Gross domestic product per capita in France and in advanced economies: the role of productivity and employment

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This issue of Rue de la Banque *examines changes in living standards as measured by gross domestic product (GDP) per capita in 13 OECD countries, including France, between 1890 and 2012. During this period, living standards rose by a factor of 9 in France, 11 in the United States, 6 in the United Kingdom and 23 in Japan. Total factor productivity (TFP) and, to a lesser extent, capital intensity (fixed capital divided by GDP at constant prices) were the main drivers behind the rise in living standards. The employment ratio, captured by the share of the population aged 15-64 in employment, and the amount of working time also play an important role, especially when it comes to explaining why the countries that comprise the current euro area ceased to close the gap with the United States between 1970 and 1995. Despite a relative increase in employment ratios, the catch-up by the euro area's three largest countries was interrupted again over 1995-2013 as US TFP surged on the back of advances in information and communication technologies.*

Many comparative studies have been conducted on economic living standards, particularly since sources of uniform data on large numbers of countries have become available (see for example Heston et al., 2012). GDP per capita is routinely used as an indicator of living standards. Although imperfect because it merely measures the economic activity of a country and does not capture, say, the trade-off between labour and leisure (see the report by the Stiglitz, Sen and Fitoussi Commission, 2009), GDP per capita offers the advantage of making it possible to compare countries over time.

This study draws on an original database that gathers together macroeconomic series for 13 industrialised countries over a long period, namely 1890-2012. The long timespan and nature of the series allow us not only to look back at more than a century of growth in GDP per capita, but also to perform an accounting decomposition of this indicator, breaking it down into four separate factors: total factor productivity (TFP), capital intensity, the employment ratio and the average

number of hours worked per year. The decomposition principle is described in Bergeaud et al. (2014b) and summarised here in the Box. Six dates are selected to create several sub-periods: 1890, the starting point for our data; 1913, the eve of the First World War; 1950, shortly after the end of the Second World War; 1974, before the first oil shock; 1995, the start of the productivity wave linked to information and communication technologies (ICTs) in the United States (Cette, 2014); and 2012, the last year for which data were available when we carried out the study. For each sub-period, we decomposed the GDP per capita growth rate for each country. We then compared the levels of each of the factors against the United States at the six chosen dates. It seems reasonable to use the United States as the benchmark when assessing convergence. Although the United Kingdom and Australia had the highest living standards in 1890, the United States had overtaken them by the end of the 1920s and has remained the leader to this day, not including Norway, which is a case apart.

Principle of accounting decomposition

To decompose GDP per capita, we use a Cobb-Douglas type production function, which allows us to posit that:

$$GDP = TFP.K^{\alpha}.(LH)^{1-\alpha}$$

Where GDP denotes gross domestic product, K is productive capital, L is the number of workers and H is the average number of hours worked per employee. α is a coefficient that is assumed to be constant and that is equal to 0.3 in all countries. TFP denotes total factor productivity and captures various elements other than the volume of factors of production that are used to explain changes in GDP, such as technical progress and education levels. Taking this expression and dividing by total population, we can highlight several components:

$$\frac{GDP}{POP} = TFP.\left(\frac{K}{LH}\right)^{\alpha}. H \cdot \frac{L}{POP}$$

The first term is TFP, the second is capital intensity, the third is the number of hours worked and the fourth is the employment ratio for the total population. The charts presented below were prepared using this expression.

The 13 countries considered in this study comprise the G7 nations (United States, Japan, Germany, France, United Kingdom, Italy and Canada), two other major euro area countries (Spain and the Netherlands) and four other countries whose peculiarities make them valuable in a productivity study: Australia, for its high starting level of productivity; Finland, whose economic integration is unusual in Europe; Norway, for its unique industrial structure; and Sweden, for the important role played by structural policies. In addition, we recompiled the euro area by aggregating the values obtained for Germany, France, Italy, Spain, the Netherlands and Finland, which make up approximately 85% of the current euro area's GDP.

The analysis is performed over a long period, using uniform data based on purchasing power parity (ppp) and consistent assumptions wherever possible.[1] This allows us to conduct a cross-country comparison of the levels and rates of growth for the different variables (for more details, see Bergeaud et al., 2014b).

