 1850 to the mid-1870s, high growth; from mid-1870s to early 1890s, slow growth; and from then to 1913, growth acceleration, without reaching the rates of the third quarter of the nineteenth century. The 'trans-war' period is definitely a period of foreign trade reduction. This happened during the wars, but also during the Great Depression. The years of WWI reconstruction and Great Depression recovery are disappointing at providing more foreign trade. By 1945 foreign trade was roughly half its 1913 value. From 1945 onwards, foreign trade grew almost without deceleration until the late 1970s. The

1980s and early 1990s were years of deceleration, stagnation and, eventually, crisis. Growth resumed after 1993. All in all, the pre-1913 period was one of foreign trade expansion; the period 1913–1945 was one of foreign trade contraction; and afterwards the dominant trend was expansive again.

Graph 7.

Source: See appendix.

This account of foreign trade growth does not fully show how intense the commitment of European Union countries was to foreign trade. This is better presented in Graph 8, on European openness $[(X+M)/GDP]$. The three major periods identified in Graph 7 are still there, but really amplified. The series start with an openness degree of 19 per cent in 1850. This ratio doubled to 38 per cent during the next three decades – 1850 to 1880. It was the era of diffusion of free-trade policies and of commercial treaties. The level reached by 1880 stagnated – or even slightly declined – for twenty years. By the turn of the century openness increased again, rising to a high of 43 per cent in 1913. This ratio was only surpassed in 1974, more than sixty years later! For the thirty years following 1913 the trend was deeply downwards, to the trough of 15.5 per cent in 1942. There were some reverses in downward path: in 1920 – but a protectionist reaction and an economic depression made 1920 truly exceptional; in 1924, when the European Union countries seemed, for a while, to return to normal; and once again in 1937, for a very short-lived economic boom. From 1940 to 1942 European openness was even smaller than in 1850.

Graph 8.

Source: See appendix.

Recovery after WWII was important, but nothing compared to what happened with investment ratios. The 1945 starting point – 20.3 per cent, i.e. in the range of the early 1850s – was to be easily surpassed and within a few years – by 1951 – the rate jumped up to 37.2 per cent. That level was unsustainable, only lasting one year. From 1952 to 1967 the values ranged between 30 and 34 per cent. So, the Golden Age, when investment ratios were astonishingly high, occurred in a Europe where average openness was at relatively low levels – the same as in the late 1860s or the worst moments of the 1920s. We feel that this contrast is highly relevant as it reveals the asymmetry between two major explanatory factors of the European Golden Age.

The increase in openness of European Union member states made important advances only from the late 1960s to the mid-1980s. The reasons for this are quite varied. The early steps should be related to the completion of the elimination of internal tariffs within the European Economic Community, in association with the impact of the GATT Kennedy rounds and EFTA trade liberalization. The shocks of the oil crises also had an effect on this trend. It seems that openness was increasing during the 1970s, but a part of this increase was only due to oil price movements, just as it happened, inversely, in 1986. So, if we cancel out the effect of the oil crises, what we get is an increase in openness lasting until late 1980s. It is difficult to identify – although it did happen – the impact of the progressive merger of the EFTA and EEC in 1973, with the U.K. and Denmark entering into the EEC. Greece and Ireland should have had a small impact in overall figures. More noticeable should have been the entrance of Spain and Portugal in 1986, as well as the European Union enlargement to include Austria, Finland and Sweden in 1995. Meanwhile, the early 1990s crises, related to German unification, the fall of East European socialist regimes and the dissolution of the Soviet Union, but also to the Gulf war, brought a reversal to the increase in openness. Once this turmoil was over, openness grew again, increasing from 41 per cent in 1993 to 57 per cent in 2000. The overall post-WWII trend is one of increasing openness, but the chronology is much less straightforward than to be expected.

Graph 9.

Source: See appendix.

The sense of trade-off between investment and foreign trade is perhaps better assessed in Graph 9. We have divided gross fixed capital formation (GFCF) by foreign trade. Our aim is to compare the relative growth of both variables. As they are competing factors in the explanation of European growth, it is worth to look at their relative behaviour. During most of the second half of the nineteenth century the trend was declining – i.e. foreign trade was growing quicker than investment. The trend was reversed in the 1890s, but it declined again in the 1900s. By 1913 it was no different to the trend up to 1880. The interwar period contributed to a dramatic increase in the trend. The ratio, quite stable at the 25–30 per cent level, rose dramatically to 70 per cent. GFCF was growing much quicker than foreign trade – indeed, the latter was declining. The high levels reached by the late 1930s remained as such until the late 1960s and early 1970s. The European system of closed economies started to switch back after its historical high of 1964 to an open system. From then until the mid-1980s the dominating trend was one of reduction – a halving of the ratio – meaning that foreign trade was a more dynamic force than investment. The declining trend is

unclear for the last decade and a half of the series, although it seems that, from a long-term perspective, it is still in force. Interestingly enough, the ratio by 2000 is quite similar to that of almost a century and a half ago – 1855 or 1860.

6. Prices and stability

It is difficult to present a European Union price index without experiencing a sense of fear, but we decided that it was, nevertheless, an exercise worth the effort: see Graph 10. One can see the usual long period of price stability for the nineteenth century (with data starting in 1840), the price revolution of WWI and its immediate aftermath, with peak prices being reached in 1923, only to be stabilized in 1924. The rest of the interwar years show quite stable prices, but with a clear cyclical pattern. During WWII prices start to rise again, reaching very high levels in the immediate post-war years, i.e. by 1948. A long period of low price increases start then, which lasts some 25 years. Around the early 1970s, and more clearly during the oil crisis, prices accelerate again. The years of double-digit inflation last a decade or so, after which prices decelerate. The major periods are clearly established and they correspond to well-known stages in European economic policy.

Graph 10.

Source: See appendix.

Graph 11.

Source: See appendix.

Graph 11 focuses on the inflation rate. It is worth emphasising that the inflation rate, just as for GDP growth rate, became increasingly less volatile as the nineteenth century proceeded. The variance seems to be very much reduced after the mid-1890s. What happened next is the closest picture of a revolution – or, to be more exact, a discontinuity – that we can get in an economic history graph. The price regime changed dramatically, expand violently up to the moment of its final collapse. The whole episode took no more than one decade, from 1914 to 1924. Afterwards we can perceive how tough the efforts were to keep monetary policy under control, causing a clear deflationary trend from 1926 to 1932. After 1932, inflation was quite symmetrical, but the outbreak of WWII changed the system again and a new wave of high inflation started in 1940 that was to last

almost another decade – until its end in 1949. This inflation–deflation cycle was less violent than that of 1914–1924, but in itself extraordinary enough. With the exception of the Korean War years, inflation was again under control from 1954 to the late 1960s. The difference was that deflation was carefully avoided. From the mid-1960s onward prices underwent a modest acceleration. The inflationary period that followed the oil crisis – thirteen years long –lasted a bit longer than the previous price crisis, but it was definitely smoother. Once the highs were over – after 1981 – the trend again tended toward inflation reduction, but avoiding deflation. The creation of the Euro should create price stability in the future.

