Supply tensions and the position of the economy in the cycle

Xavier Guillet
Bastien Virely
Clément Rousset

Département de la conjoncture

Adrien Lagouge

Département des études économiques

The business tendency surveys carried out in different sectors of the economy, both in France and in the Eurozone, confirm the growing number of companies to have experienced a slowdown in production since mid-2017. More specifically, entrepreneurs interviewed in the manufacturing industry, construction and services report growing difficulties in meeting demand. While the proportion of business leaders who say that they have been limited by insufficient demand has largely declined, more and more are reporting production difficulties related to supply, especially in Germany and France. In particular, the majority of obstacles described are related to a lack of personnel and difficulties in boosting staff numbers.

These reports of a shortfall in supply combined with excess demand are in sharp contrast to the short-term message conveyed previously in the surveys. Indeed, business leaders tended rather to report the opposite imbalance, i.e. a lack of demand. In France, the increase in supply-side tensions and the high rate of growth recorded in 2017, which contrast with figures from the previous decade, raise questions over the current economic situation. Did the French economy reach the peak of a cycle in 2017? Or, conversely, can it continue to grow at the same sustained pace in view of the pressures on the supply side already observed?

Finding answers to these questions requires first identifying the position of the economy in its cycle, a very uncertain exercise as the indicators do not all show the same tensions, as can be seen most notably from the relatively low level of core inflation. To do this, economists resort to the notion of potential gross domestic product (GDP), an unobservable quantity that corresponds to a sustainable use of production factors. In other words, potential GDP denotes a level of production that would be achieved in the absence of any imbalance in the economy. The difference between the observed level of output and potential GDP thus indicates the position of the economy in the cycle. However, this is a difficult notion to estimate. Several methods are therefore considered: a "structural" method based on a theoretical representation of production capacity, a "semi-structural" method which breaks down GDP into two unobservable components (its trend or potential GDP, and its output cycle or gap), and lastly a direct, purely statistical method based on economic indicators, with no prior modelling.

Here, the analysis is carried out for France, but the cases of Germany, Spain and Italy are also discussed. These estimates are to be considered with caution: the modelling choices may be disputed and certain weaknesses in the calculation methods may require caution in interpreting the results. However, in the case of France, they produce a relatively convergent economic diagnosis. After increasing substantially, first in 2008, and then in 2012-2013, the output gap appears to have gradually closed since 2014, in line with the disappearance of demand tensions and the appearance of supply tensions. In 2018, the French economy seems to have settled around the level of its potential, according to these three methods.

Supply tensions and position of the economy in the cycle

Difficulties with supply have outstripped those of demand since 2017

In the Eurozone, more and more companies report encountering production constraints

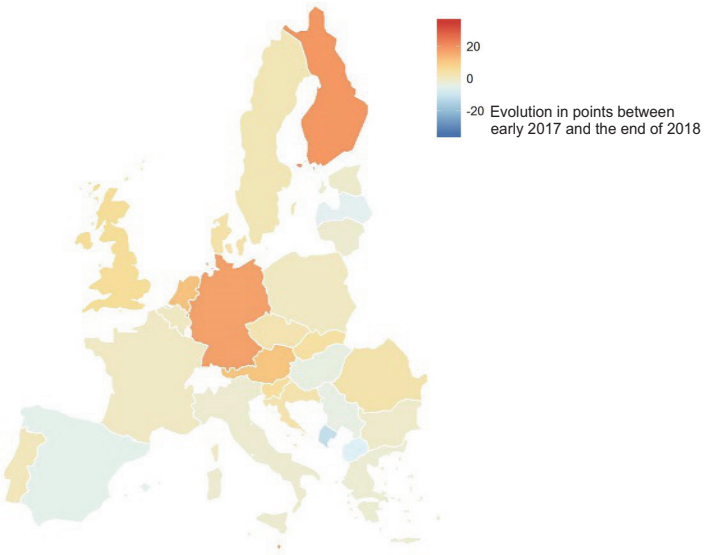
Since mid-2017, more and more companies in the Eurozone have reported encountering production constraints preventing them from making the best use of their production capacity, whether for reasons of insufficient demand, lack of equipment, materials or workforce, financing difficulties, etc. (*Box 1*). In industry in particular, the proportion was 50% in Q4 2018, 8 points higher than in Q2 2017, which was the lowest point since the 2009 crisis and the average for the 2000s. This increase was not limited to industry but could also be seen in market services and construction, although to a lesser extent.

Within the Eurozone the situation varies from one country to another. In Germany and Austria the increase in problems associated with production reported by industrial enterprises has increased since 2017 (see map). In Germany, 48% of business managers in industry reported experiencing production problems in Q4 2018, a level rarely seen, against 31% in Q1 2017. In Austria, production difficulties were close to the highest figure on record, seen at the time of the 2009 crisis, and were due to demand constraints. The Netherlands has also experienced a strong increase in production problems recorded in the industrial sector. In France, as in Portugal and Belgium, the increase is on a smaller scale: the percentage of French companies experiencing production difficulties rose from 67% in Q1 2017 to 71% in Q3 2018, equal to the average of the 1990s. In Spain and Italy, on the contrary, business tendency surveys show that production problems have become less and less significant, and this has been the case since 2014.

This increase is not the result of demand constraints, but supply constraints

Over the last few years, a lack of demand was the reason that companies often gave when reporting obstacles to an increase in production. In fact, over the last few decades, the share of industrial enterprises in the Eurozone reporting that they were hindered by a lack of demand has followed a very similar trend to the more global trend of enterprises experiencing production difficulties (*Graph 1*).

Change in the share of industrial enterprises reporting production difficulties since the beginning of 2017



How to read the map: Since 2017, the share of German industrial enterprises reporting production difficulties has risen by 17 points (from 31% to 48%).

Source: Eurostat (data and map)

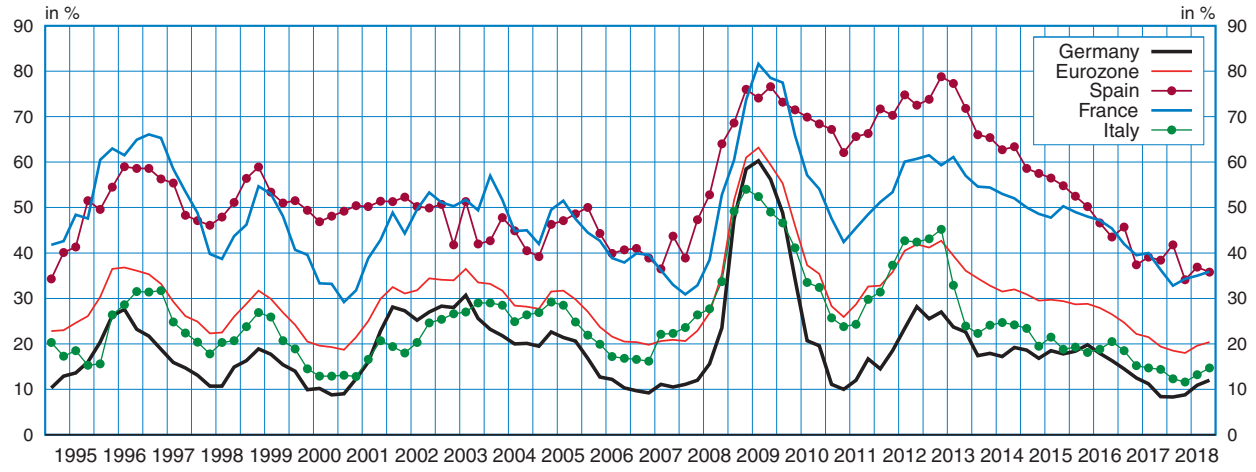
In recent years, however, the increase in production constraints is the result not of difficulties related to demand but rather of difficulties related to supply (*Graph 2*). In the Eurozone, the lack of demand reported in industry has been decreasing constantly since the high point reached during the Eurozone sovereign debt crisis (42% in Q4 2012), which itself followed on from a historic peak during the 2009 crisis (63% in Q3 2009). In Q4 2018, the share of industrial enterprises indicating a lack of demand stabilised at around 20%, one of the lowest points in 30 years. In addition, the same continuous downward trend in lack of demand was seen in the main Eurozone countries.

Thus the recent increase in obstacles to production is due mainly to difficulties linked with supply. More and more companies in the Eurozone say that their ability to increase production is limited for reasons related to supply problems: inadequate facilities or equipment, shortage of workers or financial constraints (*Graph 2*).

In France, difficulties related exclusively to supply have increased substantially and exceed those related exclusively to demand

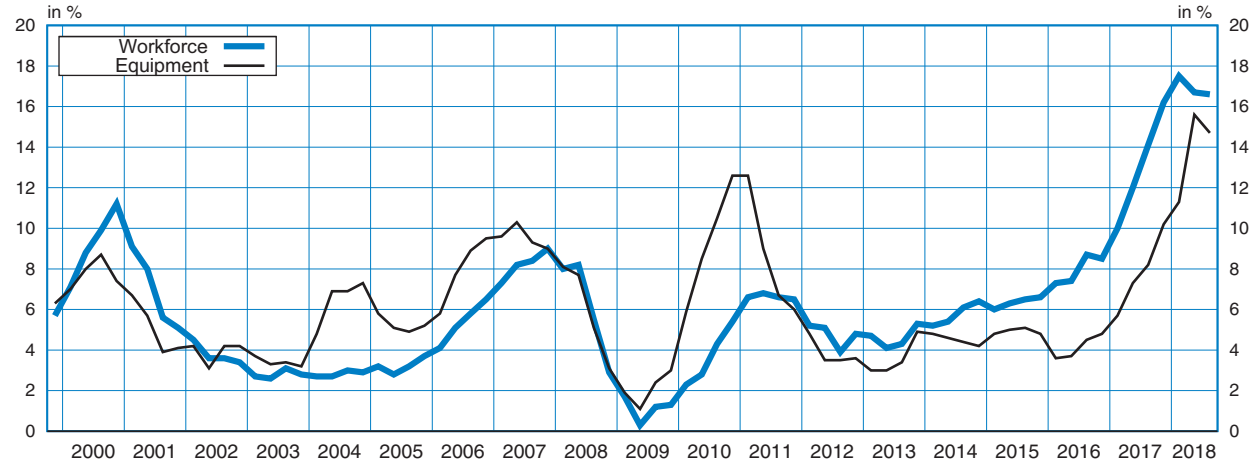
Like their European neighbours, for the last three years companies in France have been reporting more and more supply difficulties and fewer and fewer difficulties related to demand. In the French business tendency surveys, companies reporting that they are limited by demand factors exclusively can be differentiated from those reporting that they are limited exclusively by other factors, classified as supply difficulties (*Box 1*).