The main findings are the following:

■ Over the period as a whole, GDP per capita increased strongly but unevenly in all countries. Spells of strong growth, as in Europe and Japan after the Second World War, are interrupted by global shocks, such as the oil shock in the 1970s, or country-specific

C1 Average annual GDP per capita growth rate and factor contributions 1890-2012

(as a % and percentage points)
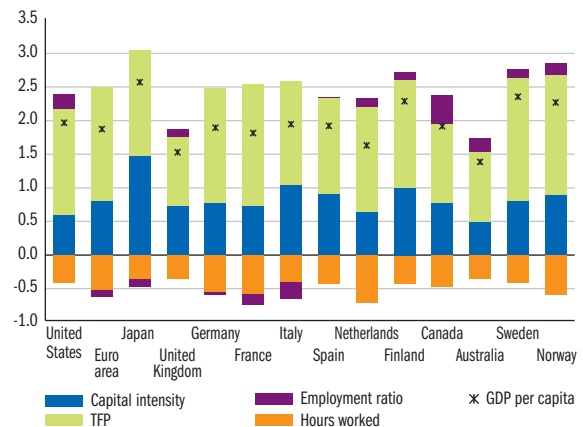
Source: Bergeaud, Cette and Lecat (2014b).

shocks (see Bergeaud et al., 2014a, for a detailed study). Overall, between 1890 and 2012, the average annual GDP per capita growth rate was 1.8% in France, 2.6% in Japan, 2% in the United States and 1.5% in the United Kingdom (see Chart 1).

■ Uneven growth in GDP per capita translates into "waves". These are obtained by applying a standard filter[2] to the annual GDP per capita growth rate. In France, two waves appear between 1890 and 2012 (see Chart 2).

C2 GDP per capita growth waves

(%)

Source: Bergeaud, Cette and Lecat (2014b).

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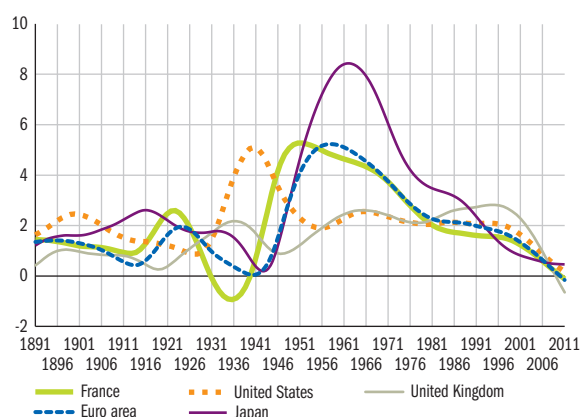
1 *For example, for each of the two products identified in the capital stock (equipment and buildings), we apply the same depreciation rate for all countries.*

2 *We use a Hodrick-Prescott filter with a λ = 500 parameter, which makes it possible to characterise long cycles.*

The first occurs in the 1920s, while a second, more pronounced wave is seen during the three decades of strong expansion after the Second World War, when France posted an average annual GDP per capita growth rate of 4.2% as it engaged in post-war reconstruction efforts and reduced the technological gap with the United States. The euro area's profile is fairly similar to that of France.

