Forecasting employment based on business tendency survey responses

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*T*o forecast short-term variations in market-sector employment, economic analysts use both macroeconomic models and calibrations based on business tendency survey data.

Using macroeconomic models for forecasting requires a scenario of activity in the market sectors and assumptions on the trend in apparent labour productivity, possibly adjusted for the effects of employment policies. However, these assumptions may be found to be inadequate in the event of a downturn.

Calibrations assume a stable statistical relationship between measured employment and the responses of business leaders interviewed for the business tendency surveys. In the very short term, the results they give are often more accurate than the macroeconomic equations. Variations in employment can be forecast both at the level of all market-sector employment and for each of the four main sectors comprising it: industry, construction, temporary employment and the rest of the market tertiary sector. Aggregating results from the sectoral calibrations gives an "indirect" forecast of employment which is comparable in terms of accuracy to direct estimates of employment as a whole.

Sectoral models also give a better understanding of the overall change in employment as a result of specific trends in each sector. Employment can follow very different trajectories from one sector to another and, depending on the quarter, this can make a small or large contribution to overall change. Of all the sectors, temporary employment stands out because although it represents only 4% of market employment, on its own it accounts for almost 40% of quarterly fluctuations. Calibrations also serve to gradually incorporate different types of information as they become available, first from the business tendency surveys, then from the first quantitative indicators, especially for temporary employment. As this information continues to be introduced, the accuracy of the forecasts is gradually improved.

A new indicator, the "employment climate", synthesises information on the change in workforce from the monthly business tendency surveys. It provides a satisfactory description of the short-term outlook for payroll employment. Compared to the business climate in France, it shows the less irregular profile of the short-term employment situation and the fact that employment reacts with a time lag to fluctuations in activity. In fact, the differences between business climate and employment climate provide a coherent picture of the apparent labour productivity cycle. For direct employment forecasts in the calibration models, this "employment climate" provides significant additional information.

Forecasting employment based on business tendency survey responses

About 45 days after the end of each quarter, INSEE publishes an early estimate (or "flash estimate") of payroll employment in the non-farm market sectors (*Box 1*). A second estimate is published later, about 70 days after the end of the quarter.

Before these estimates become available, INSEE produces an employment forecast for the current quarter with projections for the next one or two quarters for each issue of *Conjoncture in France* (*Table 1*). Two complementary tools are used to produce the employment forecast: first, macroeconomic equations which mainly relate employment to activity, and second, calibrations using enterprises' responses in the business tendency surveys or early quantitative indicators.

Macroeconomic equations and calibrations, two complementary tools for the forecaster

Macroeconomic equations require an activity scenario and assumptions about trend variations in productivity

Short-term changes in payroll employment in the market sectors can be forecast using macroeconomic equations which model the link between the number of people employed and its main determinants: mainly activity in the branches concerned, but also the cost of labour or its duration (Argouarc'h *et al.*, 2010; Passeron and Perez-Duarte, 2003). These models are estimated by assuming that apparent labour productivity increases at a regular pace in the long term. The effects of policies to enhance job growth, such as the tax credit for encouraging competitiveness and jobs or the emergency plan for employment, are usually estimated independently then incorporated on a discretionary basis into the models.[1] These macroeconomic models have proved their effectiveness over several quarters and for this reason they are used in the preparation of each *Conjoncture in France*. However, they remain dependent on the overall macroeconomic diagnosis, especially the scenario for market-sector activity. They also depend on changes in the trend in apparent labour productivity or changes in behaviour by employers who may be slow or fast to adjust their workforce according to activity. This was notably the case during the 2008-2009 crisis, a period when results from macroeconomic models were less successful.

1. See "What effects should we expect from the Tax Credit for Encouraging Competitiveness and Jobs (CICE) in 2014?", *Conjoncture in France*, December 2013, p. 71-73 and "In 2015, the CICE employment tax credit is set to ramp up and the Responsibility and Solidarity Pact (PRS) is to be introduced", *Conjoncture in France*, December 2014, p. 73-74.

Table 1 - Publication calendar for employment information in quarter Q

Indicator	Source	Release time compared to the end of quarter Q
Business tendency surveys - month 1 of quarter Q	INSEE	–70 days
60 days before the end of quarter Q: beginning of the forecast exercise Conjoncture in France *from INSEE*		
Business tendency surveys - month 2 of quarter Q	INSEE	–40 days
Estimation of temporary employment - month 1 of quarter Q	DARES	–20 days
20 days before the end of quarter Q: end of the forecast exercise Conjoncture in France *from INSEE*		
Business tendency surveys - month 3 of quarter Q	INSEE	–10 days
Payroll employment except temporary employment - end of the month - month 1 of quarter Q*	ACOSS	–5 days
Estimation of temporary employment - month 2 of quarter Q	DARES	+10 days
Payroll employment except temporary employment - end of the month - month 2 of quarter Q*	ACOSS	+25 days
Estimation of temporary employment - month 3 of quarter Q	DARES	+40 days
"Flash" estimation of payroll employment - quarter Q	INSEE	+45 days
Estimation of payroll employment - quarter Q	INSEE	+70 days

*in view of the introduction of the Nominative Social Declaration (DSN) and its gradual application since March 2015, the monthly series of workforce numbers produced by ACOSS have temporarily not been published at a monthly rate since mid-2016.
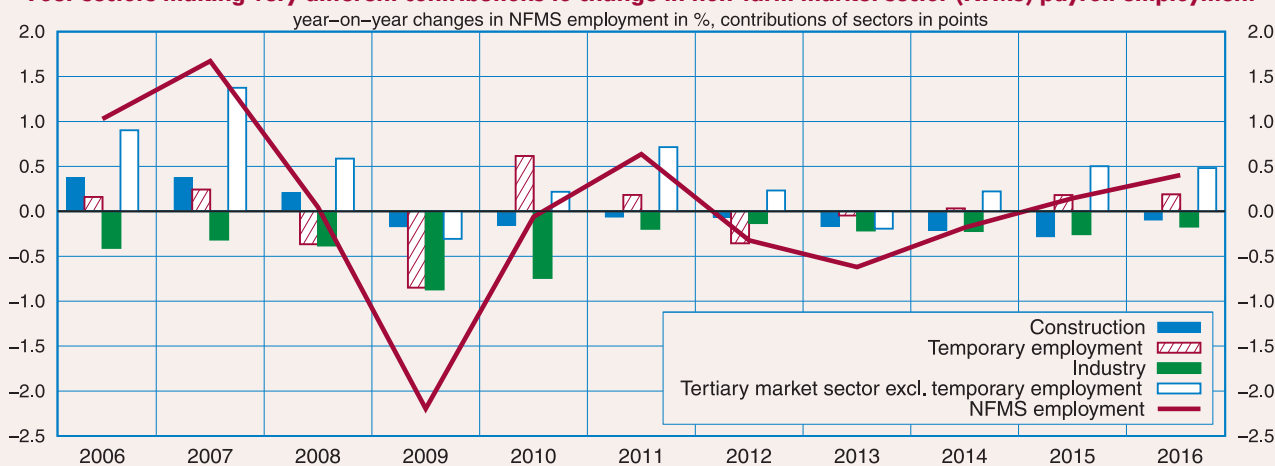*Source: INSEE*

Calibrations translate business leaders' opinions collected from the business tendency surveys into quantitative forecasts

To estimate changes in employment over the very short term — the current quarter and the following quarter — calibrations using balances of opinion from the business tendency surveys often give more accurate results than macroeconomic equations. These calibrations assume a constant statistical relationship between measured employment and balance of opinion from business leaders, especially regarding past and expected changes in their own workforce. On the other hand, they do not presuppose an economic relationship between employment and activity and do not require a growth scenario or an assumption regarding productivity.