1 – Industrial companies reporting a lack of demand



Source: EUROSTAT

2 – Companies in Eurozone industry reporting difficulties because of a lack of workforce or equipment



Source: EUROSTAT

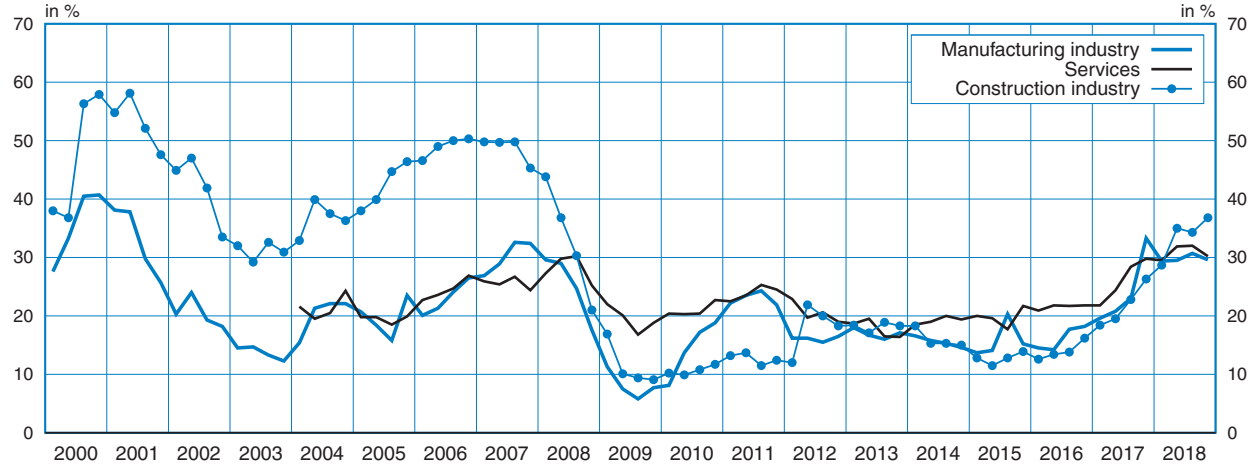
Supply tensions and position of the economy in the cycle

The proportion of companies facing only supply problems thus rose from 2016 after a period of stability from 2012 to 2015 (*Graph 3*). This substantial increase was common to the manufacturing industry, the building industry and the market service sectors interviewed in the business tendency surveys. At the end of 2017, in industry, this proportion reached its highest level since 2001 before stabilising in 2018. In services, it rose once again in 2018, in July reaching a new high point since this question was added to the survey in 2004. Finally, in the building industry, the proportion of companies facing supply problems exclusively has also increased significantly since 2016, although without returning to its high pre-crisis level.

In the manufacturing industry and the building industry, the increase in supply tensions has gone hand in hand with an increase in the production capacity utilisation rate: since 2016 companies in both these sectors have reported using their production capacity more and more intensively.

In contrast to the supply problems, the proportion of companies facing problems related to demand exclusively decreased from 2016 (*Graph 4*). Supply-related difficulties have therefore outstripped difficulties related to demand since 2017, not only in the manufacturing industry and the building industry, but also in services.

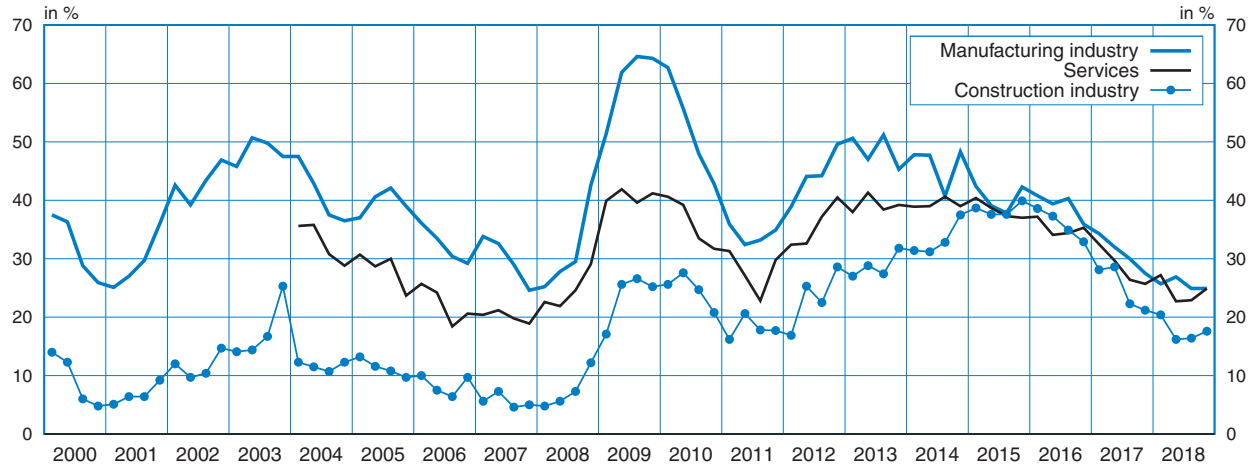
3 – Companies facing difficulties with supply only (France)



Last point: October 2018

Source: INSEE, enquête de conjoncture dans l'industrie, dans les services et dans l'industrie du bâtiment

4 – Companies facing difficulties with demand only (France)



Last point: October 2018

Source: INSEE, enquête de conjoncture dans l'industrie, dans les services et dans l'industrie du bâtiment

On the supply side, Eurozone companies report more difficulties with manpower

In the Eurozone, production problems due to difficulties in finding what is considered to be a competent workforce are particularly noticeable on the supply side. In Germany especially, in Q4 2018, more than a quarter of industrial companies said that their production was limited due to a shortage of staff, a level significantly higher than the historic average (5%). There has been a very strong increase since 2016 with a similar situation in market services and construction.

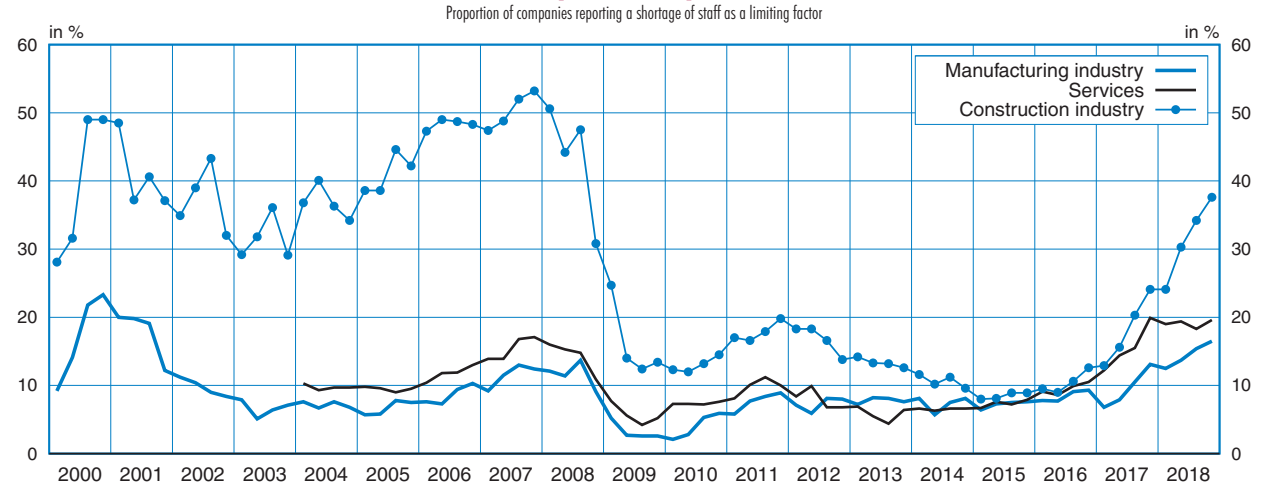
A marked rise has also occurred in France, although it appears to be more muted at this stage: in Q4 2018, 17% of industrial companies said that they were limited by a lack of staff, against 7% at the start of 2017. In Spain there has been a substantial and rapid increase, although it still concerns a smaller proportion of companies. In Italy, this limiting factor seems to be marginal.

Staff shortages have affected all sectors in France

In France, there has recently been a rise in workforce-related difficulties in industry, building construction and services (*Graph 5*). From the beginning of 2016 to the beginning of 2018, more and more companies in these three sectors have reported that they have been prevented from increasing production as much they would like because of staff shortages. This increase is common to all sub-sectors in industry, with the exception of transport equipment. It is also apparent in all sub-sectors of the services surveyed (for example, it is very

5 – Activity limited by workforce

Proportion of companies reporting a shortage of staff as a limiting factor

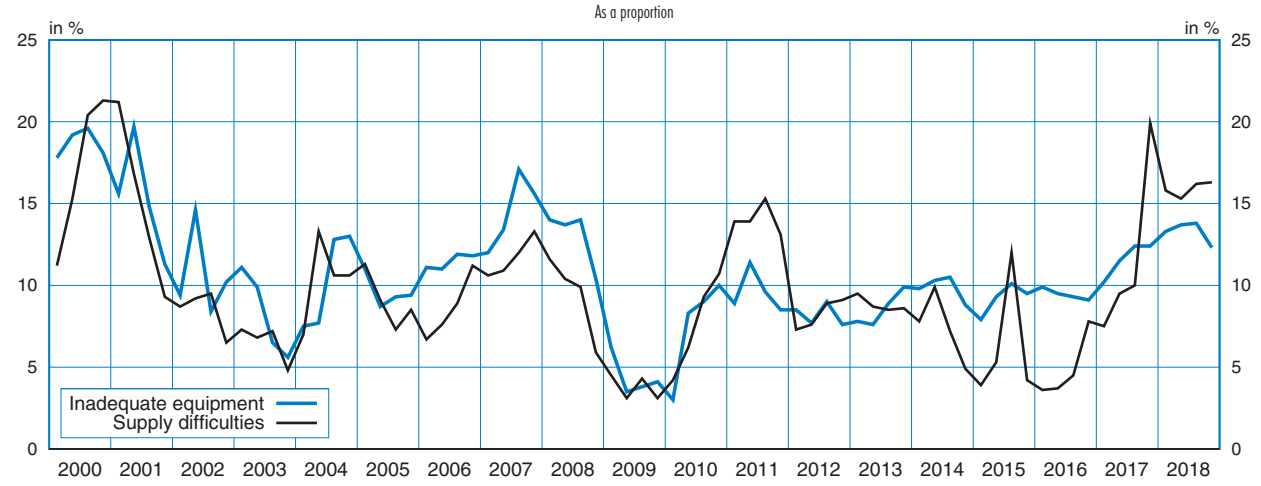


Last point: October 2018

Source: INSEE, enquête de conjoncture dans l'industrie, dans les services et dans l'industrie du bâtiment

6 - Difficulties with sourcing and equipment in the manufacturing industry

As a proportion



Last point: October 2018

Source: INSEE, enquête de conjoncture dans l'industrie, dans les services et dans l'industrie du bâtiment

Box 1: Questions on production capacities in the business tendency surveys

INSEE's business tendency surveys of activity in industry, services, civil engineering and the building industry include questions on production capacities. Depending on the survey, they cover the production capacity utilisation rate, the capacity to produce more and any factors that could prevent an increase in activity. The aim is to assess the potential for an increase in production, and to provide information on the dynamics of employment and investments.