7. Concluding remarks

To get the exact measure of the ‘European-ness’ of what has been happening with the economic performance of European Union countries it is necessary to build a European wide set of economic indicators. We have just done this, aiming at launching a new set of research venues. The overall results do not lead to major changes in our received wisdom as far as GDP and per capita GDP is considered. But investment performance and, mainly, investment effort at the European Union level are not as straightforward as GDP. There is a lot to be learnt from analysing EU investment performance, in particular it shows how exceptional the post-war boom was. We also want to emphasise how diffused the end of the nineteenth century investment boom was. As for foreign trade, we provide a series that does not offer any major surprises, but the openness rate is much more appealing as it allows for fair comparisons along the time period under scrutiny. It also suggests that the post-war economic boom was based much more in investment than on foreign trade. As this runs contrary to many traditional explanations, this point may deserve further research. European price experience is quite homogeneous, but when viewed in a historical perspective it becomes evident that the inflationary episodes signal major breaks in European economic life. No wonder that so much effort has been put in guaranteeing a powerful tool to achieve price stability!

Appendix: sources and methods

GDP and population

The fundamental source for GDP and population data is Angus Maddison's works: for 1870–1949, Maddison (1995) and for 1950–1998, Maddison (2001). The GDP is made comparable according to Maddison's criteria: 1990 international (Geary-Khamis) US dollars. This procedure allows for a substantial – although limited – correction of price effects. For 1999 and 2000 the GDP data comes from linking the preceding data with GDP growth rates as presented in International Monetary Fund financial statistics. For the population we have relied on Eurostat *Yearbook* (2002), correcting the 1 January Eurostat convention, and switching to the mid-year Maddison criteria by calculating the average of every two years. For 1850–1870 population data, when no annual data was available we interpolated a geometric trend. When more recent GDP estimates do exist or when they start earlier than those of Maddison, we have relied on them. We have used 1913 current values as the base year for switching to a common *numéraire*. Unless otherwise stated we have relied on Mitchell (1992) for data for 1850–1870.

Exceptions to the sources summarised in the previous paragraph are:

Austria : 1870–1913, Schulze (2000).

Belgium: 1850–1870, Gadisseur (1973).

Finland : 1860–1960, Hjerpe (1996).

France: 1830–1913 , Toutain (1997).

Germany : 1901–1949, Ritschl and Spoerer (1997). Population and GDP of the former German Democratic Republic for 1870–1945 have been estimated according to the proportion that it represented in 1936 within nowadays Germany (Maddison, 1995, Table B-6).

Greece: 1833–1939, Kostelenos (2001).

Netherlands: 1830–1913, Smits, Horlings and van Zanden (2000).

Portugal: Lains (2003).

Spain: 1850–2000, Prados de la Escosura (2003)

United Kingdom: 1830–1850, Mitchell (1992).

We would like to stress that we have adhered to Maddison's criteria of working with constant frontier state units. This introduces some problems in cases of major frontier changes, e.g. in Germany and France and in the United Kingdom and Ireland. As the frontier perspective is a

contemporary one, the solution adopted by Maddison is the best one for our purpose. The problem is that Ireland is not covered at all while being under British rule. The only exception to Maddison's constant frontier criteria has been Greece.

GDP per capita

The series has been calculated by dividing the sum of the GDP for all the European Union countries by their total population.

Gross Fixed Capital Formation (GFCF)

The major shortcoming is the fact that for some long periods the available national series are of *net* capital formation. Another, less important, shortcoming is that some series include inventories. An additional problem concerns prices. We have decided to calculate investment rates based on the current GDP and GFCF values as the deflators of each of them are less reliable than their current values. But there are a few cases for which we have only constant prices. All these particular cases are indicated in the following list. Unless otherwise stated, the source is Mitchell (1992) until 1988, and IMF, *International Financial Statistics*, thereafter. The investment values at 1990 international dollars come out of multiplying the investment rate series by the GDP series. The investment ratio has been calculated by dividing the sum of national GFCF series by their total GDP.

Austria: Inventories included.

Belgium: 1920–1939, Buyst (1997). 1920–1939 and 1959–1988, calculation made on Gross National Product.

Finland: 1860–1960, Hjerpe (1996).

France: 1830–1938, our own calculation based on Toutain (1997). For 1922–1938, the series were at constant prices.

Germany: 1850–1913, net investment rate, calculated from Net National Product, and including inventories. 1921–1939, Ritschl and Spoerer (1997), including inventories for the sake of continuity with the pre-war series.

Netherlands: 1830–1913, Smits, Horlings and van Zanden (2000). 1921–1939, net investment, including inventories but excluding public investment (a very exceptional case), and compared with Net National Product.

Spain: 1850–2000, Prados de la Escosura (2003).

Foreign Trade

Export (fob) and import (cif) data, as well as GDP, all in current values, come from Mitchell (1992) until 1988, and from IMF, *International Financial Statistics*, for 1989–2000.

The way to estimate a foreign trade aggregate figure for European Union countries has been the same method that we have followed for GFCF. The sum of exports and imports in current values has been divided by GDP in current values to obtain a ratio that we have applied to the GDP 1990 international dollars series. Once they are switched to a common *numéraire*, national foreign trade value series can be added to obtain the total value of EU countries' foreign trade. As with GFCF, a problem can be that GDP series may only exist at constant prices. In these cases we have proceeded as follows:

Belgium: We have used the 1913 based wholesale price index as a GDP deflator, thus obtaining nominal GDP for 1850–1913. We did the same for 1914–1948 with 1914-based price indices, linked with the 1929 based series, according to 1948 current values. All the data comes from Mitchell (1992). The exception to this exception is the period 1920–1939, from Buyst (1997), which allows to use the standard procedure.

Portugal: 1865–1910, GDP data in constant terms from Lains (2003), switched to current values according to the Nunes, Mata and Valério (1989) price index.

Other sources used have been:

Finland: 1860–1960, Hjerpe (1996).

Netherlands: 1830–1913, Smits, Horlings and van Zanden (2000).

Portugal: 1910–1958, Batista, Martins, Pinheiro and Reis (1997).

Spain: 1850–2000, Tena (forthcoming).

Prices:

They are Consumer Price Indices. As a general criteria we have relied on Maddison (1991) for 1870–1989. For 1989–2000, we relied on IMF data. The years 1840–1870 come from Mitchell (1992). The aggregation has been done according to GDP weight. The weighting schemes used have been 1913 (until 1913), 1929 (from 1913 to 1960) and 1960 (from 1960 onwards). The major problems have been:

Austria and Belgium: Both were excluded from the 1914 calculation as there is a break in the series between 1913 and 1914 (two different price series without any link between them).

Portugal: 1865–1929, Nunes, Mata and Valério (1989).

Spain: 1840–1860, Barquín (1997); 1861–1936, Ballesteros (1997); 1940–1983, Maluquer (1989, Linked Consumer Price Index); from 1983 onwards, INE (web page). The first and second periods, as well as the second and third, are linked according to the changes in the wholesale price index, from Maluquer (1989).