Box 1 – Employment forecasting based largely on that of payroll employment in non-farm market sectors

The results in this report concern only payroll employment in the non-farm market sectors, for which the first estimate is published 45 days after the end of the quarter (mainly based on the ACEMO (Labour Activity and Employment Conditions) surveys conducted by DARES (Research Studies and Statistics Department)); this estimate is then revised regularly, especially 70 days after the end of the quarter (based on comprehensive declarations by enterprises to URSSAF). Payroll employment in the non-farm market sector represents a little under two-thirds of total employment, and is made up mainly of market tertiary employment (73%). While temporary employment in this sector represents a small proportion of employment (4% of the total), its contribution to fluctuations in employment is considerably greater than its weight would suggest (*Graph* and *Table*).

Four sectors making very different contributions to change in non-farm market sector (NFMS) payroll employment

year–on–year changes in NFMS employment in %, contributions of sectors in points

Construction
Temporary employment
Industry
Tertiary market sector excl. temporary employment
NFMS employment

Source: INSEE

Temporary employment, a small but highly volatile share in non-farm market payroll employment

Contributions to quarterly fluctuations by the different employment components

	Share of employment (in 2016)	Average contributions to variations in employment over the period 2007-2016
Industry	19%	12%
Construction	8%	8%
Tertiary sector except temporary employment	69%	41%
Temporary employment	4%	39%

Scope: payroll employment of non-farm market sectors
Source : Insee

Employment in industry (19% of the total) has declined almost continuously since the first oil shock; in particular, it fell sharply at the time of the 2008-2009 crisis. In construction, employment, like activity, follows an economic cycle that is quite distinct from that of the other sectors; in particular, it made the largest negative contribution in 2015 despite representing only 8% of the total.

In *Conjoncture in France*, forecasting methods differ according to sector of activity or form of employment. These distinctions are due mainly to the availability of sources. For payroll employment in the non-farm market sector, as quarterly data are available it is possible to develop different specific tools (macro- or meso-economic equations, calibrations based on business tendency survey responses, calibrations based on quantitative indicators, etc.) for preparing forecasts. For assisted contracts in the public sector (CUI-CAE (single integration contract in the non-market sector), future contracts, etc.) sub-annual data are also available, and in this case, forecasts are based on input assumptions and parameters related to contract duration.

For other jobs (public sector tenured personnel, self-employed, agricultural employees, etc.), information is provided only at an annual rate. Forecasts are mainly deduced from trends observed in previous years. ∎

Forecasting employment based on business tendency survey responses

To forecast employment in the very short term, a "direct" forecast is compared with aggregated sectoral calibrations

Short-term change in payroll employment in the non-farm market sector from business tendency surveys is forecast either by calibrating the entire scope ("direct" approach), or by aggregating employment forecasts for the sectors comprising it ("disaggregated" or "indirect" approach): industry, construction and the market tertiary sector, taking care to differentiate temporary employment within this last sector. Sectoral forecasts are prepared based on calibrations which use different balances of opinion, mainly those on employment in the corresponding sectors (*Appendix 1*).

When using the "indirect" method it is possible to refine analysis of the short-term outlook in employment by pinpointing those sectors that have made the largest contributions. While they all undergo a common change, the different sectors are also subject to their own short-term economic uncertainties. All in all, they may make very different contributions to overall change from one quarter to another (*Box 1*). By comparing the direct and indirect methods it is also possible to test the consistency of overall forecasts.

Incorporating quantitative information on temporary employment improves the calibrations

The employment forecast published by INSEE in *Conjoncture in France* is the result of an iterative process which takes place between seventy and twenty days before the end of the current quarter. As new employment information becomes available, it is included in the calibrations to improve the forecast.

Up to 40 days before the end of the quarter, the payroll employment forecast is based solely on the business tendency surveys. This forecast is considerably improved when the results from the business tendency surveys from the second month of the quarter ("at month 2") are included. At the end of the process, temporary employment for the first month of the quarter is published by DARES (Research Studies and Statistics Department) and by taking this into account the accuracy of the forecast is further improved (*Appendix 1* and *Table 2*).

The quality of the payroll employment forecast depends on that of temporary employment

At the start of the exercise, the payroll employment forecast suffers from a lack of information on temporary employment, which by nature is difficult to predict as it is subject to wide quarterly variations. It is in fact the temporary employment estimate that contributes most to average forecasting error at the beginning of the period (*Graph 1*). While temporary employment represents a little less than 4% of market employment in level, because of its strong volatility since 2007 it has contributed about 40% of total fluctuations (*Box 1*).

Table 2 - Mean forecast error for payroll employment change in the non-farm market sector in quarter Q, according to the estimate date

in %

	Estimate date			
	Conjoncture in France Q–1	Business tendency survey - month 1	Business tendency survey - month 2	Conjoncture in France (temporary employment indicator from DARES - month 1)
(date expressed in a number of days compared to the end of the quarter)	*100 days before*	*70 days before*	*40 days before*	*20 days before*
Industry	0.16	0.15	0.14	0.14
Construction	0.31	0.23	0.23	0.23
Tertiary sector except temporary employment	0.22	0.15	0.15	0.15
Temporary employment	4.62	3.61	3.02	2.14
NFMS Employment (indirect estimate)	0.24	0.19	0.18	0.14
NFMS Employment (direct estimate)	0.24	0.19	0.16	0.15

Note: forecast errors are calculated for the period 2007-2016.
How to read the table: for a *Conjoncture in France* issue published at the end of quarter Q–1, change in employment in industry in quarter Q is forecast using a root mean (square) error of 0.16%.

Sources: DARES (temporary employment numbers - end of the month), INSEE

The contribution of temporary employment to the overall forecast error decreases with the availability of the business tendency surveys: in two months, i.e. between the beginning of the quarter and the end of the second month, the contribution by this sector decreases by more than 9 points (*Graph 1*). Incorporating the first estimate of temporary employment for the first month of the quarter at the end of the period reduces this contribution still further, by 17 points. For the other sectors, taking the business tendency surveys into account over the quarter increases the accuracy of the estimates a little more moderately; they therefore contribute relatively more to the forecast errors, especially market tertiary employment excluding temporary employment, given its weight.