Production capacity utilisation rate

In the surveys on activity in industry and the building industry, a production capacity utilisation rate indicator is calculated. In industry, this rate is defined using the following wording in the questionnaire sent to businesses in the sector: "Give the ratio of your current production to the maximum production attainable if you were to hire additional workers". In the building industry, the utilisation rate is obtained indirectly from the following question on the potential rate of increase in production (TAP in French): "if you were to receive more orders, could you increase production with your current resources? If yes, by how much (as a %)?" The production capacity utilisation rate (CUR - TUC in French) is then defined using the following formula: $TUC = 1/(1+TAP)$.

The production capacity utilisation rate indicators are highly correlated with cycles of activity and give an indication of companies' investment needs.

Factors limiting production

In each survey a specific block of questions asks companies about factors that limit their production. They are asked if at the time of the survey they are prevented from developing production as they would wish due to: insufficient demand, insufficient facilities or equipment, a shortage of workers, financial constraints or any other factors.

Specific factors are reported depending on the sector. In industry and the building industry, companies may report problems linked with sourcing, whereas in the civil engineering survey they are asked if weather conditions affected their ability to carry out work.

The different factors that limit production are differentiated according to whether they relate to demand problems (insufficient demand) or to supply problems (all the other factors). Each company can tick the boxes for several factors that limit production. In order to separate the share of demand problems from supply problems, the proportion of companies reporting demand problems exclusively or one or more supply problems exclusively is calculated.

Production bottlenecks

Production bottlenecks are calculated from the responses provided by companies about factors that limit their production and about their capacity to increase their production in the short term. They represent the proportion of companies reporting that they are unable to increase production and giving a specific limiting factor. For example, workforce bottlenecks correspond to the proportion of companies reporting that they are unable to increase production and also indicating that staff shortages are limiting the growth of their activity.

Hiring difficulties

In the surveys on activity in industry, services, the building industry and small construction companies, businesses are also asked about hiring difficulties in general, without reference to their production capacities. Some companies report production difficulties but do not say that their production is limited by a shortage of workers. The proportion of companies reporting hiring difficulties is therefore higher than the proportion that specifically mention staff shortages as a factor limiting their production. Since January 2017, companies have also been asked about the nature of any obstacles to hiring that they may have encountered (see *Focus*).

European data

French surveys form part of the Harmonised European Programme of Business and Consumer Surveys, conducted by the Directorate-General for Economic and Financial Affairs of the European Commission. This joint framework ensures that the same set of questions is used by all countries and that data are comparable. Despite the similarity of the questions, the way in which they are asked and the methods used for data exploitation, there may still be differences in reporting behaviour between countries which can influence results in the statistical series. For example, the average share of companies reporting difficulties related to demand is very variable, depending on the country. ■

evident in road freight transport). During 2018, workforce difficulties increased further in building construction although they stabilised at a high level in the manufacturing industry and services.

Other supply-side problems such as inadequate equipment or difficulties with sourcing also increased in France as they did in the Eurozone. In particular, equipment difficulties increased substantially in Germany, reaching record levels in Q3 2018, which affected 28% of companies against only 5% (approximately the average historic level) in Q2 2017. There was a similar increase in Austria. In industry in France, companies also reported more problems with sourcing, especially in the manufacture of transport equipment sector (*Graph 6*).

The increase in supply tensions can be related to the position of the economy in its cycle

The analysis so far has shown the increasing difficulties that companies are experiencing in meeting demand using their current production capacities. Therefore the question that must be asked is whether these apparent pressures on supply are likely to slow down economic activity. This question is closely linked to that of identifying the position of the economy in its cycle: does the present situation correspond to a high point in the economic cycle or a catch-up phase that is likely to continue?

To describe the economic cycle, the notion of the output gap is used. This measures the difference between the level of gross domestic product (GDP) observed and a theoretical level, termed potential GDP. This is often defined as the total amount of goods and services (aggregated supply) that an economy is capable of producing in a sustainable way, especially while maintaining stable inflation in the long term. It can also be defined as the level of GDP achievable with a sustainable degree of utilisation of production factors in the medium term, where the quantity is fixed in the short term.

These definitions do not overlap completely, which reflects the difficulty of understanding such a notion unambiguously; however, they do identify potential GDP in terms of a structural economy, i.e. linked intrinsically with the way in which the economy is organised as a whole. In contrast, the output gap can be perceived as a short-term measurement, describing, for a given structure of the economy, movements due to short-term uncertainties or uncertainties linked with one-off events.

The intention here is to analyse the output gap in France and in the other three main Eurozone countries, looking at recent years in particular. The uncertainty linked with the very definition of potential GDP leads to a selection of three alternative models. Three estimation methods are used (*Appendix 1*):

• the first method is a purely statistical approach, commonly known as the "direct method". It extracts common information from the combined change in economic indicators on the size of possible imbalances between supply and demand and is therefore capable of describing the economic cycle correctly. The indicators considered are at the traditional macroeconomic scale (GDP, unemployment rate, inflation, etc.) as well as indicators from the business tendency surveys (capacity utilisation rate in industry, insufficient demand, shortage of staff, etc.) covering different markets (industry, construction, services). In this way, the method is based directly on the tensions analysed previously;

• the second method, called the "semi-structural" method, breaks down the observed GDP directly into two unobservable components, its trend (potential GDP) and its cycle (output gap). Hypotheses based on macroeconomic

mechanisms are imposed relating to the dynamics of these two unobservable components and their relationship with observable economic magnitudes. Thus the output gap is related to the capacity utilisation rate in industry, whereas its variation over time is related to the business climate indicator;

• The third method, called the "structural" method, seeks to clarify potential output as the result of using the economy's production factors (labour, capital) and the combined productivity of these factors[1]. The functioning of the economy is modelled based on an aggregation in a single sector and a two-factor production function (labour and capital) where global productivity links the input amounts at the final level of production.[2]

Within each method, the estimated results must be considered with caution, as they are subject to some uncertainty given the degree of difficulty in providing a statistical estimate to match the selected specifications. Nevertheless, by comparing the results a converging short-term diagnosis can be created, which reinforces the information provided by other alternative indicators (*Box 3*), based on a quantitative and qualitative analysis of the economic cycle.

A positive output gap since 2017 which describes an economy at around its level of potential in 2018

According to these three methods, the economy in 2018 appears to be at around its level of potential, or even higher (*Figure 7*), both in France and in the other countries being considered. However, this convergence is the result of varied trajectories during the years following the 2009 crisis, illustrating distinctly different developments for the different countries. In France, the output gap opened up sharply in 2009 at the time of the Recession then again in 2012 during the sovereign debt crisis in the Eurozone, but appears to have closed gradually since 2014. From 2016 in particular there seems to have been a brisk period of catch-up, with the result that potential GDP was exceeded from 2017. In 2018, the output gap looks set to stand at between 0.5 and 1.1 potential GDP points, depending on the three different estimation methods.

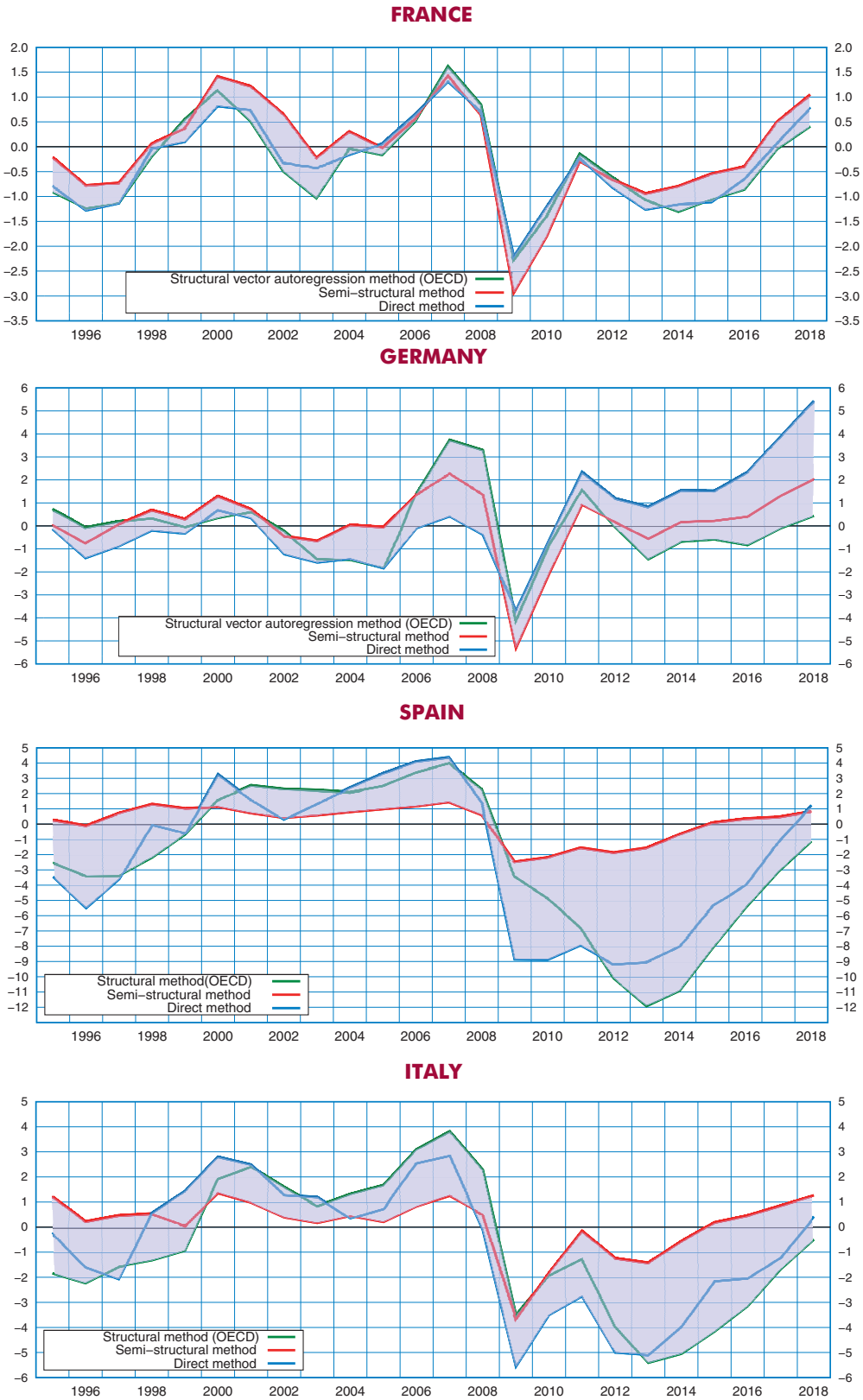
GDP in Germany also seems to be above its potential in 2018, although estimates are less convergent than in the case of France. In 2018, the output gap appears to be between 0.5 points according to the structural method and 5.5 potential GDP points according to the direct method, which is in agreement with the scale of tension reported by German companies, especially on the supply side and difficulties linked with staff shortages. The estimates also diverge over the date that the output gap closed, which was in 2017 according to the structural method, three years later than the date suggested by the semi-structural method, while for the direct method, the output gap appears to have remained positive since immediately after the 2009 crisis. In these circumstances, the diagnosis of an overheating German economy as well as a quantification of its magnitude appears difficult to prove with any certainty, as the scenario suggested by the structural method is one of a moderate catch-up, the opposite of the scenario given by the direct method, based essentially on data from business tendency surveys which reported strong production factors tensions (*see above p.2*). This divergence in the analysis can also be found in the observation that German growth as well as appearing strong tensions reported in the surveys were still not seeing any inflationary spurts despite the recent introduction, in January 2015, of a minimum wage, which has even been revised since then.