APPENDIX

MAJOR HISTORICAL MACROECONOMIC VARIABLES FOR THE EUROPEAN UNION, 1830-2000

	GDP, in Mil. 1990 Geary- Khamis \$	Population in thousands	Per capita GDP, in G-K 1990 \$	GFCF, in Mil. 1990 Geary- Khamis \$	Investment rate (GFCF/GDP) in %	Foreign trade, in Mil. 1990 G-K \$	Openness rate (FT/GDP) in %	Price Indices (1950=100)	GFCF/FT (in %)	Inflation rate (in %)
1830	157.827			9.509	6,0					
1831	163.993			9.228	5,6					
1832	169.039			8.401	5,0					
1833	168.622			10.665	6,3					
1834	173.515			11.941	6,9					
1835	180.596			14.094	7,8					
1836	182.147			14.917	8,2					
1837	184.817			17.128	9,3					
1838	194.667			18.237	9,4					
1839	197.787			18.650	9,4					
1840	200.766			18.880	9,4			88,7		
1841	198.633			16.006	8,1			86,4		-2,63
1842	195.956			15.425	7,9			85,3		-1,21
1843	202.865			16.384	8,1			79,9		-6,41
1844	212.010			17.284	8,2			80,4		0,64
1845	213.383			20.073	9,4			81,9		1,85
1846	219.783			23.883	10,9			87,9		7,32
1847	229.543			25.618	11,2			98,2		11,76
1848	228.218			21.412	9,4			82,3		-16,21
1849	230.582			20.198	8,8			76,1		-7,46
1850	230.633	156.444	1.474	20.592	8,9	43.958	19,1	74,1	46,8	-2,68
1851	234.017	157.313	1.488	20.318	8,7	44.704	19,1	75,4	45,5	1,81
1852	243.353	158.240	1.538	24.696	10,1	47.542	19,5	78,0	51,9	3,43
1853	238.243	159.044	1.498	21.428	9,0	54.024	22,7	84,8	39,7	8,64
1854	248.438	160.069	1.552	23.698	9,5	53.524	21,5	92,4	44,3	9,02
1855	245.818	160.965	1.527	19.812	8,1	54.570	22,2	94,6	36,3	2,39
1856	259.077	161.918	1.600	24.444	9,4	64.090	24,7	95,1	38,1	0,55
1857	268.112	162.805	1.647	21.338	8,0	68.077	25,4	92,0	31,3	-3,27
1858	271.984	163.631	1.662	22.988	8,5	66.339	24,4	85,7	34,7	-6,85
1859	272.394	164.544	1.655	23.553	8,6	71.583	26,3	87,0	32,9	1,53
1860	288.020	165.482	1.740	28.453	9,9	78.123	27,1	90,3	36,4	3,76
1861	285.304	166.361	1.715	25.518	8,9	77.778	27,3	91,4	32,8	1,23
1862	298.027	167.218	1.782	31.559	10,6	80.785	27,1	92,4	39,1	1,08
1863	308.289	168.071	1.834	33.472	10,9	87.655	28,4	92,1	38,2	-0,33
1864	312.892	169.127	1.850	34.899	11,2	99.518	31,8	91,0	35,1	-1,16
1865	315.342	170.012	1.855	34.089	10,8	100.796	32,0	90,8	33,8	-0,30
1866	322.482	170.842	1.888	34.420	10,7	103.702	32,2	93,3	33,2	2,74
1867	314.492	171.597	1.833	35.324	11,2	99.231	31,6	96,0	35,6	2,94
1868	325.013	172.254	1.887	36.261	11,2	103.921	32,0	95,2	34,9	-0,87
1869	334.209	173.133	1.930	33.050	9,9	109.452	32,7	92,6	30,2	-2,68
1870	341.422	174.176	1.960	32.857	9,6	109.828	32,2	93,4	29,9	0,88
1871	345.485	174.206	1.983	29.273	8,5	125.499	36,3	95,9	23,3	2,65
1872	360.785	175.079	2.061	38.970	10,8	132.726	36,8	100,1	29,4	4,39
1873	365.580	176.276	2.074	38.819	10,6	131.667	36,0	103,3	29,5	3,24
1874	380.550	177.485	2.144	43.144	11,3	129.221	34,0	101,3	33,4	-2,00
1875	388.789	178.811	2.174	42.654	11,0	136.763	35,2	95,7	31,2	-5,55
1876	383.168	180.267	2.126	41.459	10,8	138.315	36,1	97,1	30,0	1,56

1877	390.949	181.776	2.151	41.515	10,6	138.426	35,4	98,6	30,0	1,50
1878	394.437	183.211	2.153	39.138	9,9	134.293	34,0	94,3	29,1	-4,41
1879	385.836	184.662	2.089	37.119	9,6	146.861	38,1	92,1	25,3	-2,31
1880	403.587	185.903	2.171	40.276	10,0	149.659	37,1	94,7	26,9	2,80
1881	411.633	187.322	2.197	39.833	9,7	156.129	37,9	93,4	25,5	-1,33
1882	425.985	188.530	2.260	45.450	10,7	160.836	37,8	92,9	28,3	-0,50
1883	433.678	189.709	2.286	45.425	10,5	164.369	37,9	92,0	27,6	-1,02
1884	437.561	191.057	2.290	44.949	10,3	159.838	36,5	88,9	28,1	-3,34
1885	438.182	192.331	2.278	46.792	10,7	155.144	35,4	86,0	30,2	-3,28
1886	444.669	193.660	2.296	47.105	10,6	156.707	35,2	84,6	30,1	-1,58
1887	457.089	194.898	2.345	47.618	10,4	166.124	36,3	83,1	28,7	-1,83
1888	469.295	196.148	2.393	49.189	10,5	171.336	36,5	83,3	28,7	0,20
1889	480.906	197.498	2.435	46.562	9,7	183.151	38,1	85,8	25,4	3,02
1890	490.906	198.781	2.470	52.287	10,7	182.277	37,1	86,5	28,7	0,88
1891	493.758	199.995	2.469	45.635	9,2	182.036	36,9	87,5	25,1	1,12
1892	498.018	201.258	2.475	52.809	10,6	174.164	35,0	87,0	30,3	-0,55
1893	506.323	202.572	2.499	50.862	10,0	174.773	34,5	84,8	29,1	-2,54
1894	524.435	204.011	2.571	50.111	9,6	176.341	33,6	83,4	28,4	-1,66
1895	534.912	205.507	2.603	55.640	10,4	186.303	34,8	83,0	29,9	-0,50
1896	552.107	207.106	2.666	58.942	10,7	192.321	34,8	82,0	30,6	-1,19
1897	557.157	208.884	2.667	67.894	12,2	198.872	35,7	83,0	34,1	1,29
1898	585.492	210.666	2.779	70.884	12,1	206.199	35,2	85,6	34,4	3,02
1899	606.678	212.361	2.857	83.869	13,8	214.214	35,3	85,4	39,2	-0,13
1900	614.705	213.965	2.873	83.629	13,6	222.317	36,2	88,2	37,6	3,28
1901	618.026	215.709	2.865	72.601	11,7	214.261	34,7	87,7	33,9	-0,59
1902	625.097	217.602	2.873	73.663	11,8	225.336	36,0	87,1	32,7	-0,67
1903	636.381	219.460	2.900	79.657	12,5	232.530	36,5	88,3	34,3	1,32
1904	647.383	221.334	2.925	82.518	12,7	237.116	36,6	87,8	34,8	-0,55
1905	661.834	223.126	2.966	83.146	12,6	248.522	37,6	88,9	33,5	1,25
1906	684.816	225.024	3.043	94.813	13,8	273.538	39,9	91,2	34,7	2,55
1907	710.644	226.863	3.132	92.363	13,0	288.900	40,7	91,9	32,0	0,80
1908	715.403	228.808	3.127	86.817	12,1	272.316	38,1	91,8	31,9	-0,15
1909	737.879	230.747	3.198	83.847	11,4	287.779	39,0	93,5	29,1	1,87
1910	737.673	232.628	3.171	84.313	11,4	311.703	42,3	96,9	27,0	3,62
1911	775.830	234.560	3.308	96.221	12,4	323.683	41,7	96,0	29,7	-0,86
1912	797.886	236.071	3.380	103.938	13,0	344.138	43,1	99,5	30,2	3,63
1913	819.657	239.630	3.421	107.651	13,1	354.431	43,2	100,0	30,4	0,48
1914	791.539	241.391	3.279	92.753	11,7	334.002	42,2	100,9	27,8	0,87
1915	801.535	242.018	3.312	66.255	8,3	313.996	39,2	120,4	21,1	19,32
1916	821.481	241.585	3.400	52.109	6,3	325.339	39,6	152,8	16,0	26,94
1917	793.352	241.012	3.292	57.707	7,3	285.296	36,0	204,9	20,2	34,13
1918	760.480	239.377	3.177	61.071	8,0	251.143	33,0	264,3	24,3	28,97
1919	730.636	239.513	3.051	79.996	10,9	301.093	41,2	310,3	26,6	17,40
1920	761.790	240.976	3.161	104.291	13,7	343.580	45,1	455,8	30,4	46,89
1921	753.711	242.996	3.102	90.926	12,1	236.222	31,3	463,7	38,5	1,74
1922	815.293	245.488	3.321	99.411	12,2	259.213	31,8	1.527,5	38,4	229,41
1923	814.353	247.591	3.289	107.188	13,2	303.801	37,3	269.358,0	35,3	17.533,98
1924	869.985	249.457	3.488	125.539	14,4	354.597	40,8	298.378,2	35,4	10,77
1925	910.410	251.291	3.623	129.620	14,2	358.233	39,3	317.770,2	36,2	6,50
1926	917.224	253.159	3.623	126.688	13,8	348.685	38,0	339.853,2	36,3	6,95
1927	960.110	254.686	3.770	133.229	13,9	365.384	38,1	345.142,4	36,5	1,56
1928	997.277	256.206	3.892	148.484	14,9	369.940	37,1	342.188,4	40,1	-0,86
1929	1.025.501	257.727	3.979	155.420	15,2	376.490	36,7	348.643,6	41,3	1,89
1930	996.160	259.509	3.839	136.999	13,8	322.906	32,4	336.028,0	42,4	-3,62