Forecasting can benefit from the publication of monthly quantitative indicators
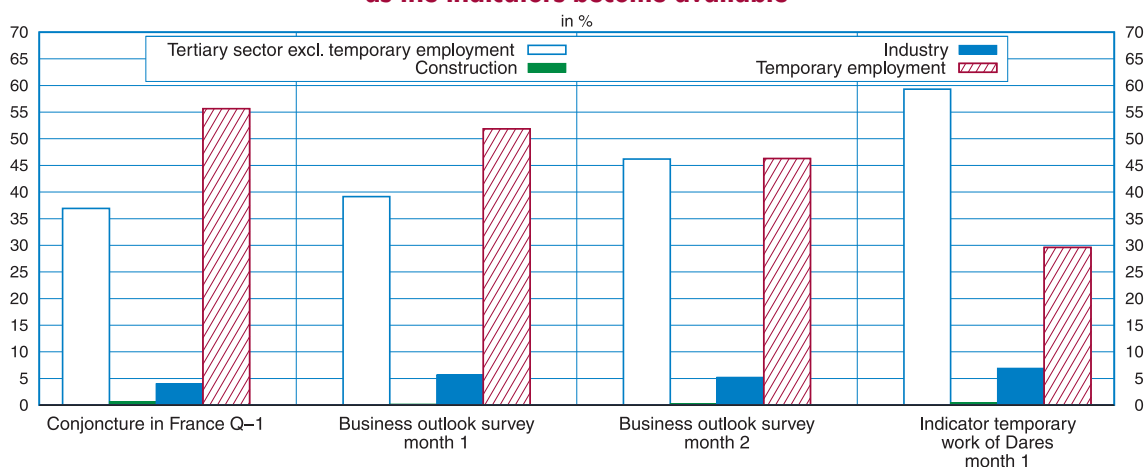
For temporary employment, introducing monthly quantitative information clearly improves the accuracy of the overall employment forecast.

Another monthly quantitative indicator illustrates this contribution: the estimate of payroll employment at the end of the month produced by ACOSS, taking as its scope competitive enterprises with at least 10 employees. When this indicator is taken into account between the end of the forecasting period for *Conjoncture in France* (T−20 days) and the first employment estimate (T+45), the forecast for quarterly change in non-farm market sector employment, excluding temporary employment, is improved (*Box 2*).

The forecasts used in each Conjoncture in France *take into account both direct and indirect approaches*

At the end of the forecasting exercise for *Conjoncture in France*, the indirect approach provides an employment forecast of predominantly better quality. However, the direct approach is more parsimonious: a single calibration is needed with one or two variables taken from the business tendency surveys. In addition, this approach does not always give less satisfactory results: since 2007 and with the models used here, at the time of publication of the *Conjoncture in France*, more than 4 times out of 10 the direct approach provides forecasts for the current quarter that are of better quality than the indirect approach. In practice, the forecasts presented in *Conjoncture in France* are based on the results obtained from different tools, macroeconomic equations and calibrations based on the surveys; for the surveys, the direct and indirect approaches are arbitrated.

1 - Contributions by the different sectors to the forecast error for employment in the current quarter as the indicators become available

in %

Tertiary sector excl. temporary employment ☐   Industry ■
Construction ■   Temporary employment ▨

Note: the mean quadratic contributions are calculated for the period 2007-2016.
How to read the graph: at the time that *Conjoncture in France* is being finalised, when the monthly indicator for temporary employment is known, forecast errors in temporary employment account for about 30% of the forecast error for quarterly change as a whole.

Sources: DARES (temporary employment numbers - end of the month), INSEE (business tendency survey and employment numbers), INSEE calculations

Forecasting employment based on business tendency survey responses

Box 2 - After publication of *Conjoncture in France* but before the "flash" estimates for employment, the ACOSS monthly indicator improves forecasting accuracy

Another producer of statistics, the Central Agency of Social Security Associations (ACOSS), publishes a payroll employment estimate at the end of every month, based on a set of data of similar scope to the non-farm market branches, that of the private sector except temporary employment, limited to enterprises with 10 or more employees. Until mid-2016, this indicator was published about 55 days before the end of the month under consideration (i.e. 5 days before the end of the quarter for the first month, 25 days after the end of the quarter for the second month). In neither case are these indicators available for the forecasting period of *Conjoncture in France* (20 days before the end of a quarter) but they are available between this publication and the flash estimate for employment published 45 days after the end of the quarter.

Incorporating the ACOSS monthly indicator[1] improves forecasting by 30%

To appreciate the contribution made by the ACOSS monthly indicator to forecasting payroll employment excluding temporary work, models that incorporate this indicator are compared with a reference model that uses the indicator for the business climate in France. However, since the ACOSS indicator is only available from 2006, there is not sufficient time depth to compare the quality of the models outside the sample. For the period 2006-2015, the inclusion of the ACOSS monthly indicator until the second month of the quarter improved forecasting by 30% between the end of the forecasting period and 25 days after the end of the quarter under consideration.

Forecast of non-farm market employment excluding temporary employment in the first month of quarter "t+1"

Reference model

$$emploi\_SMNAHI_t = \underset{(9.9)}{0.89} \times emploi\_SMNAHI_{t-1} + \underset{(3.3)}{0.015} \times Dclimat\_France\_m4_t$$

(in brackets the Student's t-test statistics)
Period of estimation: 2006Q2-2016Q4
R^2 adjusted in the model: 0.69

where:
- *emploi_SMNAHI_t* is the growth rate of non-farm market sector payroll employment excluding temporary employment in quarter t, standard deviation 0.24% from 2006;
- *climat_France_m4_t* is the business climate in France for the first month of quarter t+1;
- *D* is the difference operator.

The root mean square error (RMSE) for this model for the period 2006Q2-2016Q4 is 0.13%.

Model with ACOSS indicator

$$emploi\_SMNAHI_t = \underset{(-6.7)}{-1.24} + \underset{(5.1)}{0.48} \times acoss\_mens\_SMNAHI\_m2_t + \underset{(6.5)}{0.012} \times climat\_France\_m4_t$$

(in brackets the Student's t-test statistics)
Period of estimation: 2006Q2-2016Q4
R^2 adjusted in the model: 0.85

where:
- *acoss_mens_m2_t* is the ACOSS monthly indicator in the second month of quarter t.

The root mean square error (RMSE) for this model for the period 2006Q2-2016Q4 is 0.09%, i.e. a 30% gain compared with the reference model.

There is also a clear improvement in accuracy when considering only industrial employment.

Forecast of payroll employment in industry

Reference model

$$emploi\_industrie_t = \underset{(-1.5)}{-0.05} + \underset{(6.7)}{0.59} \times emploi\_industrie_{t-1} + \underset{(4.8)}{0.013} \times solde\_emploi\_passé\_industrie\_m4_t$$

(in brackets the Student's t-test statistics)
Period of estimation: 2006Q2-2016Q4
R^2 adjusted in the model: 0.82

where:
- *emploi_industrie_t* is the growth rate of payroll employment in industry in quarter t, standard deviation 0.31% from 2006;
- *solde_emploi_passé_industrie_m4_t* is the balance of opinion on recent change in employment in industry in the first month of quarter t+1.