■ The US profile is strikingly different, with the "one big wave" described by Gordon (1999) beginning in the 1920s and culminating in the 1940s, corresponding to an innovation shock that paved the way for a surge in productivity (Fields, 2012). Another smaller wave appears at the start of the 1990s, reflecting ICT-driven technological advances. In each case, innovation shocks seem to reach the United States ahead of the euro area. This lead is usually put down to institutional factors (Ferguson and Washer, 2004) such as competition on the goods market, labour market flexibility and the education level of the working-age population.
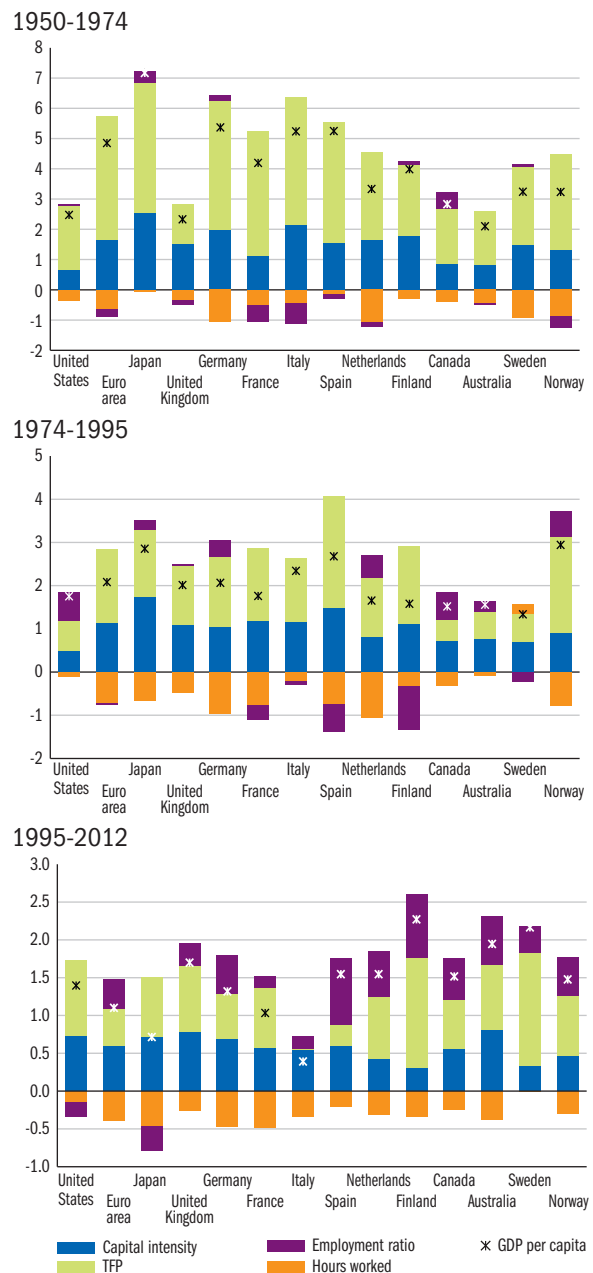
■ When we decompose GDP per capita growth, we see (see Chart 1) that TFP and capital intensity are the two factors that are chiefly responsible for the rise in living standards between 1890 and 2012.[3] Conversely, hours worked make a negative contribution, owing to the secular reduction in working time, although this varied in size across countries. The contribution from the employment ratio depends on the sub-period and the country.

■ At the end of the Second World War, the countries that make up the current euro area and Japan lagged well behind English-speaking countries, particularly the United States, which had already experienced a wave of growth in living standards. A major catch-up then took place between 1950 and 1974 in these countries, with average growth rates of 7.2% in Japan and 4.9% in the euro area. The sharp increase was mainly due to TFP, while the contribution from the employment ratio was positive in Germany and Japan but negative in France and Italy. After 1974 and the first oil shock, European countries and Japan ceased to close the gap on the English-speaking nations, and the growth rate faded to an average of 1.5%-2%. In France, GDP per capita grew by 1.8% a year over the 1974-1995 period, driven by capital intensity and TFP, while hours worked and the employment ratio made a negative contribution. This reflected the effect of labour-capital substitution resulting from the changing relative costs of these two factors, along with policies designed to shrink the labour supply (lower retirement age, early retirement, fifth week of paid holidays, reduction in statutory working time). Growth continued to slow after 1995, except in countries that introduced major structural reforms, such as Australia, Canada, Finland and Sweden.

The slowdown was less pronounced in the United States and the United Kingdom, both of which benefited from ICT effects from 1995 onwards, but intensified in the euro area, which recorded average growth of 1.1% over the period (see Chart 3).

