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Explaining productivity losses observed in France since the pre-Covid period

Since 2019, labour productivity in France has fallen by 8.5% relative to the pre-Covid trend, as job creation has outpaced GDP growth. The analysis set out in this paper accounts for just over one-half of this loss. The main permanent factors are extensive use of apprenticeships (1.2 percentage points [pp]) and a workforce composition effect (proportionally larger increase in unskilled labour, worth 1.4 pp). These factors are however partially positive, reflecting a public policy focus on employment, which has shown excellent resilience, rather than a decrease in potential wealth creation in France. Conversely, the Covid crisis is estimated to have depressed this potential by reducing productivity by 0.4 pp. Temporary factors, primarily labour hoarding in some sectors, account for 1.8 pp of the fall.

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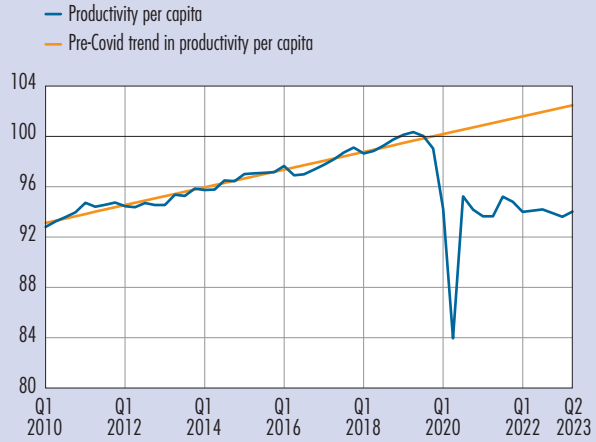
8.5%
loss of apparent market productivity in the second quarter of 2023 relative to the pre-Covid trend

3.1 percentage points
the permanent loss of productivity due to a larger proportion of low-skilled workers in the composition of employment, apprenticeships and lockdowns

1.8 percentage points
the temporary loss of productivity due primarily to labour hoarding

Drop-off in French labour productivity
(Q4 2019 of the pre-Covid trend = 100)



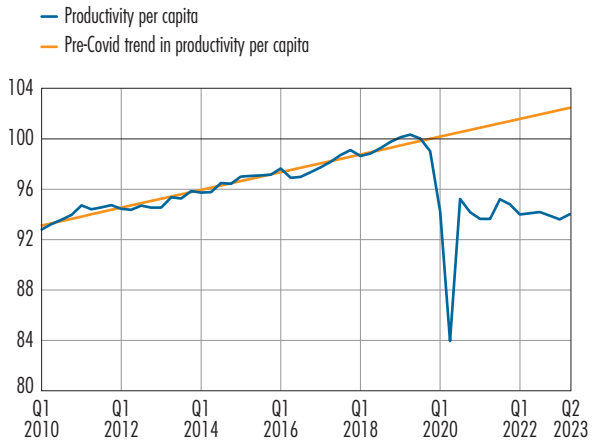
Sources: INSEE, Banque de France calculations.
Scope: Productivity of employees and self-employed workers in market sectors.
Note: Labour productivity is defined as the ratio of real value added to total employment in market sectors.

Since 2019, apparent labour productivity has fallen markedly in France. Defined here as the ratio of value added produced to the number of people employed, labour productivity in market sectors was 5.2% below its pre-Covid level (final quarter of 2019) in the second quarter of 2023. The loss increases to 8.5% if actual productivity is compared to the level that would have been reached had productivity per capita continued to grow from early 2020 at a pace comparable to that recorded over the 2010-2019 period (see Chart 1). It reflects the fact that job creation far outpaced the economy's rate of wealth creation. Other euro area countries also experienced productivity drops, but the scale and persistence of France's disconnect are surprising. In Spain, while the decrease was initially on a par with that of France, it became much smaller from the second quarter of 2022 onwards. In Germany, the gap has been narrow since the end of 2020. Overall, the average gap between productivity per capita in market sectors and the pre-Covid trend was just –2.4% in the euro area in the second quarter of 2023.