The root mean square error (RMSE) for this model for the period 2006Q2-2016Q4 is 0.13%.

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1. Since August 2016, the ACOSS monthly indicator is no longer published every month. Estimates have been disrupted by the introduction of a new method for collecting social declarations by employers, the Nominative Social Declaration (DSN). The indicators are currently only published every three months, about two months after the end of the given quarter. They are therefore temporarily no longer usable for forecasting before the quarterly publication.

Model with ACOSS indicator

$$emploi\_industrie_t = \underset{(-1.2)}{-0.04} + \underset{(3.4)}{0.44} \times emploi\_industrie_{t-1} + \underset{(4.6)}{0.53} \times acoss\_mens\_ind\_m2_t$$
$$+ \underset{(4.1)}{0.016} \times Dsolde\_emploi\_passé\_industrie\_trim_{t+1}$$

(in brackets the Student's t-test statistics)
Period of estimation: 2006Q2-2016Q4
R^2 adjusted in the model: 0.89

where:
- *emploi_industrie_t* is the growth rate of payroll employment in industry in quarter t;
- *acoss_mens_ind_m2_t* is the ACOSS monthly indicator for industry in the second month of quarter t;
- *solde_emploi_passé_industrie_trim_{t+1}* is the quarterly balance of opinion on recent change in employment in industry published in the first month of quarter t+1.

The root mean square error (RMSE) for this model for the period 2006Q2-2015Q3 is 0.10%, i.e. a 23% gain compared with the reference model.

The monthly quantitative indicator of the stock of employment established by ACOSS is not the only available indicator. First, ACOSS also publishes monthly data on hirings which can improve employment calibrations for certain sectors. Second, since the end of 2015 the human resources management consultancy ADP has introduced a monthly employment indicator based on a sample of its client companies.

Every month, ADP publishes its monthly employment report about 20 days after the end of the month under consideration, which is therefore a very early indicator. However, this indicator seems fairly difficult to use. Firstly, because of its limited time depth: it is available only from the beginning of 2012, which limits the possibility of developing an econometric model. The second reason is the poor correlation between this indicator and the INSEE indicator based on company declarations to URSSAF (covering the non-farm market sector except temporary employment; Graph): the correlation of the quarterly variations in these indicators with the area that is closest in scope (market sector except temporary employment) is 14%, well below the correlation between INSEE's quarterly variations and those of the ACOSS monthly indicator (67%). Lastly, the dynamism of this ADP indicator for 2014 and 2015 is difficult to relate to concomitant information on activity or unemployment. ∎
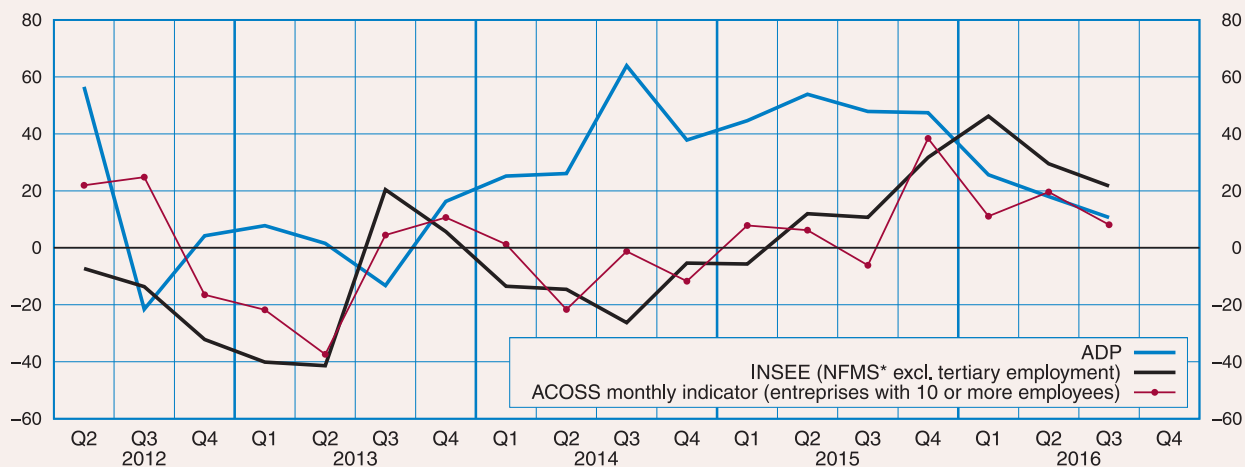
*NFMS: non-farm market sector
Note: the ADP and ACOSS monthly indicators are shown as quarterly figures.

Sources: ACOSS, ADP and INSEE

Forecasting employment based on business tendency survey responses

Employment reacts with a time lag to fluctuations in activity

All the business tendency surveys include questions on employment, usually one on past change in employee numbers and another on expected change.[2] Irrespective of the sector, the balances of opinion of business leaders concerning employment describe a very specific short-term economic cycle, with a similar profile to that of the balances of opinion for activity, though lagging slightly behind. In the manufacturing industry, balances of opinion on employment[3] recovered more slowly than those on production in the wake of the 2008-2009 economic and financial crisis (*Graph 2*). In addition, balances of opinion on employment are considerably less volatile: they vary much less than those on production, which are subject to severe jolts. At the beginning of 2016, when the balances of opinion on production showed contrasting changes (strong improvement in expected production but sharp fall in past production), the balances for employment once again showed the upward trend started at the beginning of 2015. These features of the balances of opinion clearly reflect those of the quantitative variables, especially the way that employment lags behind, reacting more slowly to fluctuations in activity for each sector, except temporary employment.

Of all the "direct" calibration models for payroll employment in the non-farm market sector, those using the estimated business climate for all market sectors of the French economy ("France" business climate) often give the most accurate forecasts (see also *Special analysis*, "How to forecast employment figures by reading the newspaper", p. 35). This may seem paradoxical, in that this climate is supposed to reflect change in economic activity overall rather than change in employment. In fact it summarises information from 26 balances of opinion from 5 sector surveys: industry, services, building industry, retail and wholesale trade

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2. In all the surveys, questions take the form, "How has your total workforce changed in the last three months?" and "What is the expected change in total workforce in your enterprise in the next three months?" However, from one survey to another there are always a few differences over the definition of workforce. The term total workforce is used for the industry survey, with no further clarification given; however, employees and self-employed workers are required for the building sector survey figures, workforce includes temporary workers for retail trade and services surveys, and lastly both temporary work and employment excluding temporary work are specified in the civil engineering survey.

3. Balances of opinion on employment in industry are now available on a monthly basis. The available timescale is now sufficient to carry out seasonal adjustments and as a result these new series can be used rather than quarterly employment balances of opinion.