1931	938.047	261.293	3.590	107.935	11,5	262.596	28,0	318.486,4	41,1	-5,22
1932	912.445	262.795	3.472	94.572	10,4	207.901	22,8	297.202,7	45,5	-6,68
1933	945.293	264.252	3.577	106.109	11,2	204.940	21,7	288.648,5	51,8	-2,88
1934	985.713	265.803	3.708	122.023	12,4	205.945	20,9	287.832,2	59,3	-0,28
1935	1.031.368	267.341	3.858	144.716	14,0	211.938	20,5	283.148,5	68,3	-1,63
1936	1.065.751	267.845	3.979	154.308	14,5	226.088	21,2	293.922,1	68,3	3,80
1937	1.128.519	270.406	4.173	172.499	15,3	280.108	24,8	323.017,3	61,6	9,90
1938	1.133.137	272.228	4.162	167.783	14,8	244.084	21,5	343.925,9	68,7	6,47
1939	1.185.950	274.385	4.322	167.919	14,2	230.059	19,4	357.661,2	73,0	3,99
1940	1.178.580	275.137	4.284	141.452	12,0	220.421	18,7	407.322,0	64,2	13,88
1941	1.210.374	274.957	4.402	124.261	10,3	194.712	16,1	463.333,2	63,8	13,75
1942	1.222.197	277.455	4.405	109.018	8,9	189.844	15,5	522.529,8	57,4	12,78
1943	1.237.518	277.692	4.456	85.953	6,9	242.529	19,6	599.122,8	35,4	14,66
1944	1.142.760	277.976	4.111	66.377	5,8	267.861	23,4	764.957,3	24,8	27,68
1945	993.674	281.379	3.531	76.714	7,7	201.979	20,3	974.843,5	38,0	27,44
1946	985.613	284.913	3.459	172.684	17,5	244.432	24,8	1.221.896,7	70,6	25,34
1947	1.057.466	288.209	3.669	223.237	21,1	300.571	28,4	1.571.869,8	74,3	28,64
1948	1.133.602	291.644	3.887	220.301	19,4	327.406	28,9	1.887.914,8	67,3	20,11
1949	1.234.678	294.109	4.198	236.668	19,2	344.489	27,9	1.997.782,1	68,7	5,82
1950	1.329.925	295.583	4.499	258.081	19,4	409.613	30,8	2.072.792,8	63,0	3,75
1951	1.408.198	297.585	4.732	269.622	19,1	523.599	37,2	2.302.777,0	51,5	11,10
1952	1.460.552	299.247	4.881	279.406	19,1	478.213	32,7	2.449.664,5	58,4	6,38
1953	1.536.677	301.042	5.105	291.281	19,0	469.642	30,6	2.463.453,3	62,0	0,56
1954	1.621.141	302.818	5.354	322.418	19,9	505.600	31,2	2.494.493,7	63,8	1,26
1955	1.723.022	304.719	5.654	366.547	21,3	560.565	32,5	2.559.003,4	65,4	2,59
1956	1.800.544	306.769	5.869	391.105	21,7	587.627	32,6	2.650.518,9	66,6	3,58
1957	1.880.410	308.838	6.089	410.191	21,8	625.171	33,2	2.745.913,9	65,6	3,60
1958	1.928.635	310.999	6.201	414.200	21,5	591.685	30,7	2.908.341,6	70,0	5,92
1959	2.019.504	313.385	6.444	440.354	21,8	633.604	31,4	2.971.495,9	69,5	2,17
1960	2.149.456	315.722	6.808	487.205	22,7	730.729	34,0	3.032.382,5	66,7	2,05
1961	2.262.130	318.379	7.105	528.238	23,4	721.951	31,9	3.111.295,3	73,2	2,60
1962	2.373.857	321.411	7.386	555.873	23,4	747.263	31,5	3.238.569,2	74,4	4,09
1963	2.485.394	324.287	7.664	577.517	23,2	791.879	31,9	3.369.272,6	72,9	4,04
1964	2.637.113	326.763	8.070	639.958	24,3	850.372	32,2	3.499.617,0	75,3	3,87
1965	2.746.892	329.488	8.337	660.951	24,1	891.556	32,5	3.654.100,8	74,1	4,41
1966	2.849.871	331.843	8.588	674.729	23,7	939.926	33,0	3.789.688,9	71,8	3,71
1967	2.949.988	333.899	8.835	676.676	22,9	953.598	32,3	3.898.782,5	71,0	2,88
1968	3.109.041	335.729	9.261	734.706	23,6	1.064.049	34,2	4.038.597,4	69,0	3,59
1969	3.287.370	337.820	9.731	794.879	24,2	1.192.219	36,3	4.204.035,1	66,7	4,10
1970	3.432.368	339.924	10.097	841.438	24,5	1.283.376	37,4	4.412.344,8	65,6	4,95
1971	3.546.197	342.295	10.360	860.204	24,3	1.289.416	36,4	4.700.800,3	66,7	6,54
1972	3.703.157	344.286	10.756	888.434	24,0	1.341.482	36,2	4.999.148,2	66,2	6,35
1973	3.918.209	346.094	11.321	955.570	24,4	1.575.813	40,2	5.424.321,0	60,6	8,50
1974	4.002.923	347.591	11.516	962.606	24,0	1.859.006	46,4	6.148.518,5	51,8	13,35
1975	3.992.418	348.884	11.443	898.564	22,5	1.671.725	41,9	7.016.039,8	53,8	14,11
1976	4.168.837	350.024	11.910	941.605	22,6	1.880.430	45,1	7.822.279,3	50,1	11,49
1977	4.288.017	351.191	12.210	950.634	22,2	1.941.537	45,3	8.737.976,8	49,0	11,71
1978	4.418.771	352.340	12.541	977.270	22,1	1.912.057	43,3	9.441.576,1	51,1	8,05
1979	4.580.771	353.556	12.956	1.042.637	22,8	2.109.300	46,0	10.367.859,8	49,4	9,81
1980	4.646.920	355.034	13.089	1.069.340	23,0	2.218.681	47,7	11.730.148,0	48,2	13,14
1981	4.655.051	356.150	13.070	1.002.308	21,5	2.285.726	49,1	13.072.107,3	43,9	11,44
1982	4.696.916	356.885	13.161	974.789	20,8	2.314.294	49,3	14.338.867,7	42,1	9,69
1983	4.782.877	357.442	13.381	970.343	20,3	2.351.040	49,2	15.408.408,6	41,3	7,46
1984	4.894.297	357.931	13.674	955.442	19,5	2.507.976	51,2	16.387.357,4	38,1	6,35