What is behind this situation? This paper proposes a partial quantification exercise that links the observed productivity drop to a variety of temporary or permanent causes (see Table 1).[1] Among the causes with lasting effects, we consider increased employment of apprentices, workforce composition changes and lockdown-related effects. Together, these factors account for 3.1 percentage points (pp) of the fall in productivity per capita. Among the temporary factors, which are responsible for 1.8 pp of the loss, labour hoarding in sectors facing a temporary drop in business make up the lion's share (1.7 pp). These combined factors account for just over half of the observed decline in labour productivity. After playing a major role at the height of the health crisis, by reducing working time and hence productivity per capita, assuming unchanged hourly productivity, other factors such as sick leave and the French job retention scheme either no longer contribute or contribute only marginally to the productivity drop-off. Ultimately, a significant share of the fall, even that linked to permanent factors, does not reflect a loss of French productive potential, but rather increased employment intensity of gross domestic product (GDP) growth via a switchover effect between productivity and labour.[2]

C1 Drop-off in French labour productivity

(Q4 2019 of the pre-Covid trend = 100)



Sources: INSEE, Banque de France.
Scope: Productivity of employees and self-employed workers in market sectors.
Notes: Labour productivity is defined as the ratio of real value added to total employment in market sectors.
Pre-Covid growth in productivity per capita is estimated at 0.7% annually over the 2010-2019 period.

T1 Decomposition of productivity per capita losses in the second quarter of 2023, market sectors

(as a deviation from the pre-Covid trend, in percentage points)

	Contribution to the loss of productivity per capita
Apprenticeship	1.2
Workforce composition	1.4
Permanent effects of the Covid crisis	0.4
Posted workers and regularisation of undeclared work	0.1
Sector composition	0.0
Total permanent losses	3.1
Sector labour hoarding	1.7
Job retention scheme	0.1
Sick leave	0.0
Total temporary factors	1.8
Unexplained factors	3.6
Grand total (as a %)	**8.5**

Source: Authors' calculations.

1 Our analysis disregards the productive capital stock. Since the Covid crisis, this stock has grown vigorously compared with value added, which theoretically should have helped to support apparent productivity. However, this variable could be subject to measurement challenges in the national accounts, particularly as regards the recognition of intangible capital.

2 Garnier and Zuber (2023) make this point, with reference to a cross-country comparison.

1 Permanent productivity losses linked to strong growth in apprenticeships, a larger proportion of low-skilled workers in the composition of employment, and lockdown effects

The increase in apprenticeship employment since late 2019 contributed an estimated 1.2 pp to productivity losses

Employment subsidies for apprentices reduce productivity by an estimated 1.2 pp over the medium term. Measurement of this effect, which is performed for three age brackets (under 18s, 18 to 20, and 21 to 25), is based on an estimate of the decrease in the unit labour cost (ULC) of jobs earning France's standard minimum wage (including apprentices) and on the elasticity of employment to labour cost,[3] which makes it possible to determine the net impact on employment and on value added (see Appendix 1). The net impact on employment stems from the fact that the apprenticeship scheme lowers the effective cost of labour and should therefore stimulate total employment. The number of minimum wage jobs, including apprentices (4 million), rose by 11.5% due to the scheme in 2023, or approximately 460,000 jobs (see Table 2). The previous scheme had already raised employment by 5.2%, or roughly 140,000 jobs, at the end of 2019. After the impact of the old scheme is taken out, the effect of the enhanced new scheme is found to be approximately 320,000 people, or 1.6% of total employment in market sectors.

The increase in net employment is also estimated to cause an increase in value added (VA) over the medium term, which mitigates the effect of the increase in employment on productivity. The increase in VA results from the fact that apprentices are a source of positive productivity, if less so than minimum wage employees: the productivity of apprentices is estimated to be 0.5 × 0.95 × 0.75 = 0.36[4] times that of other jobs, while the productivity of other minimum wage earners is estimated to be 0.5 times that of other jobs. Recognising the effect of the increase in employment on VA mitigates the impact of increased apprenticeship on productivity per capita by 0.4 pp, with the result that the rise in apprenticeship accounts in the end for just 1.2 pp of the productivity loss. Appendix 1 provides detailed calculations.

T2 Estimated net effect on employment linked to the upturn in private apprenticeships

	Minimum wage employees and apprentices (in millions)	Effect of the decrease in the cost of labour on employment (as a %)	Net effect on employment (in thousands)
a) Q4 2019	2.7	+5.2	139
b) Q2 2023	4	+11.5	461
Net effect on employment (b – a)			**322**

Source: Authors' calculations.