2 - Balances of opinion on employment have a similar profile to those for activity but they lag behind and are less uneven

balances of opinion (in %)
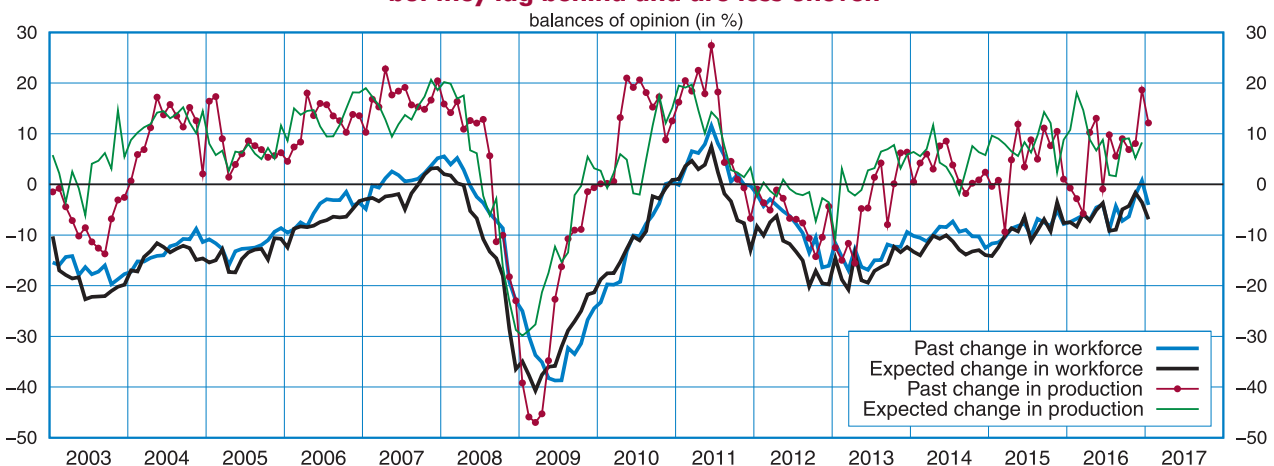
Source: INSEE, monthly business tendency survey in industry

(Bardaji *et al.*, 2008). Most of the balances used for this indicator reflect the general opinion of business leaders on change in activity (production, turnover, general outlook, etc.), and only two of the ten existing balances of opinion on employment were selected: expected changes in employment in retail trade and past changes in employment in the building industry.

"Employment climate", a new composite indicator constructed only from balances of opinion on employment

To track the specific short-term cycle of employment, factor analysis can be used to construct an indicator that summarises information contained in the balances of opinion on past and expected changes in employment in the different market sectors. The method selected here is similar to that used to calculate the business climate indicators (*Appendix 2*).

The "employment climate" is a good reflection of the short-term outlook for payroll employment

The resulting composite indicator —called the "employment climate"— very satisfactorily tracks the short-term phases of non-farm market sector payroll employment (*Graph 3*). The correlation between the employment climate calculated in the second month of a quarter and the quarterly growth in workforce numbers is high (75%), and comparable with that obtained with the business climate in France. Over the recent period the employment climate is a good reflection of the upward trend in employment that started at the beginning of 2015, and is even more accurate than the business climate.

The difference between the business climate and the employment climate reflects the productivity cycle

Concerning the non-farm market sector, the employment climate provides information that complements the business climate indicator. Since mid-2015, it has been positioned well above the business climate, and this difference illustrates the short-term slowdown in apparent labour productivity, in other words greater employment intensity of growth, mainly attributable to recent schemes to reduce labour costs. An indicator calculated as the difference between the business climate in France and the employment climate presents the cycle of apparent labour productivity in France (*Graph 4*) in a coherent way, so that it can be used to better anticipate changes.

3 - Comparison of variations in employment, "employment climate" and the business climate in France
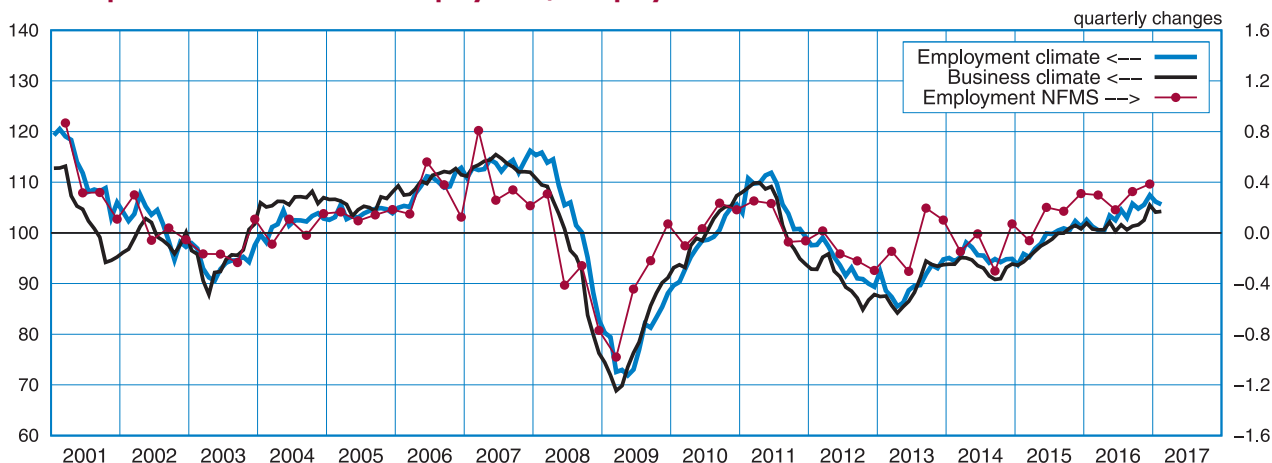
*Source: INSEE, business tendency surveys and employment numbers*

Forecasting employment based on business tendency survey responses

The employment climate complements the business climate in France to forecast change in payroll employment

To control for the properties of this new indicator, the predictive capacities of three payroll employment models were tested for the period 1991-2016 (*Box 3*): a reference model involving only the business climate; a model involving only the employment climate, and finally a model involving these two indicators simultaneously. The second model appeared slightly less efficient in forecasting than the reference model, which confirmed that the business climate contains information in advance of the employment model. In the third model, the two indicators are clearly differentiated and the model reproduces data better when it is estimated for the entire period of study (larger adjusted R^2). This shows that the employment climate provides additional information to the business climate to forecast change in payroll employment. On the other hand, forecasting errors are not significantly reduced when a real-time simulation is carried out ("real-time" RMSFE not significantly different).