The Spanish economy was deviating strongly from its potential GDP at the time of the 2009 recession. This gap persisted in the years that followed, in the

1. A variant of that method, detailed in Lequien and Montant (2014) mobilises only a single production factor (labour), productivity of which is modelised with a labour equation. For further details on labour equation currently used in the forecast exercise by INSEE, refer to Beatriz et al. (2018).
2. For Spain and Italy, a structural method similar to that selected for France and Germany came up against some methodological problems (Appendix 1); it is therefore the estimates produced by the OECD's structural method that are used here.

7 – Output gaps in France, Germany, Spain and Italy

(as a % of potential GDP)



Note: In order not to overload graphs reading, confidence intervals specific to each method have not been indicated. Nevertheless, their value is about 2 points of the potential GDP for France in 2018.

Source: Eurostat, OECD, INSEE, authors'calculation

context of the sovereign debt crisis in the Eurozone, but with a magnitude that differed significantly depending on the estimates (–12 points of potential GDP in 2013 according to the OECD structural method against –1.5 points according to the semi-structural method). Since 2014, the continuous improvement in the business climate reflects the gradual closing of the output gap as estimated by the semi-structural method, and this diagnosis is also verified by the other estimates. Thus, according to the structural method put in place by the OECD, the sharp drop in the unemployment rate, combined with the more restrained decline in the structural unemployment rate led to a reduction in the short-term unemployment rate, thus contributing to the upturn in the output gap. In 2018, the output gap is likely to stand at between –1.1 and 1.3 points of potential GDP, reflecting an economy with a possible growth reserve that has not yet been mobilised or that has already returned to its potential.

Finally, like Spain, during the recession Italy experienced a major shift in relation to its potential GDP, followed by a catch-up phase, halted in 2011 by the sovereign debt crisis. The semi-structural method suggests that the economy has returned to its potential since 2015, linked with the improved business climate, whereas the OECD's structural method rather suggests that growth potential is still available. Italy's room for manoeuvre appears to lie more in a resorption of its short-term unemployment, which was still high in 2018 according to the OECD, than in an increase in its labour force participation rate, which has exceeded its potential level since 2016. In 2018, the output gap of the Italian economy is likely to be between -0.5 and 1.3 points of potential GDP.

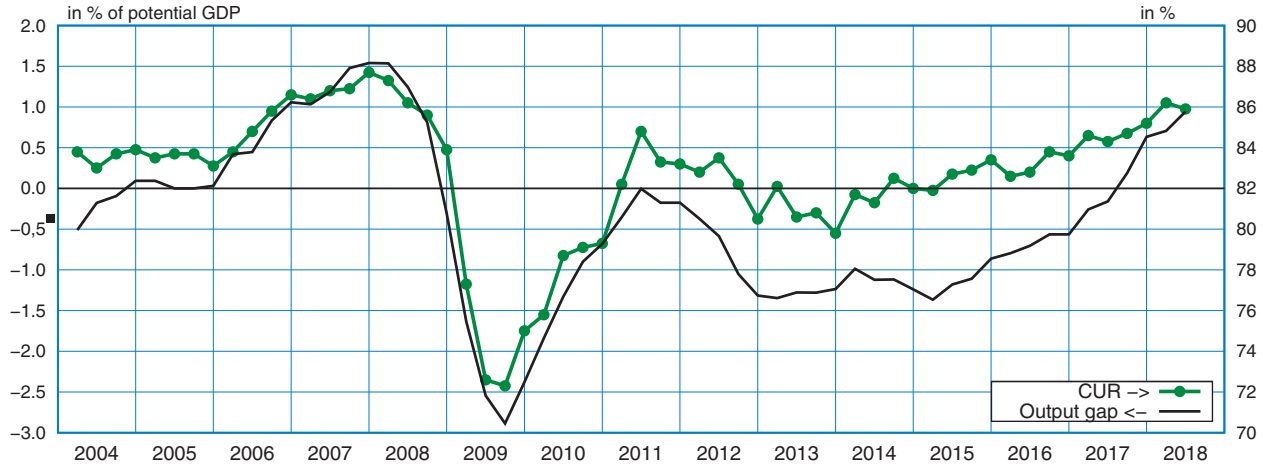
The divergences observed in the profiles concerning the cyclicity of the output gap are based in part on European economic developments which, although shared by the four countries under consideration, do not affect them in the same way. Thus, the cycles in Spain and Italy appear to be more persistent than those in France and Germany (*Box 2*).

In France, the closing of the output gap reflects the disappearance of demand tensions and the appearance of supply tensions

For France, the gradual closing of the output gap from 2014 went hand in hand with the gradual reduction in the imbalance between supply and demand, as reflected in the declarations by business managers in manufacturing, construction and services (gradual reduction in problems of demand and an increase in obstacles linked with supply, especially shortage of manpower).

In addition to the declarations by business leaders about their problems associated with insufficient demand or staff, the production capacity utilisation

8 - Production capacity utilisation rate (France)



Note: the output gap is the one calculated with the direct method

Source: INSEE, Author's calculations

rate (CUR) in manufacturing was also an effective indicator of short-term demands on production capacity. Indeed, using available production capacity reserves is the main lever for responding quickly to a demand shock. Unlike the balances of opinion expressed in the business tendency surveys, which reflect qualitative judgements, the CUR provides quantitative information (*Box 1*), hence its use in both the direct method and in the other methods (*Appendix 1*).

In January 2018, the CUR reached its highest level in ten years, at 85.7% or 2.5 points above its long-term average. After falling sharply from 2011, the steady rise in the CUR from the end of 2013 onwards and the overtaking of its long-term average (83.2%) from July 2016 suggest a steady increase in demand for products (*Figure 8*). However, since the beginning of 2018, the CUR has declined slightly, in a similar way to the decline in demand constraints measured in the business tendency surveys and in the business climate since the beginning of the year.

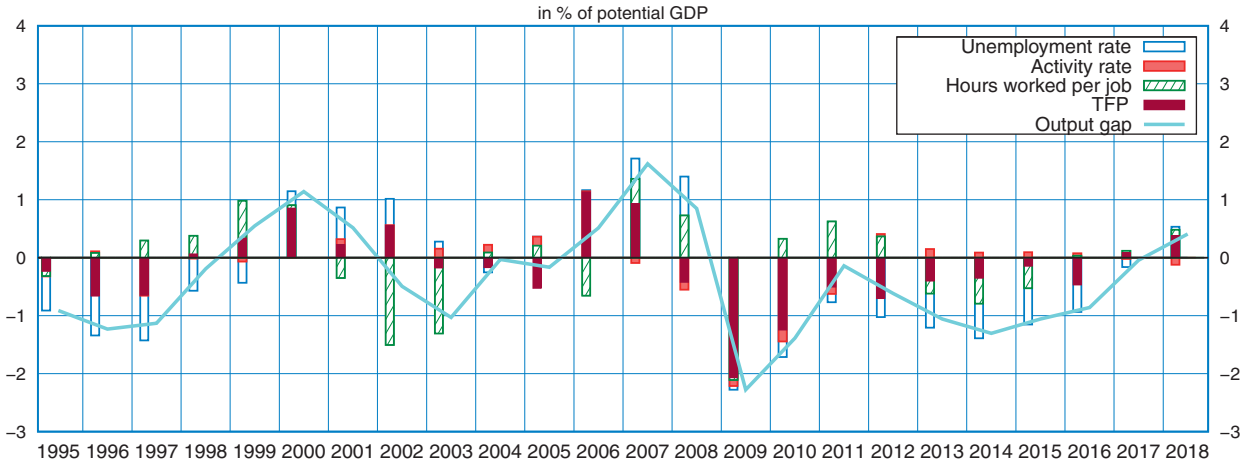
At all events, the recent increase in CUR and the fact that pressures on supply exceed those on demand are in line with a closing of the output gap, or may even suggest that the French economy has exceeded its potential. Therefore, signs of overheating of the French economy can possibly appear. This diagnosis needs to be qualified, however, as the output gap estimated by the direct method mainly reflects the influence of the short-term indicators that are used, with much less attention paid to macroeconomic indicators such as core inflation, the unemployment rate or the investment rate of households and companies. In France these indicators show an inertia which gives them a lesser degree of explanatory power over the variance as a whole.

Growth determinants in France are close to their structural level, or even slightly higher

The purely statistical method described above (direct method) shows in the indicators of tension that the economic situation is near a closing of the output gap; however, it is not able to describe the economic situation in more detail. In particular, determinants of growth are not analysed.

Estimating potential GDP using the structural method provides a breakdown of the output gap according to the contribution to the economy of employed labour (difference between effective level and potential level) and total factor productivity (TFP, difference between effective level and potential level). The gap between the contribution of labour and its potential is also defined according to

9 - Contributions (to the output gap for France) estimated using the structural method



Note: the output gap is the one calculated with the structural method

Source: INSEE, Author's calculations

determinants for quantity of employed work: labour force participation rate, unemployment rate and number of hours worked per job.