Skill composition effects connected with the employment of people who have been out of the labour market for a prolonged period or of low-skilled workers account for an estimated 1.4 pp of the loss

The brisk employment growth observed in France is leading to rapid changes in workforce composition that could depress apparent labour productivity. In addition to the dynamics specific to apprenticeship (see above), the entry into employment of people who have been out of the labour market for a prolonged period or of low-skilled workers has a downside impact on measured productivity. This factor may have a transitional component: the productivity of new recruits improves as they are trained in their positions or as they are steered towards jobs that better suit their skills. It may also be cyclical in nature: low-skilled jobs suffer more from destruction during economic downturns, but see more creation than higher-skilled positions during upswings. Finally, this factor may have a more permanent dimension if employment growth is linked to a structural change in the composition of employment, for example due to reforms intended to get people who are the

3 Parameter measuring the percentage change in employment in the event of a 1% shock to the cost of labour.

4 The productivity of minimum wage employees relative to that of other employees is estimated at 0.5, which corresponds to the ratio of the cost of minimum wage labour to the cost of labour at the median wage in 2018. This is multiplied by the productivity of apprentices relative to minimum wage employees (0.95) and by the effective workload of apprentices relative to that of full-time equivalent (FTE) employees (0.75).

most excluded from the labour market, who also tend to be the lowest-skilled workers, back into employment. The "Macron" labour law executive orders of 2017, which reformed collective bargaining law by giving primacy to company agreements in a number of areas relating to dismissal terms, and the employment insurance reforms of 2019 and 2023, for example, may have caused effects of this kind.

Between the fourth quarter of 2019 and the second quarter of 2023, the French employment rate rose considerably, even when the contribution from the increase in apprenticeship is stripped out. While a small portion of the increase, linked to transitional factors, is expected to fade, a large portion reflects a structural change and could therefore prove permanent. Thus, the long-term trend in the employment rate among people aged 15-74, referred to as the "potential employment rate", is expected to remain 2.8 pp above the pre-Covid level on a three-year horizon. This increase is likely to have a structural impact on workforce composition, which would be associated with a lasting decrease in productivity.

Bourlès et al. (2012) quantify the effect of workforce composition on productivity. They estimate that, on average, a 1 pp increase in the employment rate is associated with a 0.5% decrease in apparent productivity.

Based on this semi-elasticity, applied to the 2.8 pp increase in the potential employment rate, workforce composition effects could thus account for 1.4 pp of the decrease in productivity per capita, which would be treated as permanent.

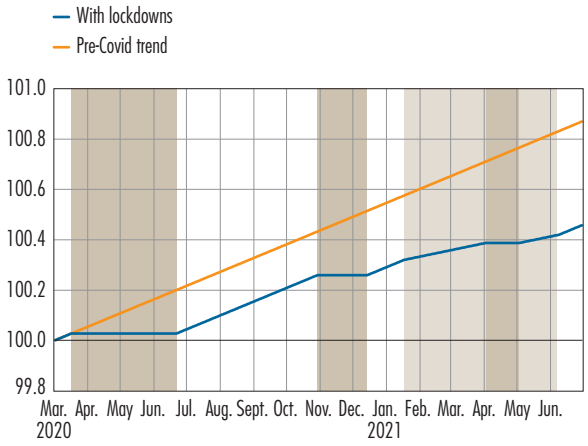
The direct long-term effect of Covid-related health policies is assessed at 0.4 pp

The long-term effects on French productivity linked directly to the Covid-19 pandemic and the policies implemented in 2020 and 2021 to respond to the crisis have multiple potential causes, such as disruptions to value chains and to educational and vocational training, and long-term crowding-out of investment by government debt. At the same time, policies designed to support the economy, such as the job retention scheme and state-guaranteed loans, helped to mitigate much of the shock's impact on companies and households. The crisis also fostered innovation and tech investments, notably connected with the rise of online commerce, and promoted work-from-home arrangements, which could have positive effects over the long run. While the long-term productivity impact of the Covid crisis, which was unprecedented in its nature and magnitude, is inherently hard to quantify, a simple approach linking long-term productivity losses to the periods during which business activity was interrupted (full and partial lockdowns) offers an initial assessment, without seeking to identify the channels through which the economy was impacted. Subject to the assumptions detailed below, the result is a long-term productivity loss of 0.4%.

Echoing the physical capital approach, productivity is modelled as a stock of knowledge or human capital, which accumulates innovation flows over time. Unlike physical capital, however, this stock does not depreciate. Trend productivity gains in the market sector, estimated at 0.7% annually on average over the pre-crisis decade, reflect the accumulation of human capital in normal times. During days covered by full lockdowns, accumulation halts. During days when business activity is partially disrupted by targeted lockdowns, accumulation is halved. Chart 2 summarises the calculation.