INSEE will publish this new indicator every month from April 2017, as a complement to the indicators on business climate and the economic turnaround in France. ∎

4 - Differences between the business climate in France and the employment climate closely follow change in per capita productivity

productivity: year–on–year changes, difference between the France climate and the employment climate: 5–month moving average
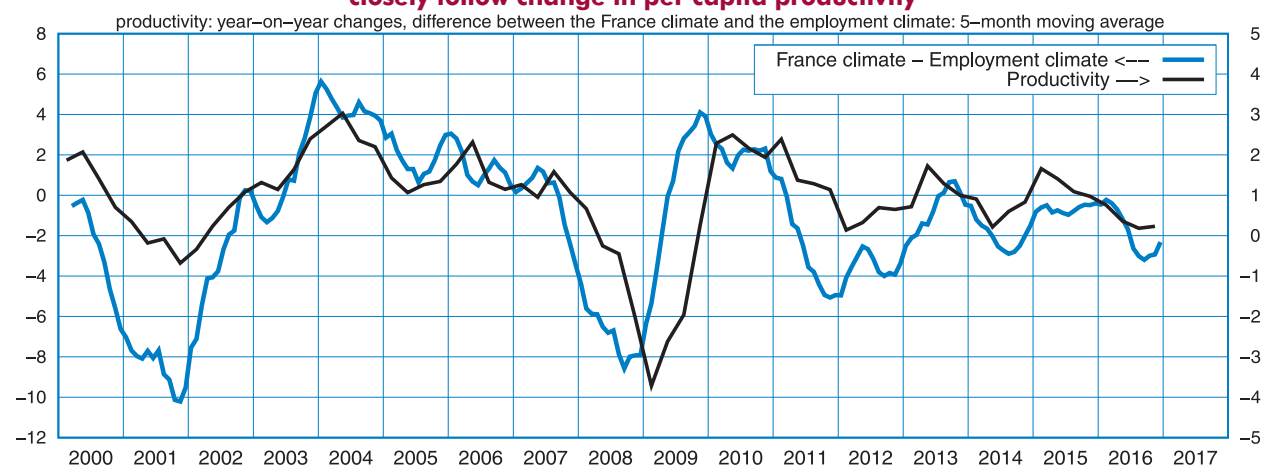
Source: INSEE, business surveys, quarterly accounts

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Passeron V. and **Perez-Duarte S.** (2003) , "Will the recovery be jobless?", *Conjoncture in France*, December, p. 11-28. ∎

Box 3 – The employment climate in the forecasting models
and testing its forecasting properties

In order to directly forecast change in non-farm market employment in the short term, the reference model that can be applied in the second month of the quarter is a calibration involving the indicator for the business climate in France.

Reference model

$$emploi\_SMNA_t = \underset{(-2.3)}{-0.89} + \underset{(3.1)}{0.30} \times emploi\_SMNA_{t-1} + \underset{(3.7)}{0.36} \times emploi\_SMNA_{t-2}$$
$$+ \underset{(2.3)}{0.009} \times climat\_France\_m2_t + \underset{(5.0)}{0.057} \times (climat\_France\_m2_t - climat\_France\_m1)_t$$
$$+ \underset{(2.4)}{0.013} \times Dclimat\_France\_m1_t$$

(in brackets the Student's t-test statistics)
Period of estimation: 1991Q1-2014Q4
R^2 adjusted in the model: 0.78

where:
- $emploi\_SMNA_t$ is growth in non-farm market payroll employment in quarter t , where the standard deviation is 0.33% since 2007;
- $climat\_France\_m1_t$ is the business climate in France in the first month of quarter t;
- $climat\_France\_m2_t$ is the business climate in France in the second month of quarter t;
- D is the difference operator.

The root mean square forecast error for this model ("real time" RMSFE) for the period 2007Q1-2016Q4 is 0.15%.

Model with employment climate only

$$emploi\_SMNA_t = \underset{(2.3)}{0.24} \times emploi\_SMNA_{t-1} + \underset{(3.3)}{0.32} \times emploi\_SMNA_{t-2} + \underset{(2.8)}{0.28} \times emploi\_SMNA_{t-3} + \underset{(6.8)}{0.047} \times Dclimat\_emploi\_m2_t$$

(in brackets the Student's t-test statistics)
Period of estimation: 1991Q1-2014Q4
R^2 adjusted in the model: 0.77

The standard deviation error for this model ("real time" RMSFE) for the period 2007Q1-2016Q4 is 0.19%.

Model with employment climate and business climate in France

$$emploi\_SMNA_t = \underset{(-2.4)}{-0.91} + \underset{(2.8)}{0.26} \times emploi\_SMNA_{t-1} + \underset{(4.3)}{0.38} \times emploi\_SMNA_{t-2}$$
$$+ \underset{(2.4)}{0.009} \times climat\_France\_m2_t + \underset{(5.2)}{0.061} \times (climat\_France\_m2_t - climat\_France\_m1)_t$$
$$+ \underset{(3.0)}{0.019} \times Dclimat\_emploi\_m2_t$$

(in brackets the Student's t-test statistics)
Period of estimation: 1991Q1-2014Q4
R^2 adjusted in the model: 0.80

The standard deviation error for this model ("real time" RMSFE) for the period 2007Q1-2016Q4 is 0.16%. ∎

Forecasting employment based on business tendency survey responses

Appendix 1 – Calibrations from business tendency surveys to forecast short-term change in non-farm market sector payroll employment

Forecasting change over the short term in payroll employment from the business tendency surveys can be done either by calibrating the scope of the entire non-farm market sector (in what is called a "direct approach"), or by aggregating forecasts from the industry, construction, tertiary except temporary employment and temporary employment sectors ("disaggregated" or "indirect" approach).

Calibration of non-farm market payroll employment (direct approach)

The different tests carried out with the many balances of opinion in the surveys conclude that in general, in a forecasting exercise in *Conjoncture in France* (in the second month of a given quarter "t"), the best direct forecast of change in non-farm market employment is obtained from a calibration that uses the business climate indicator for the French economy.

$$
\begin{aligned}
(1) \quad emploi\_SMNA_t = &\underset{(-2.3)}{-0.88} + \underset{(2.7)}{0.26} \times emploi\_SMNA_{t-1} + \underset{(4.4)}{0.42} \times emploi\_SMNA_{t-2} \\
&+ \underset{(2.4)}{0.009} \times climat\_France\_m2_t + \underset{(2.3)}{0.013} \times Dclimat\_France\_m1_t \\
&+ \underset{(5.6)}{0.066} \times (climat\_France\_m2_t - climat\_France\_m1_t)
\end{aligned}
$$

(in brackets the Student's t-test statistics)
Period of estimation: 1995Q1-2016Q4
R^2 adjusted in the model: 0.79

where:
- *emploi_SMNA_t* is the growth rate of non-farm market payroll employment in quarter t, where the standard deviation is 0.33% from 2007;
- *climat_France_m1_t* and *climat_France_m2_t* are the values for the France business climate in the first two months of quarter t;
- *Dclimat_France_m1_t* is the variation in the France business climate in the first month of quarter t.

The root mean square forecast error for this model ("real time" RMSFE[1]) for the period 2007Q1-2016Q4 is 0.16%.