1985	5.013.354	358.537	13.983	971.092	19,4	2.607.286	52,0	17.309.109,5	37,2	5,62
1986	5.154.263	359.281	14.346	992.040	19,2	2.346.251	45,5	17.826.248,3	42,3	2,99
1987	5.305.290	360.015	14.736	1.037.258	19,6	2.379.618	44,9	18.324.991,5	43,6	2,80
1988	5.523.053	361.076	15.296	1.127.036	20,4	2.491.552	45,1	18.948.432,8	45,2	3,40
1989	5.712.523	362.503	15.759	1.208.905	21,2	2.725.783	47,7	19.906.628,0	44,4	5,06
1990	5.776.326	364.146	15.863	1.231.328	21,3	2.662.721	46,1	21.004.839,1	46,2	5,52
1991	5.876.462	365.847	16.063	1.234.422	21,0	2.584.142	44,0	22.006.546,5	47,8	4,77
1992	5.950.498	367.616	16.187	1.200.183	20,2	2.518.148	42,3	22.897.247,9	47,7	4,05
1993	5.934.374	369.333	16.068	1.112.282	18,7	2.467.686	41,6	23.622.604,1	45,1	3,17
1994	6.100.941	370.593	16.463	1.132.152	18,6	2.689.689	44,1	24.275.689,6	42,1	2,76
1995	6.250.891	371.689	16.818	1.219.110	19,5	2.942.311	47,1	24.967.655,3	41,4	2,85
1996	6.351.854	372.726	17.042	1.229.280	19,4	2.987.021	47,0	25.530.965,5	41,2	2,26
1997	6.510.447	373.732	17.420	1.259.142	19,3	3.249.920	49,9	26.046.624,7	38,7	2,02
1998	6.685.254	374.500	17.851	1.321.138	19,8	3.371.581	50,4	26.489.401,2	39,2	1,70
1999	6.888.403	375.526	18.343	1.397.638	20,3	3.482.300	50,6	26.802.499,3	40,1	1,18
2000	7.128.972	376.543	18.933	1.478.685	20,7	4.064.054	57,0	27.435.337,3	36,4	2,36

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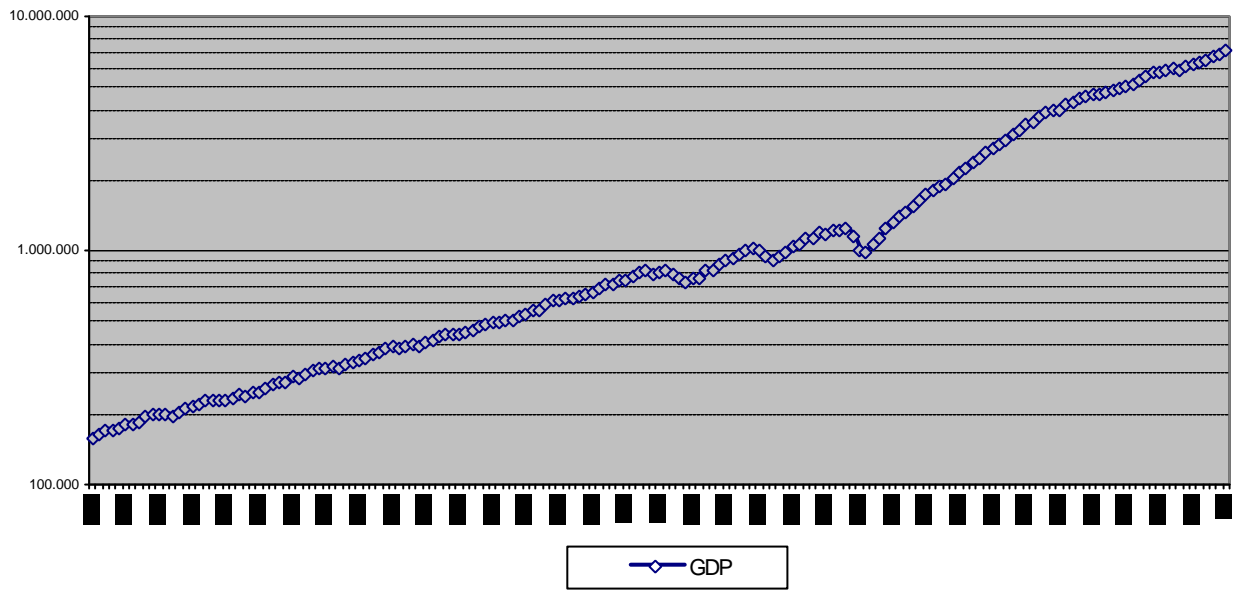
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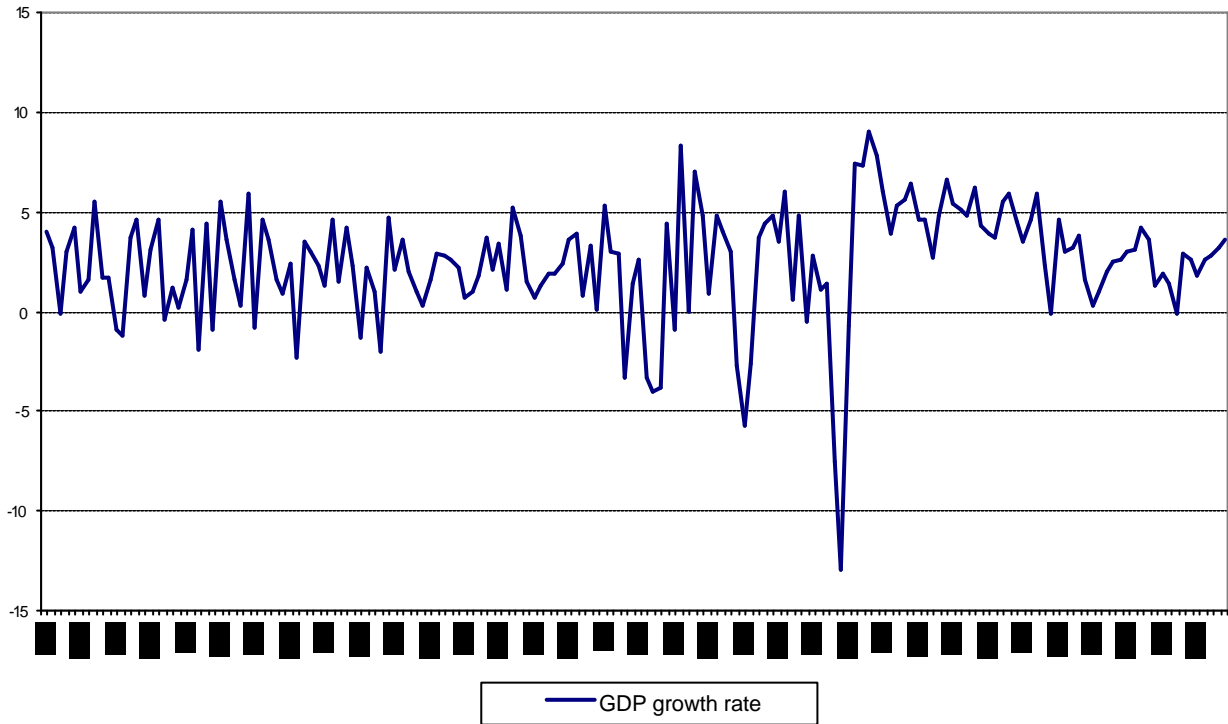
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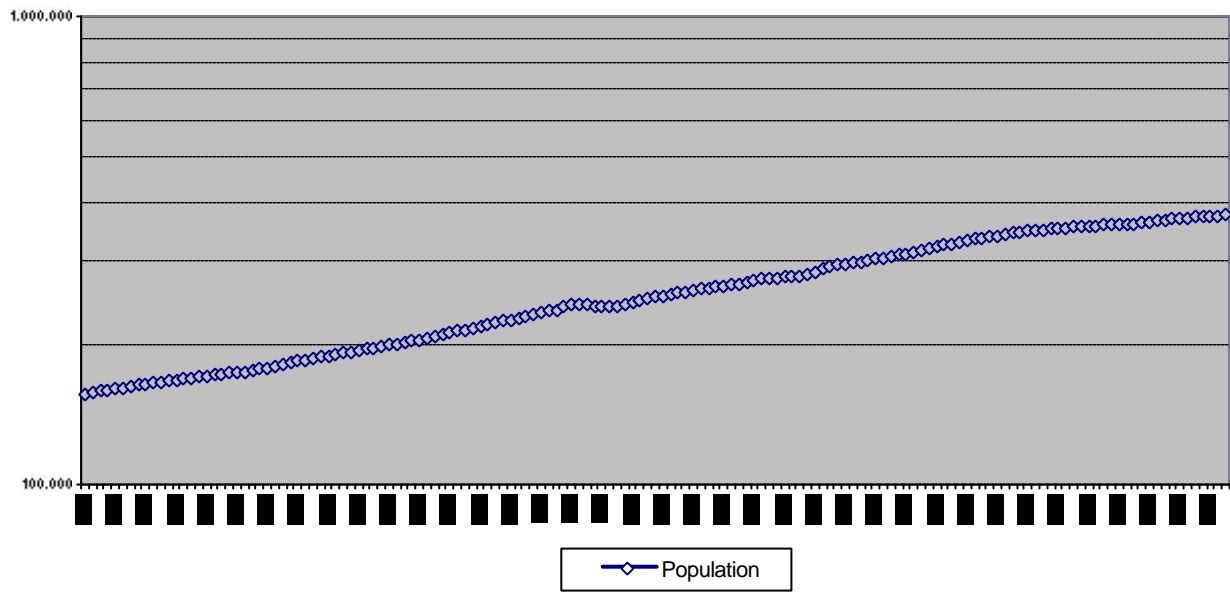
Graph 1. European Union GDP, 1830-2000 (in Mil.1990 G-K \$)