C2 Impact of full and partial lockdowns on trend hourly productivity in the market sector

(1 March 2020 = 100)



Source: Authors' calculations.
Note: Full lockdowns (including periods during which restrictions are gradually lifted) are shown in dark brown and partial lockdowns in light brown.

Obviously, the calibration applied here (zero gains during full lockdowns, 50% reduction during disruptions), the linear link between loss and duration assumed here for the sake of simplicity and transparency, and the lack of a catch-up effect, are open to question. Furthermore, the analysis excludes a host of factors that could cause delayed effects or impacts that are magnified over the long run, including government debt and education. Accordingly, these estimates are subject to considerable uncertainty.

2 Temporary labour hoarding accounts for part of the productivity drop-off

Four sectors are identified as experiencing potential temporary labour hoarding effects (see Table 3): transportation equipment manufacturing, construction, accommodation-food services and information-communication. After correcting for permanent factors and temporary effects related to the job retention scheme, overstaffing in these sectors is estimated at roughly 360,000 jobs in the second quarter of 2023 and reduced productivity by 1.7 pp.

This estimate is based on the identification of sectors exhibiting overstaffing as well as a profit margin below the pre-crisis level. To this end, overstaffing[5] is defined for each sector based on the deviation in productivity per capita relative to its past trend. Next, these excess positions are corrected for jobs resulting from other effects estimated in this study (see Table 1).

T3 Estimated labour hoarding in the second quarter of 2023, by sector

	Deviation from productivity per capita trend (as a %)	Estimated overstaffing excluding other effects (in thousands of jobs)	Difference in profit margin relative to 2018 (in percentage points)
Transportation equipment manufacturing	-25.9	40	-9
Construction	-15.5	236	-1
Accommodation and food services	-8.7	74	-16
Information and communication	-4.2	10	-6

Source: Authors' calculations.

Available sector information is integrated. The selected sectors exhibit residual overstaffing and recorded a profit margin during the second quarter of 2023 that was below the average observed in 2018.

3 Other regularly mentioned factors have weak explanatory power and leave much of the fall unaccounted for

Posted workers and regularisation of undeclared work have a minor impact

The Covid-19 crisis and measures implemented to support companies during that period, labour shortages and stepped-up inspections and contribution adjustments by the bodies in each French *département* responsible for collecting social security and related contributions (URSSAFs), incentivised firms to i) regularise undeclared workers and ii) replace foreign posted workers with local employees. These factors, which chiefly affected industry, construction, retail trade, accommodation-food services and road transportation, led to an increase in recorded employment, without any change in the quantity of labour actually used by French companies. However, the overall effect was modest, contributing around 0.1 pp to the loss of productivity (see Appendix 2).

The job retention scheme and sick leave similarly played a small role

The job retention scheme and sick leave automatically impact productivity per capita (but not hourly productivity). The effect of the job retention scheme, measured based on data from the French Labour Ministry's Directorate for Research, Studies and Statistics (DARES), has grown very weak, accounting for a mere 0.1 pp of the fall in productivity. The impact of sick leave, measured based on daily compensation expenditures published by France's national health insurance scheme (CNAM) and deflated by wage inflation at the level of the minimum wage, is close to zero (see Appendix 2). However, in the most recent Banque de France survey on production conditions in manufacturing (see Lesterquy et al., 2024), 47% of surveyed companies reported an increase in absenteeism in 2023. It may therefore be that this factor

5 National accounts data on productivity per sector may be affected by the decrease in the share of temporary employment over the period. However, assessing the effect of temporary employment on productivity per sector goes beyond the scope of this study.

remains significant in some sectors, and especially in manufacturing, but is offset at the level of the overall market sector or, alternatively, is supported by causes other than sick leave. Whatever the case may be, the result suggests that there could be a small upside risk to the estimate provided in this study about the size of the effect.

Other possible reasons for the unexplained losses

This analysis supplements estimates by other institutions (see Appendix 3), which offer a number of possible avenues to account for the residual portion that is unexplained by our analysis, or some 3.6 pp of productivity losses. These were not selected, either because they overlap with factors already identified in our study, or because they could not be demonstrated quantitatively.

