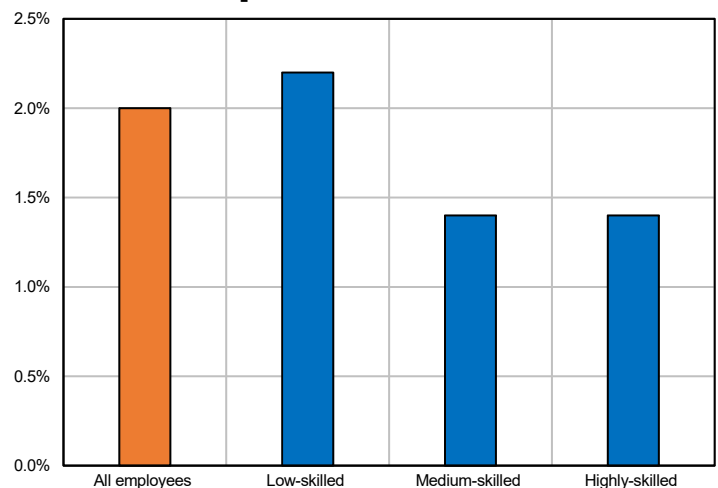


Can low-skilled workers benefit from innovation in France?

- Over the last two decades in France, employment of low-skilled workers has fallen sharply compared to skilled employees. Between 2003 and 2018, the number of employees with a level of education less than or equivalent to the first cycle of secondary school decreased by 42% whilst those having graduated from higher education rose by 64%. Unemployment among low-skilled workers, which was twice as high as that for graduates in 2003, is now three times higher.
- Technological change puts a drag on the employment of low-skilled workers in relative terms. It very often complements abstract tasks by boosting their productivity and makes low-skilled jobs which include many routine manual tasks easy to automate. By altering labour demand according to qualification levels, technological progress widens the wage gaps between low-skilled and highly-skilled workers.
- Nevertheless, a recent survey using British data conducted by the economists P. Aghion, A. Bergeaud, R. Blundell and R. Griffith has revealed that low-skilled workers are better paid when they work for innovative firms. Low-skilled workers benefit from working for a firm that invests in R&D even more than highly-skilled employees do.
- Similar results are obtained when this study is reproduced with French data. In innovative firms, low-skilled workers have a wage premium that is higher than for more skilled employees. The impact is however less pronounced than in the British case.
- These outcomes should be viewed in light of lower demand for low-skilled labour in innovative firms. Among the 5% most R&D intensive firms, low-skilled employees are on average 3.5 times less numerous than highly-skilled ones. Conversely, they are five times more numerous on average in non-innovative firms. This means that employees receiving these substantial wage gains only account for a small proportion of low-skilled workers in the labour market.

Wage gain from working in a highly innovative firm based on qualifications in France



Source: Authors' estimates.

How to read this chart: A low-skilled employee working in the 5% most innovative firms earns an average of 2.2% more than a worker with identical individual features who is employed by a non-innovative firm.

1. The contribution of technological change to labour market polarisation

Innovation fosters growth and most advanced economies roll out innovation support policies such as tax incentives or direct funding as part of broader industrial strategies.¹ However, the impact of innovation is not restricted to speeding up productivity.

As from the 1990s, with growing labour market polarisation, greater interest was paid to the distributional consequences of technological change.² The conclusion was that technological progress does not reduce the total stock of jobs but distorts the structure of employment. New technologies enable capital to replace workers, most often low-skilled ones, who carry out routine manual tasks that can be easily automated, whilst requiring more higher-skilled employees for abstract tasks. All else being equal, this structure effect drives wage inequalities up, including in France.³

Between 2003 and 2018, the number of workers with a level of education less than or equivalent to the first cycle of secondary school fell by 42% whilst employees who are higher education graduates jumped by 64%. Unemployment

among low-skilled persons is now three times higher than among those who are highly qualified, whereas the figure was only the double in 2003.

Besides the impact of demand for qualifications, some low-skilled workers do nevertheless benefit from the heightening of innovation. This is borne out by analysis carried out by P. Aghion, A. Bergeaud, R. Blundell and R. Griffith (2019)⁴ using British data. Innovative firms (with more than 400 employees) are identified as those having reported R&D expenditure for at least one year between 2004 and 2015. A comparison of the average wages of employees of innovative and non-innovative firms based on qualifications required for the various occupations allows for econometric testing of the differential impact of R&D intensity on wages based on qualifications.