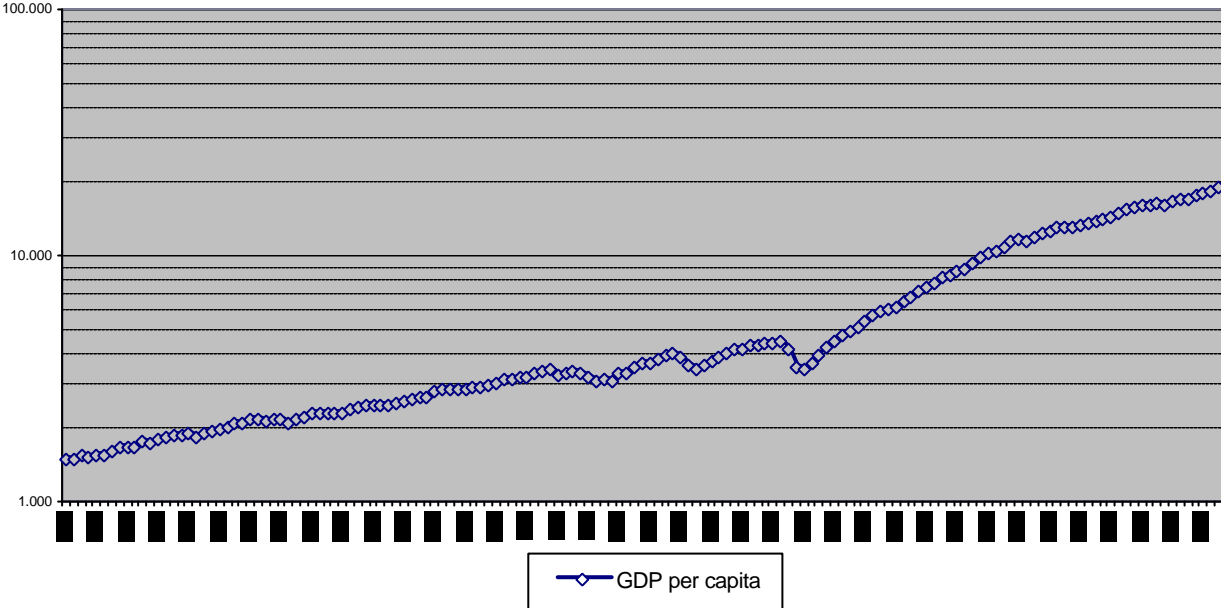
Graph 2. European Union GDP growth rate, 1831-2000 (in %)



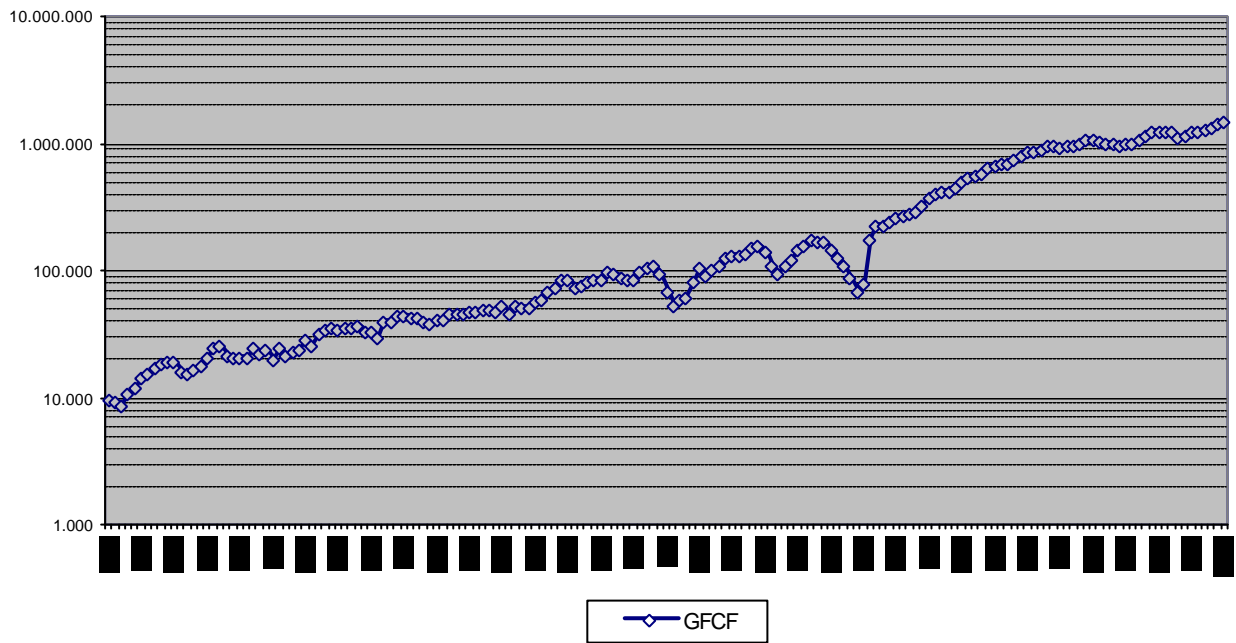
Graph 3. European Union Population, 1850-2000 (in 000)