Calibration of non-farm market payroll employment (indirect approach)

The calibration models by sector, on the other hand, show balances of opinion from business leaders in the sector under consideration on their own workforce, supplemented by other variables.

Manufacturing industry

$$
\begin{aligned}
(2) \quad Ind_t = &\underset{(-0.7)}{-0.02} + \underset{(9.2)}{0.67} \times Ind_{t-1} + \underset{(3.3)}{0.006} \times solde\_commandes\_Ind\_m2_t \\
&+ \underset{(3.1)}{0.014} \times Dsolde\_effectif\_prévu\_Ind\_trim_t
\end{aligned}
$$

Period of estimation: 1995Q1-2016Q4
R^2 adjusted in the model: 0.80

where:
- *Ind_t* is the growth rate of payroll employment in industry in quarter t, where the standard deviation is 0.33% from 2007;
- *Dsolde_effectif_prévu_Ind_trim_t* is the variation in the balance of opinion on expected change in employment, calculated from the quarterly survey;
- *solde_commandes_Ind_m2_t* is the balance of opinion on the level of order books in the second month of quarter t.

Construction

$$
\begin{aligned}
(3) \quad BTP_t = &\underset{(6.1)}{0.36} + \underset{(2.9)}{0.28} \times BTP_{t-1} + \underset{(4.5)}{0.009} \times solde\_commandes\_Bat\_m2_t \\
&+ \underset{(3.1)}{0.016} \times Dsolde\_effectif\_prévu\_Bat\_m2_t + \underset{(5.1)}{0.011} \times solde\_activité\_prévue\_TP_t
\end{aligned}
$$

Period of estimation: 1995Q1-2016Q4
R^2 adjusted in the model: 0.88

where:
- *BTP_t* is the growth rate of payroll employment in construction in quarter t, where the standard deviation is 0.55% from 2007;
- *Dsolde_effectif_prévu_Bat_m2_t* is the variation in the balance of opinion on expected change in employment in the second month of quarter t;
- *solde_commandes_Bat_m2_t* is the balance of opinion on the level of order books in the second month of quarter t;
- *solde_activité_prévue_TP_t* is the balance of opinion on expected change in activity in civil engineering in quarter t.

The root mean square forecast error for this model ("real time" RMSFE) for the period 2007Q1-2016Q3 is 0.23%.

---

1. To find the best model, we try to position ourselves in the same conditions in which the economic analyst would find himself at each date t to construct the calibration. The idea is to recalculate the model coefficients at each date t, by including at each stage the latest available information observed and then measuring the forecast error obtained with this information. The simulation is nevertheless carried out using historical series of payroll employment and survey balances as published today and not that of the variations measured for the first publication: strictly speaking, this is therefore "pseudo real time".

Tertiary employment except temporary employment

$$(4) \quad \begin{aligned} TerMHI_t &= -0.55 + 0.34 \times TerMHI_{t-1} + 0.018 \times Dclimat\_Service\_m2_t \\ &\underset{(-2.0)}{} \quad \underset{(3.6)}{} \quad \underset{(4.2)}{} \\ &+ 0.015 \times solde\_effectif\_passé\_ComD\_m2_t + 0.008 \times climat\_ComG\_m1_t \\ &\underset{(4.0)}{} \quad \underset{(2.6)}{} \\ &+ 0.78 \times ind1998Q2 \\ &\underset{(4.3)}{} \end{aligned}$$

Period of estimation: 1995Q1-2016Q4
R² adjusted in the model: 0.79

where:
- $TerMHI_t$ is the growth rate of payroll employment in the tertiary sector excluding temporary employment in quarter t, where the standard deviation is 0.23% from 2007;
- $solde\_effectif\_passé\_ComD\_m2_t$ is the balance of opinion on past change in employment in retail trade in the second month of quarter t;
- $Dclimat\_Service\_m2_t$ is the variation in business climate in services in the second month of quarter t;
- $climat\_ComG\_m1_t$ is the business climate in wholesale trade, in the first month of quarter t;
- $Ind1998Q2$ is a dummy for Q2 1998.

The root mean square forecast error for this model ("real time" RMSFE) for the period 2007Q1-2016Q3 is 0.15%.

Temporary employment

For this sector, it is possible first to take into account only the survey variables (calibration (5)); when carrying out a forecasting exercise for *Conjoncture in France*, we can then use the temporary employment estimate from month 1 of quarter t published by DARES (calibration (6)).

$$(5) \quad \begin{aligned} Inter_t &= 0.24 + 0.47 \times Dclimat\_France\_m2_t + 0.28 \times Dsolde\_effectif\_prévu\_Ind\_trim_t \\ &\underset{(0.5)}{} \quad \underset{(3.4)}{} \quad \underset{(2.1)}{} \\ &+ 0.06 \times solde\_activité\_prévue\_Ind\_m2_t \\ &\underset{(1.4)}{} \end{aligned}$$

Period of estimation: 1995Q1-2016Q4
R² adjusted in the model: 0.47

$$(6) \quad \begin{aligned} Inter_t &= 0.31 \times Dclimat\_industrie\_m2_t + 0.11 \times Dsolde\_effectif\_prévu\_tp\_trim_t \\ &\underset{(5.2)}{} \quad \underset{(3.2)}{} \\ &+ 0.08 \times Dsolde\_effectif\_prévu\_bat\_m1_t + 1.0 \times indicateur\_Intérim\_Dares\_m1_t \\ &\underset{(1.7)}{} \quad \underset{(9.3)}{} \end{aligned}$$

Period of estimation: 2002Q2-2016Q4
R² adjusted in the model: 0.79

where:
- $Inter_t$ is the growth rate of temporary employment in quarter t, where the standard deviation is 4.89% from 2007;
- $Dsolde\_effectif\_prévu\_tp\_trim_t$ is the variation in balance of opinion on expected change in employment in the civil engineering sector in quarter t;
- $Dsolde\_effectif\_prévu\_bat\_m1_t$ is the variation in balance of opinion on expected change in employment in the building industry sector in the first month of quarter t;
- $indicateur\_Intérim\_Dares\_m1_t$ is the monthly change in the DARES indicator in the first month of quarter t;
- $Dclimat\_France\_m2_t$ is the variation in the France business climate in the second month of quarter t;
- $Dclimat\_industrie\_m2_t$ is the variation in business climate in industry in the second month of quarter t.

The root mean square error for model 5 ("real time" RMSFE) for the period 2007Q1-2016Q4 is 3.02% whereas for model 6 it is 2.14%.

Result of the aggregation

Aggregating these sector forecasts gives a forecast of change in employment in the scope of the non-farm market sector which is comparable in terms of accuracy to the direct method. At the end of the forecasting exercise for *Conjoncture in France*, it is possible to use the first monthly estimate for temporary employment to forecast both temporary employment and non-farm market employment across the whole quarter: for the period 2007Q1-2016Q4, the indirect method is better in 53% of cases, however, according to a Diebold and Mariano test, this difference is not statistically significant. ∎

Appendix 2 - Construction of a composite employment indicator from business tendency surveys

In most business tendency surveys, balances of opinion are available on past or expected employment.