The conclusion is that workers in low-skilled occupations in the most R&D intensive firms earn 12% more than workers in firms that do no R&D. This wage gain is 3% for workers in high-skilled occupations.

2. In France, lowest-skilled workers earn slightly more in innovative firms

The divergences with the British economy, for instance as regards the workings of the labour market and the extent of venture capital, mean that these results cannot be transposed to France without a specific study using French data.⁵ To this end, a sample of 682,355 employees was established.⁶ They were monitored between 2009 and 2014 in 318,442 different firms.⁷ Information is available on the specific features of each individual (age, gender, socio-economic classification, etc.), his/her job (part-full time,

number of hours worked, wages), as well as the characteristics of his/her employer (SIREN number, headcount, R&D expenditure).

An examination of the average features of workers highlights a substantial variation in wages between employees of innovative firms and those of non-innovative ones, which is slightly higher for low-skilled workers

(1) In France, innovation subsidies represented €9.4bn in 2017 (€7bn in indirect subsidies – €6.3bn of which was for the Research Tax Credit (CIR) – and €2.4bn in direct subsidies). For a full overview of innovation subsidies in France, refer to the Lewiner Report, *Les aides à l'innovation en France*, March 2018.

(2) Using American data, see Katz L. and K. Murphy (1992), "Changes in relative wages, 1963-1987: supply and demand factors", *The Quarterly Journal of Economics*, 107(1), 35-78; Autor D., Levy F. and R. Murnane (2003), "The Skill Content of Technological Change: An Empirical Exploration", *The Quarterly Journal of Economics*, 118(4), 1279-1333. Using French data, see Maurin E. and D. Thesmar (2004), "Changes in the Functional Structure of Firms and the Demand for Skill", *Journal of Labor Economics*, 22(3), 639-664; Charnoz P. and M. Orand (2017), "*Progrès technique et automatisation des tâches routinières, une analyse des marchés du travail locaux en France*", *Économie et Statistique*, 497, 103-122.

(3) Reshef A. and F. Toubal (2019), "*La polarisation de l'emploi en France : ce qui s'est aggravé depuis la crise de 2008*", *Éd. Rue d'Ulm*.

(4) Aghion P., Bergeaud A., Blundell R. and R. Griffith (2019), "The Innovation Premium to Soft Skills in Low-Skilled Occupations", Banque de France WP 739.

(5) The transposition of Aghion et al's model (2019) using French data is explained in detail in a working document from the Directorate General of the Treasury: Faquet R., Mas C. and G. Roulleau (2020), "*L'innovation en France peut-elle bénéficier aux salariés peu qualifiés ?*", *DG Trésor working document no. 2020/3*.

(6) The sample originates from matching the annual declaration of workforce data (DADS) bases and the Research Tax Credit Management Base (GECIR).

(7) As a comparison, Aghion et al's work using British data involves 7,370 firms and 186,000 employees. Whilst our sample encompasses all company sizes, Aghion et al's is limited to firms with more than 400 employees.

(average of 13% compared to 11% for highly-qualified employees).

These wage gaps are combined with other characteristics that differentiate workers in innovative firms, which are similar to those which were identified using British data (See Table 1). Men are the predominant employees in

innovative firms and more often work full-time. The average number of employees of innovative firms is more than ten times higher than that of companies that never incur R&D expenditure. There are more least-skilled workers, including in innovative firms but their proportion is significantly lower.

Table 1: Characteristics of employees in innovative and non-innovative firms for 2014

Innovative firm	Yes	No
Gross hourly wage (€)	23.6	17.7
Age	42.8	42.3
Proportion of men (%)	64.7	54.4
Full-time (%)	87.3	81.2
Average number of employees (individuals)	14,046	1,074
Seniority	9.4	8.2
Proportion of low-skilled workers (%)	44.4	66.5
Proportion of highly-skilled workers (%)	32.3	13.8

Source: DADS "all employees" panel 2014 and GECIR 2009-2014. Calculations: DG Trésor.
How to read this table: In 2014, around 64.7% of employees of innovative firms were men.