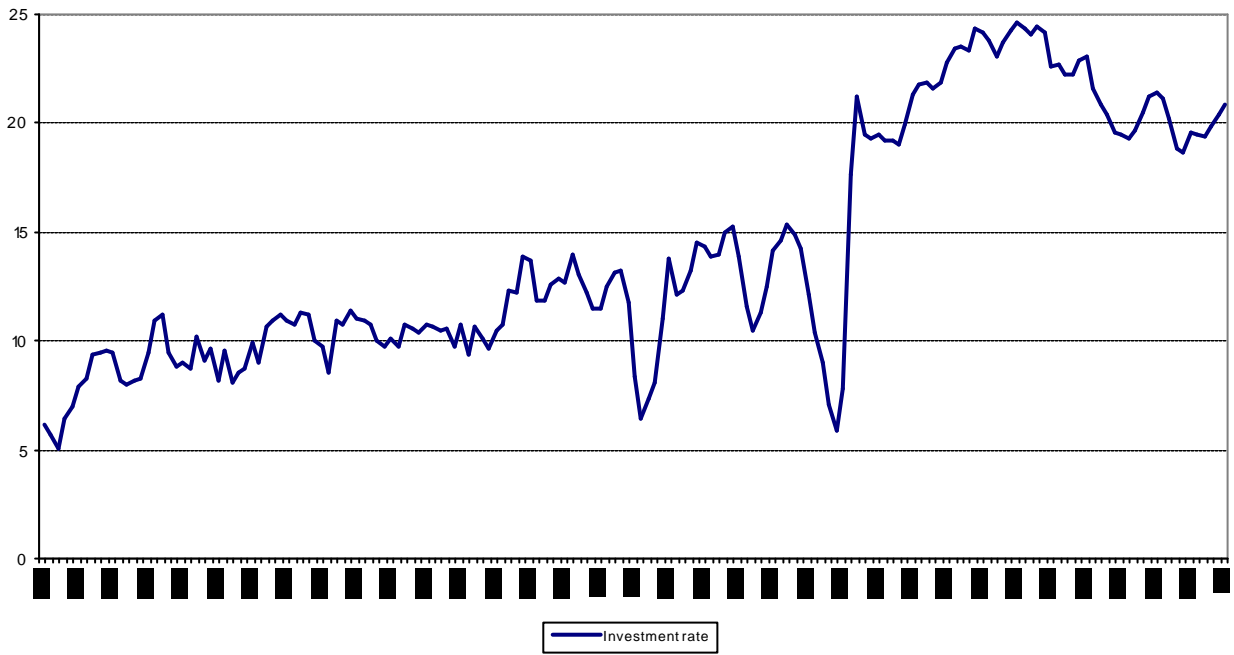
Graph 4. European Union GDP per capita, 1850-2000 (in 1990 G-K \$)



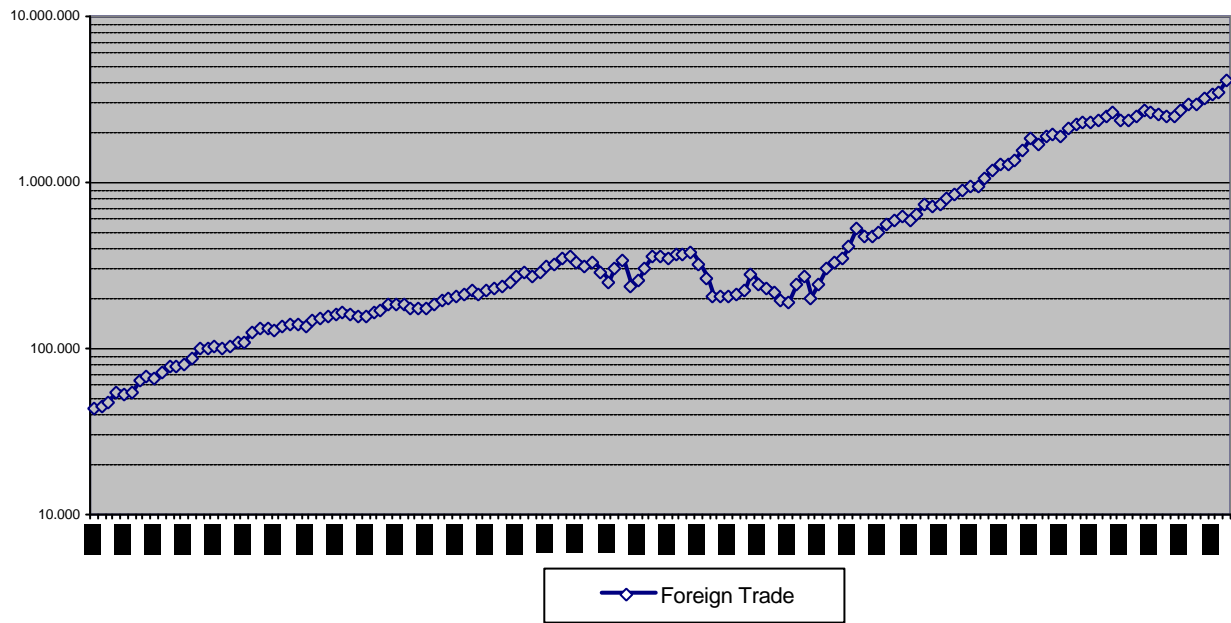
Graph 5. European Union Gross Fixed Capital Formation, 1830-2000 (in 1990 G-K \$)