C3 Average annual GDP per capita growth rate and factor contributions
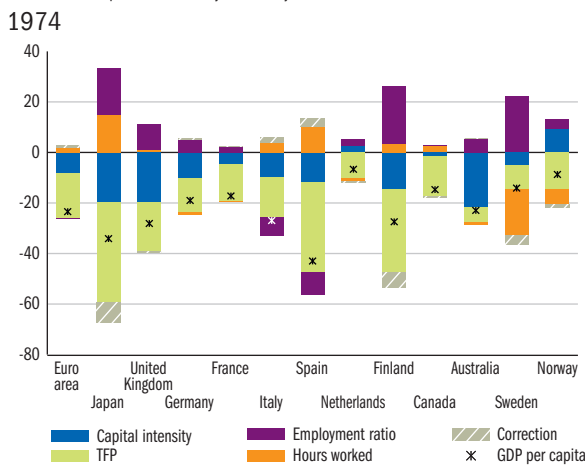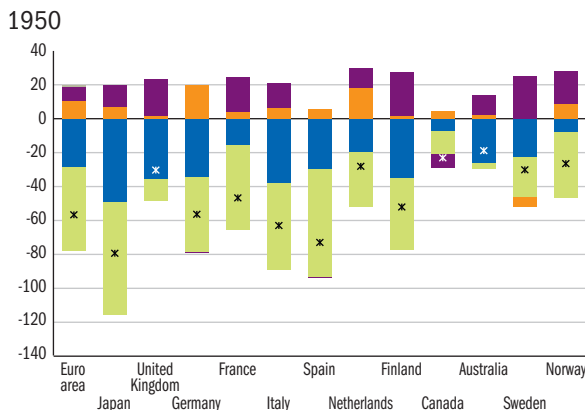
(as a % and percentage points)

1950-1974

1974-1995

1995-2012

Capital intensity — Employment ratio — ✻ GDP per capita
TFP — Hours worked

Source: Bergeaud, Cette and Lecat (2014b).

3 *GDP per capita rose by a factor of 9 in France between 1890 and 2012, 11 in the United States, 6 in the United Kingdom and 23 in Japan.*

C4 Relative levels of GDP per capita compared with the United States

(in percentage points, ppp $2005)

1890

1950

1974

Legend: Capital intensity · TFP · Employment ratio · Hours worked · Correction · × GDP per capita
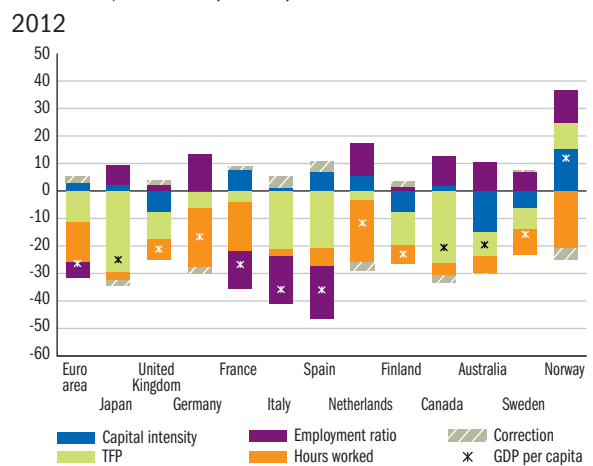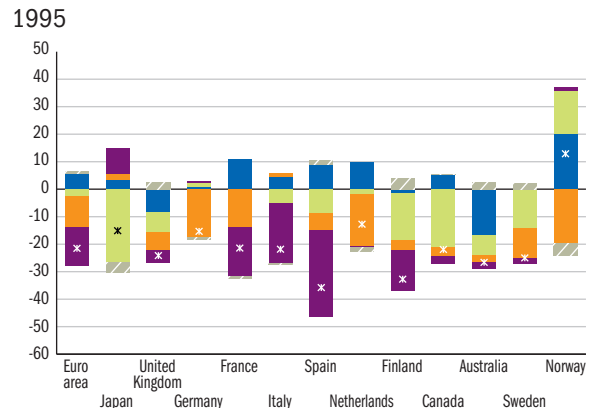
Source: Bergeaud, Cette and Lecat (2014b).

■ In 1890, and again in 1913, three countries were ahead of the United States in terms of living standards: Australia, the United Kingdom and the Netherlands. In other countries, the lag ranged from nine points for Germany to 64 points for Japan, largely owing to negative contributions from capital intensity and TFP, which were partly offset by the employment ratio. The United States caught up with the

C5 Relative levels of GDP per capita compared with the United States

(in percentage points, ppp $2005)

1995

2012

Legend: Capital intensity · TFP · Employment ratio · Hours worked · Correction · × GDP per capita

Source: Bergeaud, Cette and Lecat (2014b).

three leader countries between the wars as shown above, and by 1950, differences relative to US living standards were negative and substantial across the board, with the gap going from 21 points in Australia to 80 points for Japan. In 1974, the United States still had the highest level of GDP per capita but the gaps were drastically narrower, ranging from seven points for the Netherlands to 43 points for Spain.