In the years following the crisis, the majority of shifts in the output gap were the result of TFP diverging from its potential level (*Figure 9*). Potential TFP certainly declined slightly following the shock of the crisis, but to a much lesser extent than effective TFP. Since 2013, TFP has become more and more dynamic in moving closer to its potential level, and has initiated the gradual closing of the output gap. This is still only a partial explanation for the recent buoyancy of the output gap, however, given that TFP is calculated as a residual and is therefore in part inherently inexplicable. However, the predominant influence of TFP on the closing of the output gap puts into perspective the influence of other determinants like the unemployment rate or the labour force participation rate which contributed much less over the same period.

The estimate for the output gap for the most recent years must be considered with caution. Although calculating the output gap for 2017 and 2018 using the structural method appears plausible in the light of the results from the other two estimation methods, determining potential levels and hence the contributions of the different determinants of growth are particularly uncertain for the last points presented. In fact, the statistical smoothing technique used to determine the potential level of the series being studied (Kalman filter) requires the exploitation of information from all monitoring centres for the scales considered. For dates in the middle of the sample, information on years before and after is modelled. However, for years close to 2018, information about future observations is limited (and is even non-existent in the case of 2018). The result is a more uncertain estimate of the output gap, with a greater margin of error than for the years in the "middle" of the period[3]. This methodological difficulty explains to a large extent why "real-time"[4] estimates of the output gap using the structural method often need to be revised and why they sometimes result in incorrect interpretations of the position of the economy in its cycle.

There has been a slight rebound since 2017 in line with increasing production tensions

As an indicator of imbalances between supply and demand, the output gap is theoretically in line with the dynamics of inflation: for example, a positive output gap is assumed to reflect demand in excess of the immediate productive capacities of the economy, leading companies to increase the use of their capacities and raise their prices in order to take advantage of the rise in demand. In this context, the progressive closing of the output gap which appears to emerge from the previous estimates, even the slight overtaking in France, provoks questionning in terms of the weak inflationnary signals registred at the moment in the countries examined[5].

One possible cause of the hiatus observed between inflation and output gap could be sought in the ability of this indicator to fully reflect changes in the different components of inflation. In Gordon's "triangle" model (1997), total inflation does indeed depend on anticipated inflation, partly related to the inertia of past inflation, demand-driven inflation, essentially domestic, and supply-driven inflation, especially by production costs that are subject to shifts in

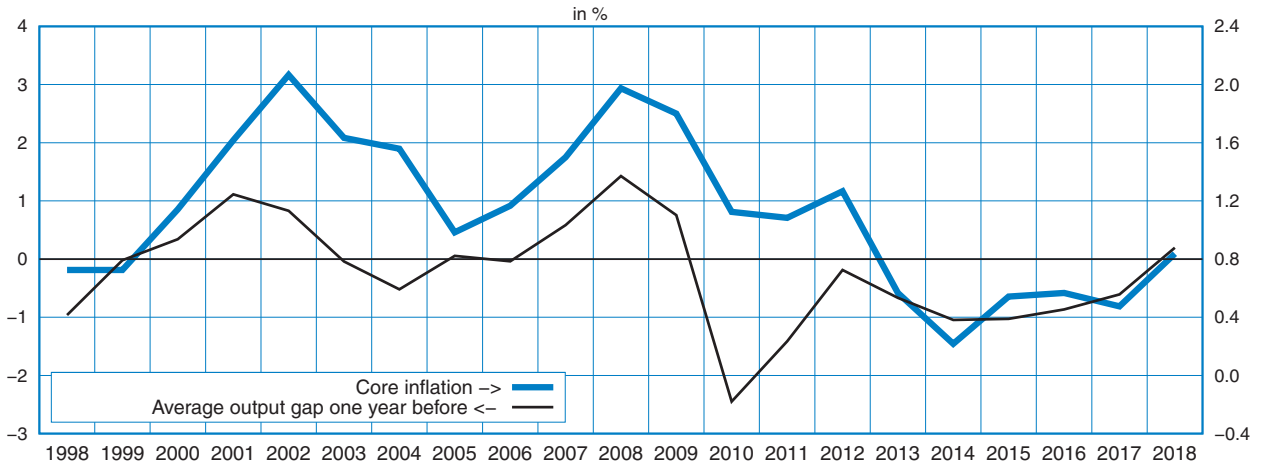
3. This difficulty could potentially be removed by using provisional values to extend the series artificially. On this subject, see the developments proposed by De Waziers 2018.
4. A "real-time" estimate consists in proposing an indicator value on the basis of information present in the statistical series that is effectively available on a given date. This contrasts with an ex post estimate which can take into account, for example, revisions to series or values in these series on dates that are later than the date for which the estimate is proposed.

commodity prices. In this context, the output gap should be considered in relation to demand-driven inflation.

However, several recent empirical studies[5] challenge the statistical quality of using the output gap as the only indicator to describe this cyclical component of inflation correctly. As can be seen in the case of France (*Figure 10*), changes in the output gap seemed to describe variations in inflation and hence the acceleration in prices correctly, and slightly in advance, up until the 2008–2009 crisis; however, it can be seen that this link has obviously become blurred since 2016 and 2017 because the core inflation has slightly decreased while the output gap went on closing. The link, however, is likely to be restored over the more recent period[6].

Thus the apparent paradox between closing the output gap and a weak total inflation and even weaker core inflation between 2014 and 2017 seems to be attributable less to a problem of measuring inflation or estimating the output gap than to a change, now fairly well documented in Europe and in most developed countries, in the inflation regime. This change in regime appears to have weakened the link between inflation and the degree of tension measured by the output gap. Several reasons have been put forward to account for this phenomenon. On the one hand, the greater predictability in carrying out monetary policy could have increased its credibility so that expectations were more firmly anchored around the Central Bank's long-term inflation target. Globalisation could also have had a strong impact on the way in which domestic prices are determined[7]. The significant increase in the share of world trade makes national economies more dependent on the international economic situation and the shift to a floating exchange rate has left prices more sensitive to exchange rate movements. This explanation is rather limited in the case of Eurozone countries, however, due to the monetary integration that resulted in the adoption of the single currency. The opening up of trade has also resulted in increased competition between national companies and their foreign competitors and their market power has therefore deteriorated, leading to changes in their price fixing processes. Finally, developments specific to the

10 - Variations in core inflation and output gap in France



Note: The average output gap is the average of the output gaps measured with the three methods. It is advanced by one year: the point of 2000 corresponds thus to the output gap for year 1999.

5. Stock and Watson (2018) provide a characteristic example of the quantitative exploration of this research topic.
6. Refer to the analysis by Faquet (2018: to be published) over the link between inflation and the position in the cycle in France.
7. For example, Forbes (2018) has looked specifically at the links between inflation and globalisation in the developed countries

labour markets of the advanced economies have affected the dynamics of average wages and ultimately prices. In particular, the effects of the composition of the workforce appear to have played a significant role, whether in the return to the labour market of the low-qualified and previously discouraged unemployed or the strong increase in job offers for the over-55s (see Verdugo, 2016; Mojon & Ragot, 2018).

Conclusion

The tensions that have emerged in the business tendency surveys have led to questions about the position of the European economies in their economic cycle. Concerning France, the methods used to estimate potential GDP appear to converge; they follow the major economic episodes and provide a fairly similar diagnosis: after a gradual closing of the output gap since 2014 accompanied by a reduction in the imbalance between supply and demand, as reported by business leaders, the growth observed appears to have accelerated compared with its potential growth in 2017, resulting in the economy making a vigorous return to its balanced level of production. In 2018, estimates also agree in situating the economy slightly beyond its potential. The relative easing of constraints as indicated by the business tendency surveys should lead to a reduction in the output gap and hence to a stabilising of the economy around the level of its potential.

However, these results must be considered with caution. In addition to the known weaknesses of the smoothing techniques used in the structural and semi-structural methods, links have weakened between the usual economic variables when studying economic cycles, such as the unemployment and core inflation rates and the position of the economy in its cycle, and the basis of the models is now called into question. The divergence of the estimates provided by the different methods for Germany, Italy and Spain also suggest that caution is required.

Nevertheless, outside of France, for each country studied, a common scenario emerges with a gradual closing of the output gap. Spain and Italy appear to be at around their potential level, with Germany above its potential, but the methods diverge widely when it comes to quantifying this divergence: the direct method highlights the tensions that business leaders report, while the structural method suggests a much more mitigated conclusion. ■

Box 2: Economic cycles and spectral analysis

To compare the cyclical components of different economies, it may be wise to consider the series using "spectral" or "frequency" analysis.

The spectral representation of a time series $y(t)$ has its theoretical basis in the notion of decomposing a Fourier series which guarantees that any analytical function can be approximated by a linear combination of trigonometrical functions whose frequencies (called "harmonics") are multiples of a so-called "fundamental" frequency. Once this decomposition has been carried out, it is then possible to construct a quantity called the spectral density (denoted $f(\omega)$) which measures the relative importance of each of the different frequency components contributing to the changes over time of the series under consideration. Using the Wiener-Khinchin theorem, a close link can be established between the temporal autocorrelation function of the series and its spectral density since these two functions are reciprocal Fourier transforms. Notably, this implies that the total area under the spectral density equals the observed variance of the series:

$$Var(y) = \int_{\omega} f(\omega)\ d\omega$$

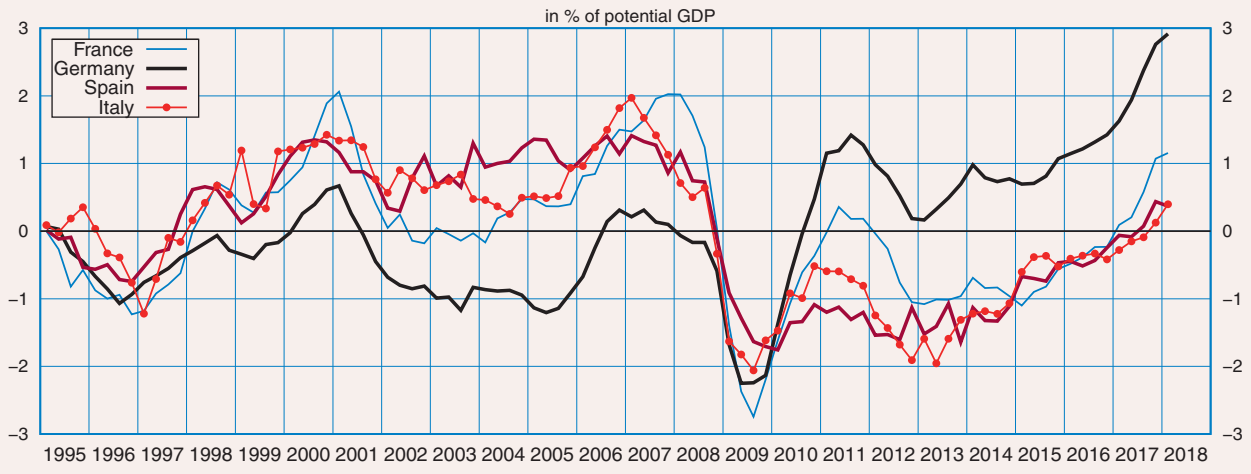
By decomposing the spectrum of a series into frequency bands of clearly defined size and calculating the area under the spectral density on the corresponding frequency intervals, it is possible to specify what types of frequency components participate most in the variance of the series.