Using French data, the econometric outcomes confirm that the wage premium from working for an innovative firm, which is noted irrespective of qualifications, is slightly higher for low-skilled workers. The estimate (See Box 1) shows that employees of the most innovative firms (i.e. the 5% with the highest R&D intensity) earn, on average, around 2.0% more than those working for non-innovative firms. This premium is a little more if the individual is low-skilled: the wage gain is 1.4% for highly-skilled and medium-skilled employees, and 2.2% for low-skilled workers. Although these results are significant from a statistical standpoint, they are quantitatively low and less pronounced than in the British case. In the United Kingdom (Aghion *et al.*, 2019), a worker in an R&D intensive firm earns around 8% more than

if he/she worked in a firm that does no R&D, with the gain ranging from 3% for workers in high-skilled occupations to 12% for those in low-skilled ones (8% for medium-skilled workers). French data therefore highlights that not only is the wage premium for working in a highly-innovative firm lower on average than in the UK, but also that the relative gain for low-skilled workers compared to more skilled employees is more moderate. These gaps do not appear to be related to the specific fields of the firms sampled by the two studies. The wage premium is even lower when small and medium-sized enterprises are excluded from the French study.⁸ This means that they could rather be interpreted as variations in the workings of the labour market or the distribution of value.⁹

Box 1: Econometric model

A regression with panel data of the hourly wage (in logarithm) on R&D intensity (defined at firm level as the ratio of R&D expenditure to its total number of employees, in logarithm) is estimated, controlling for other variables that could account for the wage differentials between firms (age, seniority, firm's number of employees, full-time dummy variable). The impact of R&D intensity on wages is allowed to vary according to qualifications (LS dummy variable for low-skilled workers and MS for medium-skilled workers), on the basis of the following specification:^a

$$\ln(\text{wage}_{it}) = \beta_1 \text{IntRD}_{ft} + \beta_2 \text{IntRD}_{ft} * \text{LS}_i + \beta_3 \text{IntRD}_{ft} * \text{MS}_i + \beta_4 \text{Age}_{it}^2 + \beta_5 \text{Seniority}_{it} + \beta_6 \text{Seniority}_{it}^2 + \beta_7 \text{Employees}_{ft} + \beta_8 \text{Fulltime}_{it} + \beta_9 \text{LS}_i + \beta_{10} \text{MS}_i + \gamma_i + \eta_t + e_{it}$$

a. See Faquet R., Mas C. and G. Roulleau (2020), *op. cit.* The working document details a large number of robustness checks and discusses the methodological limitations of this estimate.

(8) And, in this case, the wage premium for low-skilled workers is the same as for highly-skilled employees. See Faquet R., Mas C. and G. Roulleau (2020), *op. cit.*

(9) Several assumptions could be put to the test: a lower distributable surplus for French innovative firms, less distribution of the surplus of French innovative firms to their employees, pay scales that are subject to more constraints in France due to the extension of occupational sector agreements, etc.

3. These distributional consequences call for a combining of support for innovation and training policies

There is a complicated relationship between technological change and wage inequality. The fact that innovation by a company benefits its unskilled workers is only one of the aspects of the issue.

Higher wages in innovative firms must be set against the backdrop of slacker demand for low-skilled labour from these firms. In the 5% most R&D intensive firms, there are, on average, 3.5 times less low-skilled workers than highest-skilled employees. This means that employees receiving these substantial wage gains only account for a small proportion of low-skilled workers in the labour market.

The shift in the productive specialisation of the French economy¹⁰ towards R&D intensive activities is cutting back

demand for low- and medium-skilled workers in both industry and the services. Innovation support policies are justified by the fact that these strategies help bolster competitiveness and generate productivity gains to increase the population's standard of living in the medium term. They must be combined with policies to foster transition on the labour market. Not only should initial and vocational training enable employees to obtain the skills required to work in innovative firms, but intra- and inter-sector mobility between occupations should be prioritised to allow less-skilled workers to secure better paid positions in sectors experiencing the most momentum.

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(10) For a detailed overview of changes to the French economy's productive specialisation during the last decade, see Faquet R., Rachiq C. and L. Le Saux, (2019), "Composition and competitiveness of the French economy", *Trésor-Economics* No. 248.

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