■ In 1995, the United States was still the leader in terms of living standards (with the exception of Norway)[4] but the factors underlying its advance over other nations had changed. TFP continued to make a negative contribution but capital intensity was now positive. Crucially, though, the contributions from the employment ratio and hours worked were negative everywhere except Japan (see Chart 5).

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4 *Norway is a case apart. It is a country whose economy is heavily based on three sectors with high capital intensity and a high level of TFP, namely petroleum, forestry and fishing. This explains why Norway has had by far the highest level of TFP since 1974 (see Bergeaud et al., 2014b, on this question).*

By 2012, the situation appeared to have reversed, with the employment ratio making a positive contribution.

These observations prompted us to take a closer look at the employment ratio factor by decomposing it into two components: a purely demographic component, corresponding to the share of the population aged 15-64 in total population; and a component characterising the balance on the labour market, namely the employment ratio in the working-age population (15-64).

Chart 6 presents this decomposition in terms of the difference in labour participation growth rates relative to the United States during the 1974-1995 and 1995-2012 periods.

Over the first sub-period (1974-1995), the contribution from labour participation to the relative change in GDP per capita compared with the United States is negative.
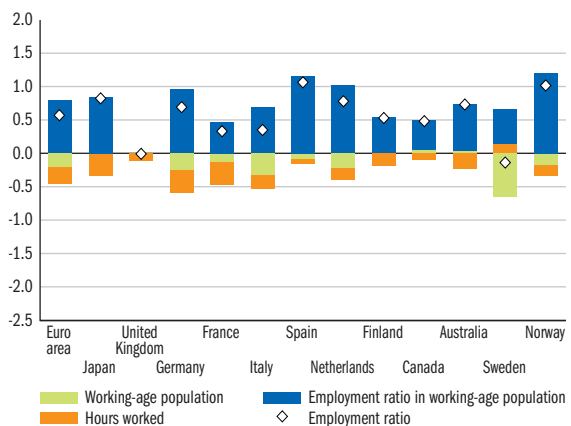
C6 Decomposition of labour participation as a growth rate compared with the United States

(in percentage points per year)
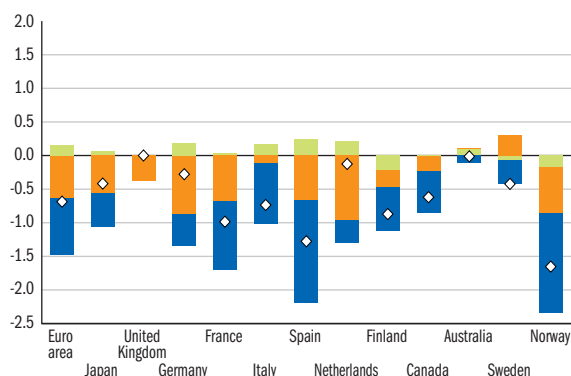
Source: Bergeaud, Cette and Lecat (2014b).

In all countries, the relative contribution from the demographic factor is actually positive[5] but hours worked and the employment ratio of the working-age population are primarily responsible for the negative contribution by the employment ratio in Europe and Japan relative to the United States. These observations suggest that in Europe (except Sweden), the choice was made to steer towards a "leisure society" where free time is placed ahead of gains in GDP per capita. A considerable body of literature has been devoted to the reasons for this choice. Does it stem from collective preferences, as suggested by Blanchard (2004), or the effect of tax disincentives on the labour supply, as Prescott (2004) argues? Whatever the case, it seems certain that policies followed after the 1970s impacted employment ratios. In France for example, such policies sought to shrink the labour supply as baby boomers and more women entered the job market.

Between 1995 and 2012, the reverse trend was seen in all countries except the United Kingdom, and the contribution from the employment ratio became highly positive. This was due to two effects.

First, a decline in the employment ratio among people aged 15-24 and 25-54 in the United States, and second, an increased employment ratio among seniors aged 55-64 in other countries (up from 37.4% to 61.5% in Germany and from 29.3% to 44.5% in France between 1995 and 2012). This increase easily made up for the slight decline in the employment ratio among young people, particularly in Germany and Italy.

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5 *This is chiefly because of a decline in fertility in all countries other than the United States, which explains the smaller proportion of under-15s and hence the larger share for the population aged 15-64.*

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