For each country considered in this report, the quarterly series[7] of output gap estimated by the direct method are cut up into frequency bands corresponding to economic cycles of between 6 and 32 quarters[8].

Analysis in the temporal domain shows a relative synchronicity in variations in the series of differences in activity between the four countries (*Graph 11*). However, their profiles diverge occasionally, especially during the period 2001–2007 when output gaps in Germany and France appear to have had a downward trend, whereas in Spain and Italy they remained around the average level. Spectral analysis reinforces this observation: it shows that in Germany and France, the economic cycle appears to be governed more by short period components than in Spain and Italy (*Graph 12*).

7. These series have been previously centred and reduced so as to have identical variances, thus guaranteeing their comparability during spectral analysis.
8. In academic studies looking at the dating and characteristics of these cycles, the duration of "short" economic cycles (as opposed to multi–decade cycles like "Kuznets" cycles or "Kondratieff" cycles, for example) is commonly considered to be between 6 and 32 quarters.

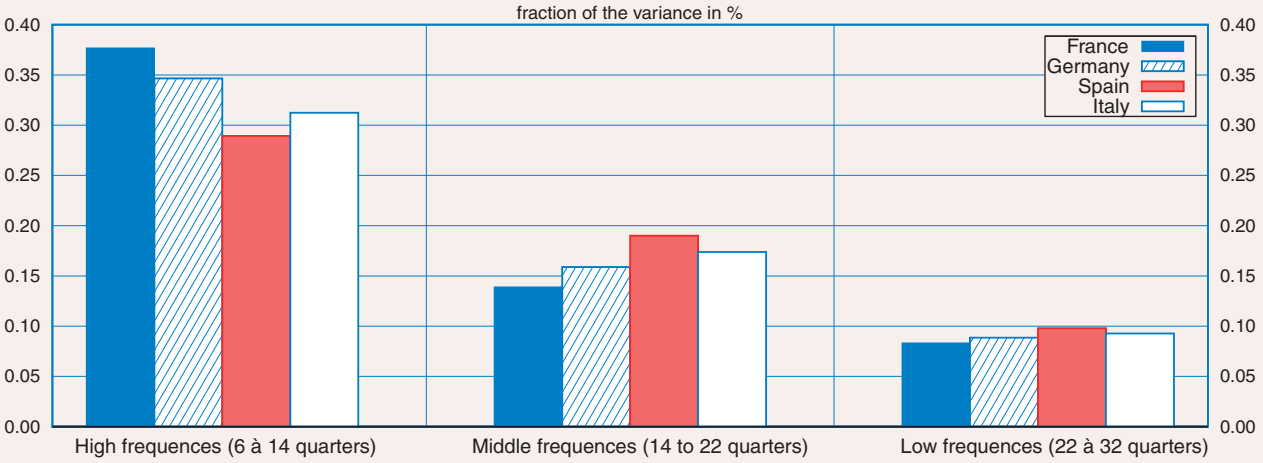
11 – Output gaps estimated using the direct method



Source: Author's calculations

Supply tensions and position of the economy in the cycle

12 – Frequency decomposition of output gap variation



How to read it: in the French case, almost 40% of the variance of the output gap series is explained by 6 to 14 quarter-cyclical components.

Source: Author's calculations

Box 3: The short-term economic indicators used at INSEE

In order to establish a short-term diagnosis, INSEE has put in place two types of monthly composite indicators which summarise the information in the balances of opinion provided by the business tendency surveys. The Monthly indicator of the French business climate (Clavel, Minodier, 2009) measures the state of the economic outlook; the economic turning point indicator (Bardaji, et al., 2008) is qualitative and is used to pinpoint in real time when economic trends are reversed.

The notion of a cycle of growth is used here, based on trend deviations. Recessions are rare in France and so in order to study economic outlook it is more interesting to situate growth in relation to an average determined by the trend.Traditionally, a reference date for GDP is obtained by applying a Christiano–Fitzgerald filter which is able to decompose the series into a trend and a cycle. To be more exact, the period of cycles covers between one and a half years and ten years. A phase is required to last at least four quarters. The peaks and troughs in the series of the cycle obtained define points of turnaround. The light and dark bands on the graph below correspond to phases of slowdown and acceleration respectively in relation to the medium-term trend. (*Figure 13*)

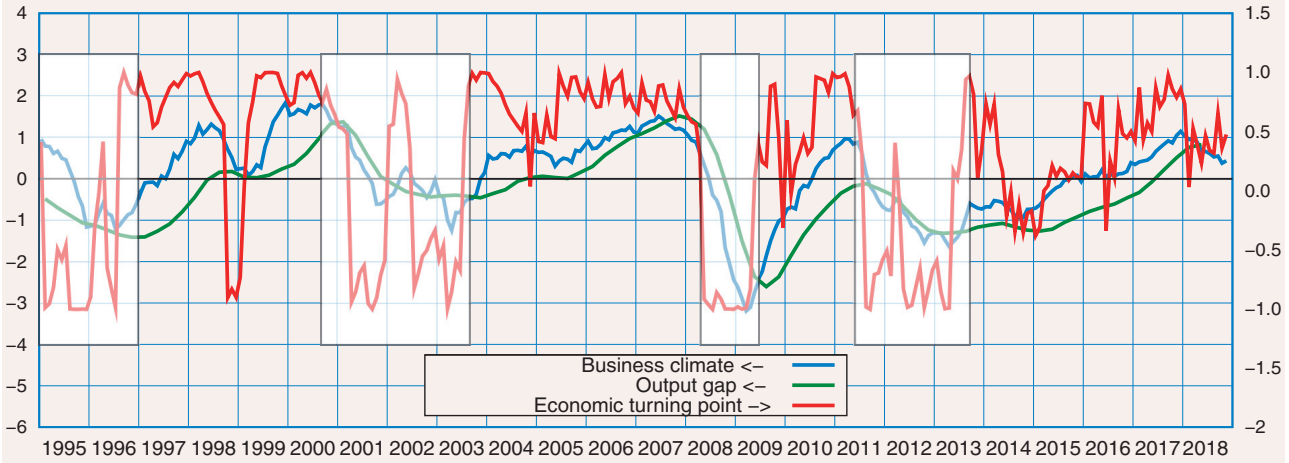
The business climate indicators, the economic turning point indicator and the output gap indicator (direct method) provide a coherent picture of the economic outlook. The main economic events are shown. The 2008 crisis is highlighted by the economic turning point indicator and the composite business climate indicator. In fact the latter begins to change direction in mid-2007 and moves below its long-term average at the start of 2008. The economic turning point indicator clearly signals a sustained slowdown phase. Lastly, the output gap indicator turns down a little late compared with the business climate indicator and dips sharply.

The crisis recovery period is indicated by an improvement in business climate and output gap indicators. The economic turning point indicator does not signal an acceleration phase until June 2009.

The next period, between Q2 2011 and Q3 2013 corresponds to the Eurozone sovereign debt crisis. The French economy experienced stagnation for a few quarters. The economic turning point indicator signalled a deterioration in the economic outlook from August 2011. After this, only a slight hesitation in March 2012 disrupts the diagnosis, while the hesitation is shared by the business climate indicator, which increases slightly at this time. This indicator drops almost continuously until October 2012 before fluctuating around a low point. The output gap indicator also dips during this period before stabilising between Q4 2012 and Q2 2013.

From the end of 2013, the cycle obtained by filtering appears rather to suggest a phase of growth acceleration above the trend. However, the message from the economic outlook indicators calls for more nuance. The business climate indicator experienced a few jumps, as in 2014, for example, where it drops even though it is already below its average. The economic turning point indicator also shows a hesitant economic outlook at this period while the output gap dips slightly. From the end of 2014, the output gap is likely to close gradually, following a continuous improvement in the business climate, although this indicator does not rise above its average for any length of time until 2016. In a similar way, the economic turning point indicator signals an uncertain economic outlook in 2015 and then a more favourable one from 2016, a year that was in fact marked by some uncertain episodes, and the diagnosis delivered becomes clearer in the course of 2017. Since the beginning of 2018, the business leaders questioned for the business tendency surveys have been less and less optimistic. The business climate has fallen back gradually, while remaining above its average. The turning point indicator thus points clearly a hesitant rather uncertain situation. For its part, the output gap indicator slows down in Q1 and Q2 2018 after clearly accelerating in 2017.

13 - Comparison of short-term economic indicators produced at INSEE



How to read it: the dark (respectively clear) areas show periods in which the GDP growth is lower (resp. greater) than the mid-term trend.

Appendix 1 - Methodology

In the absence of a single definition of the concepts of potential gross domestic product (GDP) and output gap, there are many alternative methods to estimate these unobservable magnitudes from statistical data. We usually differentiate "statistical" methods which extract raw data from series without attempting to establish a theoretical economic link between them, from "structural" methods based on prior theoretical reasoning and applied to data using econometric tools. The former have the advantage of not being based on theoretical suppositions, whereas the latter are able to decompose potential GDP according to its determinants, which can be used for medium-term forecasting or projections.

However, the boundary between the two categories of methods is porous as there are also so-called "semi-structural" methods incorporating aspects from each of the two families and which can thus be described as mixed. The decomposition of production into potential GDP (trend component) and output gap (cyclical component) is a technique that uses notions of statistical filtering and smoothing. To estimate the output gap, we first eliminated those components that evolve very slowly, attributed to a movement of potential GDP, and components that evolve very quickly, considered as simple statistical noise, while highlighting the components located in a band generally perceived to correspond to the duration of the economic cycle. However, as it was our intention to propose common models or models estimated across the same time period for the four major European countries, this sometimes limited the specifications selected, which partly detracted from the statistical quality of the results produced.

Direct method

The direct method is based entirely on a principal component analysis (PCA) conducted on a set of variables fixed over time (*Table 1*). The first principal axis is a global indicator of imbalance, which is then made homogeneous to the output gap by a process of normalisation in mean and in variance using an estimated output gap. More precisely, on the one hand is the output gap calculated using the structural method presented in this report for France and Germany, and on the other hand is the output gap calculated by the OECD for Spain and Italy.
Several types of variables were used to carry out PCA. Concerning the business tendency surveys, balances of opinion relating to obstacles to increasing activity due to insufficient demand in the construction, services and industry sectors directly reflect the state of demand that companies experienced. They therefore provide clear information on demand shocks affecting the economy and hindering production. The proportion of companies reporting obstacles linked with low demand decreased at the high point of the cycle, and conversely they increased at the low point.