A composite indicator of employment can be constructed from a static factor analysis of these balances of opinion. Using this method, the behaviour of several variables can be summarised in a single unobserved variable, which represents the common trend in the balances considered.

Static factor analysis assumes that at each date t, the balance of opinion (S_{it}) is represented as the sum of a term proportional to the common factor (F_t) and a component specific to each balance (u_{it}):

$$S_{it} = \lambda_i F_t + u_{it}$$

The common factor is therefore written as a linear combination of balances of opinion:

$$F_t = \sum \omega_i S_{it}$$

The terms ω_i are the coefficients associated with the balances of opinion and these terms, called loadings, track the correlation between a given balance and the common factor.

Choice of balances and estimation period

The main difficulty in preparing this composite indicator lies in the different periodicities of the balances of opinion to be combined and the dates when they are available. In addition to the fact that some surveys are not monthly (surveys on wholesale, small construction companies and civil engineering), the balances of opinion on employment in the other surveys have also changed their periodicity over time. For example, balances on employment in the services survey have been monthly only since June 2000, the date when the survey became monthly (*Table 1*).

Table 1 - Balances of opinion on employment available in business tendency surveys

Survey	Balance of opinion "past employment"		Balance of opinion "expected employment"	
	1st disponible point	Frequency	1st disponible point	Frequency
Services	January 1988	Monthly since June 2000; quarterly before	January 1988	Monthly since June 2000; quarterly before
Industry	April 1976	Monthly since January 2003; quarterly before	April 1976	Monthly since January 2003; quarterly before
Retail trade	January 1991	Monthly since March 2000; bimonthly before	Janaury 1991	Monthly since March 2000; bimonthly before
Wholesale trade	July 1979	Bimonthly	July 1979	Bimonthly
Building industry	April 1975	Monthly since September 1993; quarterly before	January 1975	Monthly since September 1993; quarterly before
Small construction companies	January 1991	Quarterly	October 1990	Quarterly
Civil engineering	January 1974	Quarterly		

Source: INSEE

Only the monthly balances are selected

To calculate a common monthly employment factor, it seemed preferable to select only monthly balances. Taking quarterly balances into account would mean extending them in the months for which they are not available in order to have monthly series, thus increasing the probability of having to revise the indicator once the quarterly balance is known. In addition, the sectors concerned (civil engineering, wholesale trade) account for only 7% of employment in the non-farm market sector.

#### In services, temporary employment activity can be distinguished

Temporary employment activities are part of the scope of the services survey. However, the temporary employment sector has its own specific economic outlook compared with the other sectors (*Box 1*), due to the nature of this type of work, which in particular adjusts more quickly to fluctuations in activity (Argouarc'h *et al.*, 2010). The services survey reflects this situation well (*Graph*): the balance on expected employment increased much earlier for temporary employment than for services excluding temporary employment after the 2008-2009 crisis. For this reason, balances used to calculate the common factor for employment are not calculated for services as a whole. Instead we use balances for "services excluding temporary employment" on the one hand, and those for temporary employment on the other.

The composite indicator is estimated for the period 2003-2016 then backcast from 1991

As the balances of opinion on employment in the services, industry, retail trade and building industry business tendency surveys have all been monthly since 2003, the parameters of the composite indicator are estimated for the period 2003-2016. Once the parameters are calculated, they are applied to the balances of opinion from 1991 to 2003, after linear interpolation of the series that were quarterly before 2003. Lastly, the composite indicator is standardised across the entire period, which starts in 1991, so that it has a mean of 100 and standard deviation of 10 (same convention as for the business climates).

Balances of opinion on expected change in employment in services excluding temporary work and in temporary work
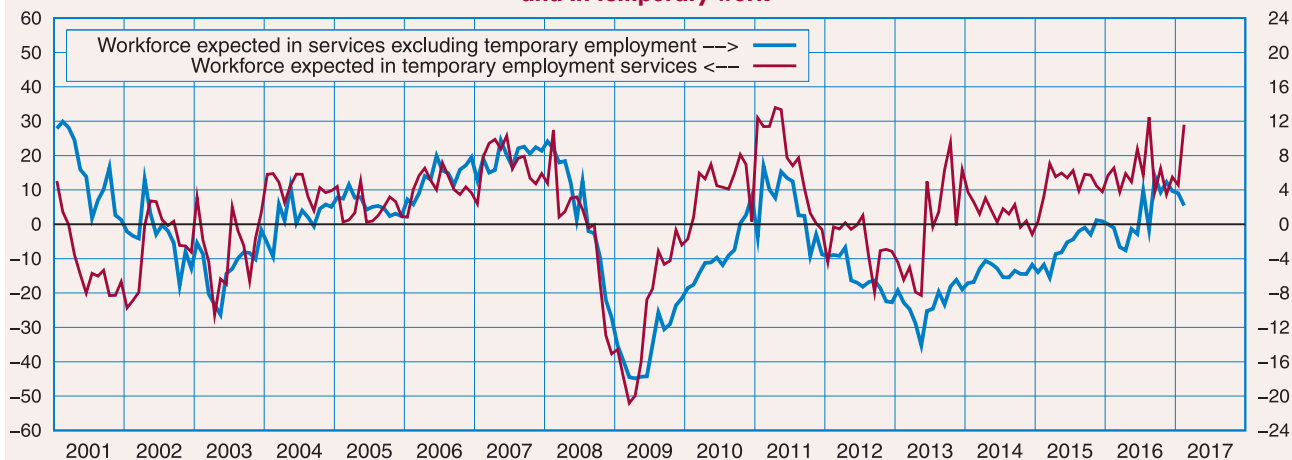
Note: For the temporary employment indicator, this is the balance without a workforce weighting, which is far smoother and more readable than the weighted balance due to the strong concentration in the sector.

Source: INSEE, business tendency survey in services

Quality of the indicator obtained

The common factor obtained from 10 balances on past and expected employment in the four surveys (services, manufacturing industry, retail trade and building industry) proved satisfactory in that on the one hand, all the loadings associated with the balances appeared high (*Table 2*). On the other hand, the composite indicator constructed in this way appears to be readable and correlated with the quantified measure of employment. ∎

Table 2 - Coefficients and loadings associated with balances of opinion to calculate employment factor

	Coefficients		Loadings	
	Past employment	Expected employment	Past employment	Expected employment
Services except temporary employment	0.26	0.33	0.95	0.96
Temporary employment	0.05	0.05	0.74	0.76
Industry	0.09	0.10	0.86	0.87
Retail trade	0.07	0.08	0.83	0.84
Building industry	0.03	0.04	0.61	0.70

Note: Loadings show the correlation between the balance being considered and the common employment factor.
Source: INSEE, business tendency surveys and calculations