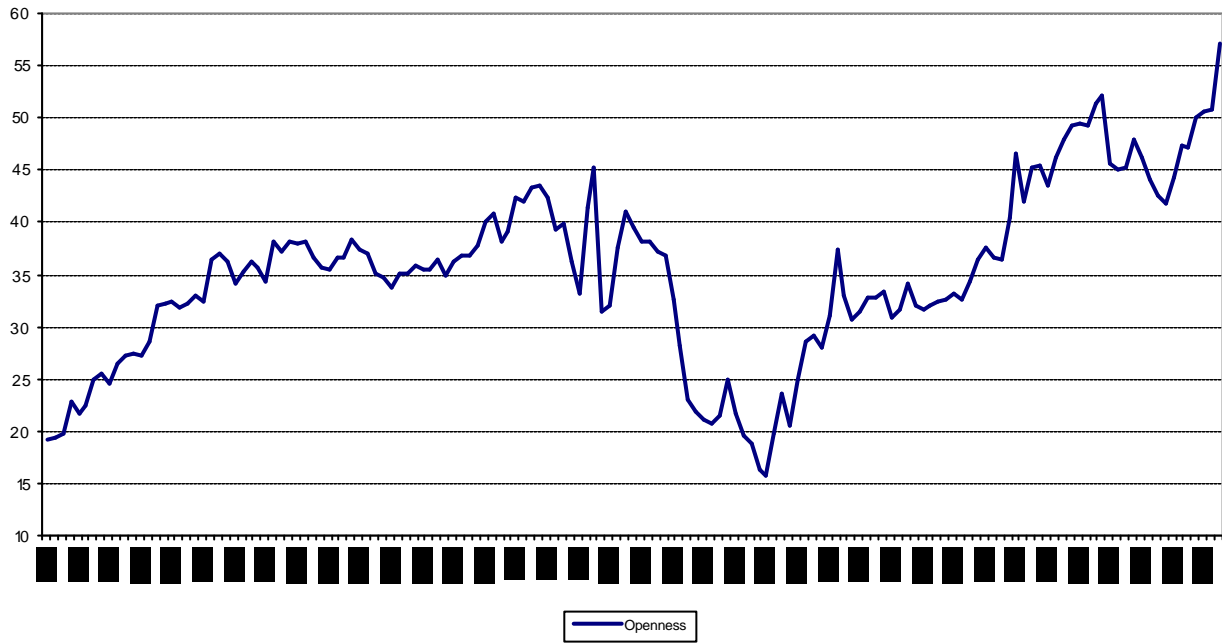
Graph 6. European Union investment rate, 1830-2000 (in %)



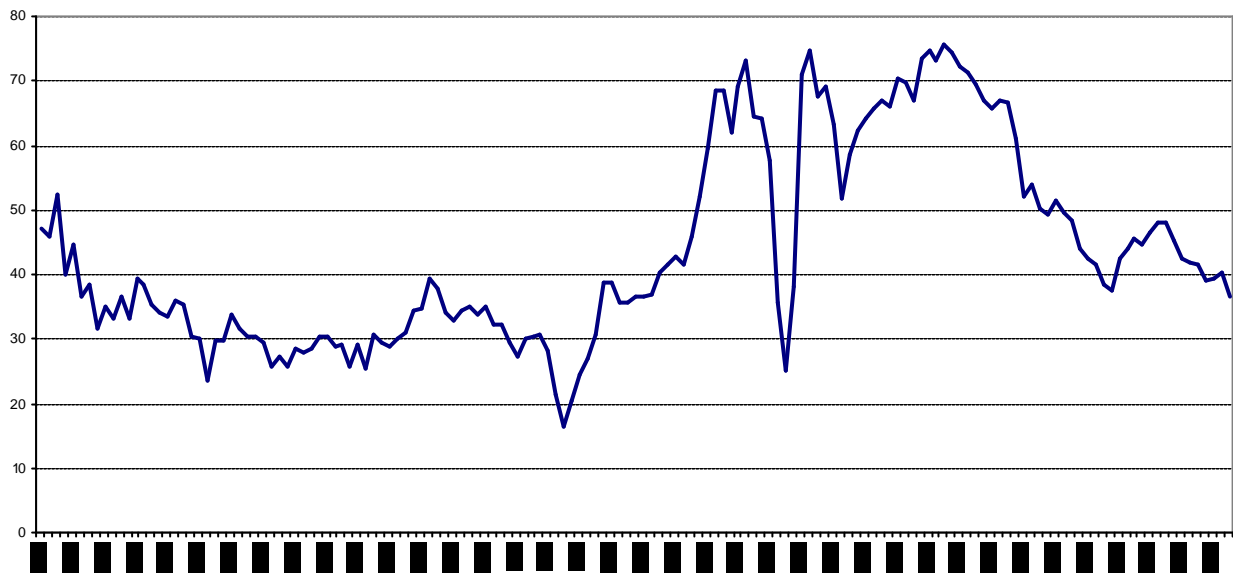
Graph 7. European Union Foreign Trade, 1850-2000 (in Mil.1990 \$)



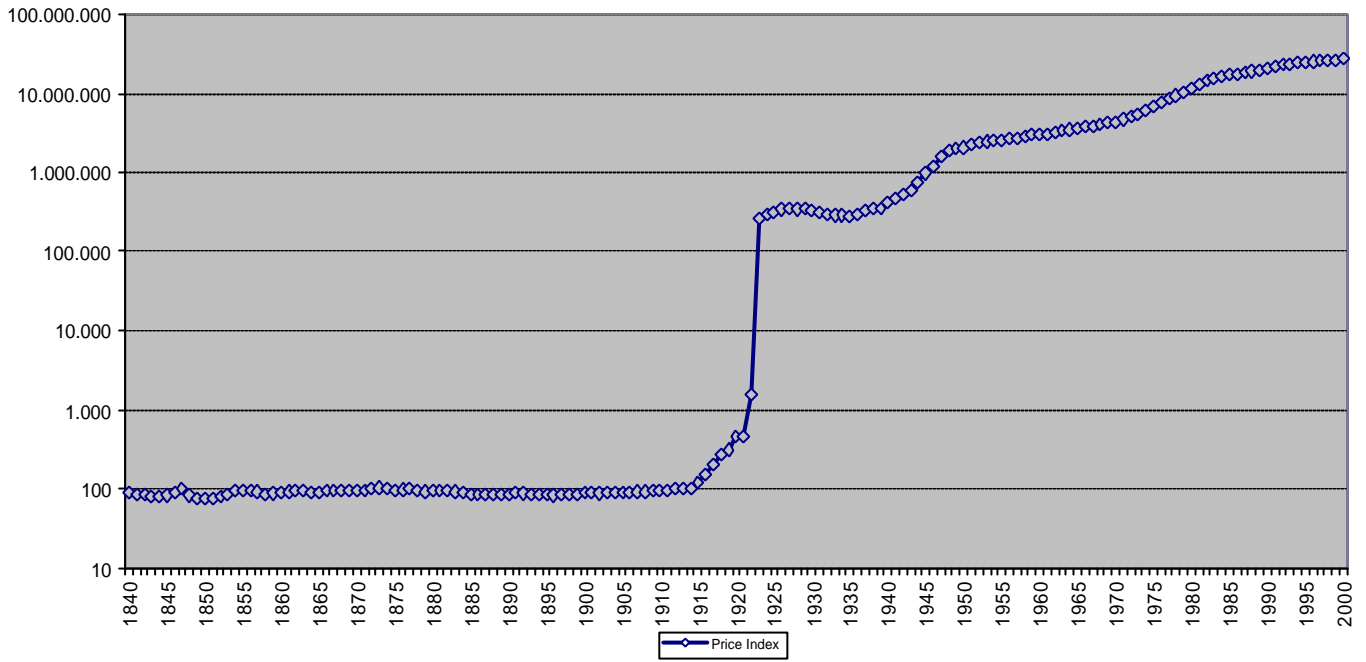
Graph 8. European Union Openness, 1850-2000 (in %)



Graph 9. Gross Fixed Capital Formation / Foreign Trade, European Union, 1850-2000, in %.



European Union Consumer Price Index, 1840-2000 (1913=100)



European Union inflation rate, 1841-2000 (in %)