PCA also incorporates the production capacity utilisation rate in industry. This variable picks up the short-term adjustment made in production capacity to an increase in activity. To cope with an increase in demand, companies can decide to hire staff or to invest, but the determinants of these decisions are complex and tend to be more medium- to long-term in nature. In the short term, the main driving force is the mobilisation of available reserves in their production capacity, provided that this is not saturated.

Table 1 – Indicators selected for the direct method

Sector	Indicator	Source Eurostat	Unit
Industry	Labour shortage	Business tendancy surveys in undustry	Balance of opinions in points
	Insufficient demand		
	Capacity utilisation rate		
Services	Labour shortage	Business tendancy surveys in services	Balance of opinions in points
	Insufficient demand		
Construction	Labour shortage	Business tendancy surveys	Balance of opinions in points
	Insufficient demand		
Whole of the economy	Unemployment rate	Workforce surveys	%
	Nominal unit labour cost per hour worked	Labour cost surveys	Year-on-year variation in %
	Core inflation	Consumer price index	Year-on-year variation in %
	Gross investment rate of non-financial corporations as a % for added value	National accounts	Year-on-year variation in %
	Gross investment of households as a % of gross disposable income	National accounts	Year-on-year variation in %

Other indicators from the business tendency surveys, this time on the supply side, are also considered: difficulties in increasing production due to staff shortages are partly a signal to suggest the appearance of inflationary thrusts, if a tense situation in the labour market is able to lead to wage increases. Finally, a few aggregated indicators complete the analysis: core inflation rate (year-on-year) and unit wage costs (year-on-year), also the unemployment rate, so as to approximate variations in the domestic component of inflation according to the position of the economy in the cycle. Finally, the investment rates of households (% of their real income) and non-financial corporations (% of value added) indicate the state of demand and are therefore good indicators of its movements over time.

The coefficients of each variable introduced into the calculation of the first principal axis are presented for each country.

Table 2 – Indicator coefficients in calculating the first principal axis in PCA

	France	Allemagne	Italie	Espagne
Industry-demand difficulties	–0.35	–0.28	–0.26	–0.39
Industry-workforce difficulties	0.22	0.37	0.38	0.32
Industry-CUR	0.35	0.25	0.32	0.39
Services–demand difficulties	–0.36	–0.38	–0.31	NA
Services–workforce difficulties	0.33	0.34	0.36	NA
Construction–demand difficulties	–0.33	–0.37	–0.38	–0.39
Construction–workforce difficulties	0.33	0.36	0.35	0.06
Unemployment rate	–0.26	–0.33	–0.24	–0.40
Inflation (ga)	0.15	0.04	0.10	0.33
Unit labour costs (ga)	–0.05	–0.03	0.05	0.33
NFC investment rate (ga)	0.3	0.19	0.18	0.03
Household investment (ga)	0.27	0.21	0.3	0.25
Proportion of explained variance with the first principal component	0.56	0.48	0.48	0.53

Semi–structural method

This method is based on a decomposition of GDP into two unobservable components, a trend component equivalent to potential GDP and a cyclical component equivalent to the output gap. To perform this breakdown, the unobservable component values are inferred for each date, on the one hand from observable variables, in this case two indicators from the business tendency surveys (production capacity utilisation rate in industry and business climate), and on the other hand, the writing of the underlying dynamic of the unobservable variables which constrains their variations statistically. The different relationships imposed between variables give this method its "structural" aspect as they define a framework which, although flexible, limits possible changes in the different estimated unobservable magnitudes.

First. relations between these different variables are written in the form of the following linear space–state system:

$$\begin{cases} y_t = y_t^p + OG_t \\ TUC_t = TUC_{ref} + \alpha * 100 * OG_t + \varepsilon_{1t} \\ Climat_t = 100 + \beta * 100 * (OG_t - OG_{t-1}) + \varepsilon_{2t} \end{cases}$$

$$\begin{cases} y_t^p = y_{t-1}^p + \eta_t \\ \eta_t = \gamma * \eta_{t-1} + \varepsilon_{\eta t} \\ OG_t = \delta * OG_{t-1} + \varepsilon_{OGt} \end{cases}$$

– where y_t^p denotes the trend component of GDP;
– OG_t , output gap;
– TUC_t , capacity utilisation rate and TUC_ref an estimated level of reference;
– $Climat_t$, business climate with a reference value fixed at 100;
– η_t , potential growth (or rate of growth of the trend component of GDP).

This space-state system is then estimated using the Kalman smoothing technique. Here the difficulty in modelling is mainly associated with the choice of dynamic imposed on the unobservable components y_t^p and OG_t . In particular, the trend component y_t^p is sometimes likened to a random step, which seems inappropriate here as we want a trend component that has a certain persistence. We want it to describe the possibly complex effects that may be generated on the productivity trajectory by, for example, innovation shocks, adjustment costs on

factors of production, effects of dissemination or learning. The stochastic trend was finally modelled as an integrated process of order 1 and the output gap as an autoregressive process of order 1.

Results of the coefficient estimates are given here:

	TUCref	α	β	γ	δ
France	83.6 (0.99)	2.38 (0.40)	7.62 (1.46)	0.91 (0.06)	0.37 (0.21)
Germany	83.7 (1.98)	2.06 (0.37)	3.60 (1.22)	0.80 (0.09)	0.59 (0.28)
Spain	77.4 (3.46)	2.80 (1.09)	8.44 (3.30)	0.82 (0.14)	0.79 (0.33)

How to read this table: the standard deviations of the estimated coefficients are shown in brackets. The models are estimated from quarterly data covering the period 1995–2018

The advantage of this method is also that it is able to provide a statistical confidence interval directly around the estimated value of the output gap. Thus for 2018, the output gap measured using this method and shown in the body of the report was 1.0% of potential GDP with a symmetrical confidence interval between 0.4% and 1.6% of potential GDP.

Structural method

The structural method described here is inspired by the one used by Lequien and Montaut (2014) and developed by D'Auria et al. (2010). It is based on a representation of production capacity in the form of a Cobb–Douglas production function, combining two factors of production – amount of work measured in number of hours worked and capital stock – and total factor productivity (TFP) broadly including all potential sources of growth not taken into account when simply combining labour and capital. For example, this TFP includes technical or organisational progress, and any change at the level of worker knowledge which improves their hourly productivity. GDP is written:

$$Y = PGF \times \left(POP_{15-64} \times T_x Act \times (1-U) \times NbH \right)^{\alpha} \times K^{1-\alpha}$$

where

Y is GDP;
PGF total factor productivity (TFP);
POP_{15-64} population of working age (15 to 64 years old);
TxAct labour force participation rate;
U unemployment rate;
NbH number of hours worked per job;
K capital stock.

Based on this theoretical representation of production capacity, potential GDP is derived from a combination of potential amounts of production factors (labour and capital) and potential TFP. Each potential magnitude is estimated from observed magnitudes, using methods based on theoretical relations and/or statistical filters (Kalman smoothing). Using these filters, the cyclical component and the trend component can be extracted from an observed magnitude.

For capital stock, it is usual to consider that potential stock is identical to effective stock. It is indeed difficult to evaluate the cyclical component of changes in capital stock as its determinants correspond to a basic shift in the economy. Similarly, the potential population of working age is assumed to be identical to the corresponding population observed, as it appears to be almost totally constrained by long demographic developments. which are by nature orthogonal to short-term economic changes.

To estimate its potential level, the TFP is compared with the capacity utilisation rate in industry, considered as an indicator of the relevant cycle. The method selected assumes the absence of variations in the capacity utilisation rate around a reference value –calculated here when estimating the semi-structural method.

$$\begin{cases} pgf_t = pgf_p^t + \lambda^* \left(TUC_t - TUC_{ref} \right) + \varepsilon_{pt} \\ \Delta pgf_p^t = \zeta + \theta^* \Delta pgf_{t-1}^p + \varepsilon_{gt} \end{cases}$$

where

pgf (resp.pgf^p*)* is the logarithm of total factor productivity (or potential total factor productivity)

TUC is the capacity utilisation rate in industry and TUC_{ref} is the capacity utilisation rate in the reference industry

The potential unemployment rate, usually called the "structural" rate, depends on the characteristics of the labour market. One way to evaluate it is to assume that when the effective unemployment rate moves away from its structural level, tensions appear in the labour market. These are expressed either by a deceleration in wages and prices in the event of an excess supply of labour, or by an acceleration if the opposite is the case. Thus the structural unemployment rate corresponds to the NAIRU (Non–Accelerating Inflation Rate of Unemployment). This is calculated by estimating a "Phillips curve", according to which core inflation[9] is the result of inflation expectations, assumed to be equal to delayed core inflation, and by the difference between effective and structural unemployment, it reflects surplus or insufficient demand. For Germany, since recent developments in inflation appear to be too independent of changes observed in the unemployment rate, thus considerably weakening the estimate from a Phillips curve, the potential unemployment rate was estimated directly using a similar model to that used for TFP.

	λ	χ	θ
France	0.238 (0.02)	0.1 % (0.04)	0.88 (0.05)
Germany	0.125 (0.13)	1.1 % (0.5)	–0.31 (0.55)

How to read this table: The models are estimated from yearly data covering the period 1995–2018

For France

$$\begin{cases} \pi_t^{sj} = \underset{(0.2)}{1.4\%} + \underset{(0.09)}{0.05}\pi_{t-1}^{sj} - \underset{(0.28)}{2.29} * \left(U_t - U_t^p\right) + \varepsilon_{inf\,t} \\ U_t = U_t^p + c_t \\ \Delta U_t^p = \underset{(0.07)}{0.62}\Delta U_{t-1}^p + \varepsilon_{ut} \\ c_t = \underset{(0.16)}{0.35} c_{t-1} + \varepsilon_{ct} \end{cases}$$

For Germany

$$\begin{cases} U_t = U_t^p - \underset{(0.001)}{0.089} * \left(TUC_t - TUC_{ref}\right) + \varepsilon_{ut} \\ \Delta U_t^p = \underset{(0.006)}{0.89} * \Delta U_{t-1}^p + \varepsilon_{upt} \end{cases}$$

where

π_t^{sj} is core inflation
U^p unemployment rate (or structural rate)

For Spain and Italy, it was difficult to find a variable that could both describe the presence of tensions affecting production capacity and also be associated in a relevant way with the very marked variations in unemployment in these two countries, especially following the recession of 2008–2009 and then during the Eurozone sovereign debt crisis. For these reasons, the potential unemployment series that would have been estimated with similar models to those used for France and Germany would only have been simple statistical smoothing techniques incorporating no economic information and these series would therefore have been very similar to the observed unemployment rate series, which was not satisfactory given the theoretical definition of the concept of potential unemployment. In addition, the results that would ultimately have been obtained to estimate the output gap would have been significantly different from those produced by other institutions producing annual output gap estimates for Spain and Italy, such as the European Commission or the OECD. Given this lack of robustness in our results, it was decided that instead we would use the OECD estimates which were produced using a structural method which differed slightly from the one presented in this appendix.

The estimate of the potential labour force participation rate derives from that of structural unemployment (see *above*). We assume that the difference between the effective and the potential labour force participation rate is related to the difference between the effective and potential unemployment rate and the difference between the capacity utilisation rate and a reference value, in order to detect any signs of inflection in the labour market.

$$\begin{cases} TXAct_t = TXAct_t^p + \rho * \left(TUC_t - TUC_{ref}\right) + \sigma * \left(U_t - U_t^p\right) + \varepsilon_{txt} \\ \Delta TXAct_t^p = \Delta TXAct_{t-1}^p + \varepsilon_{upt} \end{cases}$$

9. The core inflation indicator [calculated by INSEE] is estimated by removing from the consumer price index all prices for energy, fresh produce and public tariffs, and adjusting it for tax measures and seasonal variations. Thus core inflation is more suited to an analysis of inflationary pressures as it is less disrupted by external phenomena.

Supply tensions and position of the economy in the cycle

Finally, the potential value of the number of hours worked per capita was estimated from the observed series by a simple purely statistical filter, in this case a Hodrick-Prescott filter adjusted to filter annual data.

The decomposition of the "structural" output gap into its different components is deduced from the production function written in the following form:

$$OG = \frac{Y - Y^*}{Y^*} \approx \ln\left(\frac{Y}{Y^*}\right) = \ln\left(\frac{PGF}{PGF^*}\right) + \alpha \times \left[\ln\left(\frac{TxAct}{TxAct^*}\right) + \frac{U^* - U}{1 - U^*} + \ln\left(\frac{NbH}{NbH^*}\right)\right] \blacksquare$$

	ρ	σ
France	0.002 (0.002)	0.03 (0.01)
Germany	–0.023 (0.03)	–0.22 (0.18)

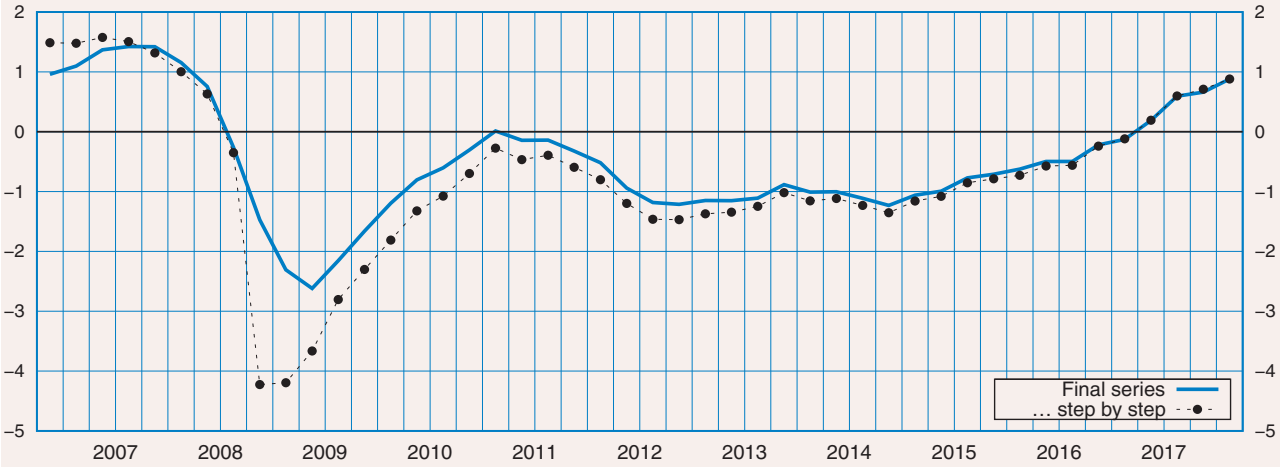
How to read this table: the models are estimated from the periode 1995–2018

Appendix 2 - Simulations in real time for the direct method

One of the main advantages of using the direct method to estimate output gap is the low level of revision over time of information on the recent position of the economy in the short-term cycle. To explain it, the application of the direct method for France is subject to a step-by-step estimation exercise, also called "pseudo real-time", where the output gap is calculated for each quarter using only short-term and economic indicators for the current quarter and preceding periods. The exercise was carried out for France from 2007 (*Figure 14*). The output gap calculated step-by-step has some differences when compared with the value obtained when the direct method is applied to the entire period as this time the coefficients estimated at the time of the principal component analysis were completely recalculated at each date and therefore varied over time. Major differences can be seen with the move into recession in 2008–2009 but these later disappeared. The global profile appeared to be relatively robust, however, where the output gap estimates obtained from structural methods can lead subsequently to some major revisions[10].

The indicator derived from PCA was calculated from cyclical indicators. The coefficients calculated quarter after quarter (*Table 3*) enabled us to examine changes over time. Thus the coefficient associated with the balance of opinion on difficulties associated with insufficient staff in industry slipped back regularly. The coefficient of the unemployment rate varied considerably between Q1 2008 and Q1 2010. These changes can be explained by the lack of any time perspective: the series begins in 2004, with the result that there are only 13 observations up until Q1 2007, for 12 variables. In addition, the balances of opinion reacted to the 2008 crisis very harshly for the most part, which had the effect of distorting the point cloud. ■

14 – Output gap for France, obtained by the direct method carried out step by step or applied to the entire period



Note: the indicator from data analysis,implemented with the direct method is mean- and variance-standardized with the output gap estimated with the structural method which is thus taken as a reference. That output gap is not itself obtained in real time but fixed once for all at the value in 2018; that hybrid exercise is then qualified as "pseudo-real time".

10. Refer to De Waziers (2018) for an in-depth discussion about the order of magnitude of these revisions.

Tableau 3 - Indicators coefficients for calculating principal component analysis in the first principal axis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Ind.diff.dem	–0.32	–0.34	–0.33	–0.34	–0.34	–0.34	–0.35	–0.34	–0.34	–0.34	–0.34
Ind.diff.mo	0.33	0.30	0.30	0.32	0.31	0.29	0.24	0.22	0.20	0.19	0.21
Ind.TUC	0.34	0.36	0.33	0.34	0.35	0.34	0.34	0.34	0.33	0.34	0.35
Serv.diff.dem.	–0.32	–0.35	–0.32	–0.33	–0.34	–0.34	–0.34	–0.35	–0.35	–0.36	–0.36
Serv.diff.mo	0.34	0.32	0.31	0.33	0.33	0.33	0.34	0.34	0.35	0.35	0.33
Cons.diff.dem	–0.32	–0.34	–0.32	–0.32	–0.32	–0.32	–0.33	–0.33	–0.33	–0.33	–0.33
Cons.diff.mo	0.32	0.33	0.32	0.32	0.31	0.31	0.32	0.33	0.33	0.33	0.33
Taux chômage	–0.30	–0.19	–0.23	–0.25	–0.24	–0.24	–0.25	–0.27	–0.27	–0.27	–0.26
Inflation (ga)	–0.01	0.00	0.16	0.17	0.17	0.17	0.19	0.21	0.21	0.20	0.16
Coûts sal.unit.ga	0.08	–0.15	–0.17	–0.11	–0.11	–0.13	–0.10	–0.05	–0.03	–0.02	–0.05
Invest.SNF.ga	0.33	0.36	0.32	0.29	0.29	0.30	0.30	0.29	0.29	0.30	0.30
Invest.ménages.ga	–0.21	0.17	0.27	0.25	0.25	0.26	0.25	0.26	0.26	0.26	0.27

Note: the table coefficients are those obtained in Q1 every year.

Bibliography

Basu S., Fernald J. G. (2009) "What do we know (and not know) about potential output?", Federal Reserve Bank of St. Louis Review, p. 91, July/August.

Bardaji J., Minodier C., Clavel L., Tallet F. (2008) "Two new indicators to help analyse the economic outlook in France", *Conjoncture in France*, Insee, p. 23-44, December.

Clavel L., Minodier C. (2009) "A monthly indicator of the French business climate", *Document de travail de la Dese*,No. G2009–02, INSEE.

Coibion O., Gorodnichenko Y. (2015) "Is the Phillips curve alive and well after all? Inflation expectations and the missing disinflation", *American Economic Journal : Macroeconomics*, 7(1). p. 197–232.

De Waziers D. (2018) "Que nous disent les enquêtes de conjoncture sur la position de l'économie dans le cycle ?". *Trésor-Eco*, n°223.

Forbes K. (2018) "Has Globalization Changed the Inflation Process?",17th BIS Annual Research Conference, Zurich.

Gordon R. J. (1997) "The time–varying NAIRU and its implications for economic policy", *Journal of economic Perspectives*, 11(1), p.11–32.

Herlin A., Gatier A. (2017) "La croissance potentielle en France". *Trésor-Eco*. n°206.

Hong G. H., Kóczán Z., Lian W., Nabar M. (2018) "More Slack than Meets the Eye? Wage Dynamics", Advanced Economies, *IMF Working Paper* WP/18.

Lequien M., Montaut A. (2014) "Croissance potentielle en France et en zone euro : un tour d'horizon des méthodes d'estimation", *Document de travail n° G2014–09*, INSEE.

Mojon B., Ragot X. (2018) "The labor supply of baby–boomers and low–flation", Sciences Po OFCE, *Working Paper, n° 9*, January.

Pybus. T. (2011) "Estimating the UK's historical output gap", Office for Budget Responsibility, *Working Paper N°1*, November.

Pybus T. (2011) "Estimating the output gap", Office for Budget Reponsability, *Briefing paper N°2*, April.

Stock J., Watson M. (2018) "Slack and cyclically sensitive inflation", ECB Forum on Central Banking, Sintra

Verdugo G. (2016) "Real Wage Cyclicality in the Euro zone before and during the Great Recession : Evidence from micro-data", *European Economic Review*, vol 82.

Beatriz M., Marrakchi A., De Waroquier de Puel Parlan S. (2018) "Slowdown in labour productivity and forecasting employment in France", *Conjoncture in France*, INSEE, p. 23-43, juin.

Insee. (2017) "More and more French companies consider themselves hampered by production capacity issues", *Conjoncture in France*, INSEE, December. ■