They include the record low number of corporate failures during the Covid crisis, which may have hampered the allocation of resources to the most productive companies,[6] or the decrease in the real cost of labour relative to the pre-Covid period, which may have encouraged companies to hire more. However, these factors, which are proposed by the *Observatoire français des conjonctures économiques* (French Economic Observatory – OFCE), overlap with some that we had already identified (labour composition effect and hoarding). Labour-intensive businesses may also have added market share. While this effect is not detectable at a sector level, it could nevertheless be substantial at a more granular level, based on company-level data, for example.[7] Increased numbers of self-employed workers on short working hours might also depress productivity per capita[8] in some sectors. This effect would be felt via the working time of self-employed workers, but would be hard to demonstrate owing to the lack of accurate measurements of working time for this type of employment. Last but not least, the Banque de France's most recent survey on production conditions in industry suggests that manufacturing productivity may also have been affected by higher raw material and energy costs and by hiring difficulties (Lesterquy et al., 2024).

⁂

Taken as a whole, the factors examined here account for just over half of the drop-off in labour productivity observed between the fourth quarter of 2019 and the second quarter of 2023 relative to the pre-Covid trend, i.e. 4.9 pp out of a total decrease of 8.5%, of which 3.1 pp linked to permanent factors. The main factors identified, namely increased use of apprenticeships, workforce composition effects and labour hoarding, suggest that this development had more to do with brisk employment growth than with a decrease in French potential wealth creation.

6 Aghion et al. (2019) in particular explore the link between financial constraints and productivity.

7 A study using data on Italian corporates (Banca d'Italia, 2023) covering the 2015-22 period finds that the decrease in productivity in 2021-22 could be partly due to composition effects, with more labour-intensive companies winning market share from more input-intensive companies.

8 "Uberisation" could also depress hourly productivity by increasing the share of low-skilled employment, but it is not clear that this trend became more pronounced post-Covid and, even if it did, this factor would be captured by the workforce composition effect described in section 1.

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Appendix 1
Long-term effect on productivity of the increase in apprenticeship employment: detailed calculations

This appendix begins by assessing the effect of the increase in apprenticeship employment on overall employment, before considering the impact on value added (VA) and productivity.

Effect on employment

The effect on employment in market sectors is obtained by calculating the decrease in the unit labour cost (ULC) of minimum wage jobs (including apprentices) compared with other types of jobs, based on the following elements, in the case of apprentices aged between 18 and 20:

- The relative cost of an apprentice, estimated at roughly 19% of the labour cost of a minimum wage employee. This cost factors in the specific remuneration of an apprentice in this age bracket and the average effective length of contracts (estimated at approximately 14 months based on arrival and departure flows until 2019) plus the first-year EUR 6,000 hiring subsidy;

- The relative workload of an apprentice compared with a full-time minimum wage employee, which is set at 0.75, because apprentices are required to be in training for 25% of the term of their contract. The national accounts record this as working time;

- The relative hourly productivity of an apprentice compared with a minimum wage employee, set at 0.95 (the productivity of minimum wage employees is itself assumed to be half that of the average for other jobs, see below);[1]

- The share of these apprentices in all minimum wage-earning jobs (including apprentices), or 8.2% on average.

According to these elements, the ULC of apprentices aged between 18 and 20 is considered to be equivalent to approximately 19% that of a minimum wage earner, for a ULC reduction of 81%. Given the employment share of these apprentices (8.2%), this results in a decrease in the ULC for all minimum wage earners (including apprentices) of approximately 6.1%. Applying an elasticity of employment to labour cost of 0.6[2] to the decrease in the ULC results in an impact on total net employment of minimum wage earners (including apprentices) of 3.6%.[3] The same approach is used to measure the employment effects of the apprenticeship schemes for people aged under 18 and over 21, leading to an overall impact on minimum wage earners, including apprentices, of approximately 11% (see Table A1 below).

In the medium term, the current scheme's expected impact on employment is calculated by multiplying its net average effect (11%) by the number of minimum wage-earning jobs (including apprentices, i.e. approximately 4 million people in the second quarter of 2023[4]), which corresponds to an effect of 461,000 people. To identify the effect resulting from

1 When the relative workload of apprentices (0.75) is factored in, the hourly productivity of apprentices is 2.8 times lower than that of other employees (1 divided by 0.75 x 0.5 x 0.95), which is in the upper range of existing estimates. Fougères and Schwerdt (2001) and DARES (2023) find it to be lower by a factor of 4 and 3.7 respectively.

2 Apprentices are assumed to exhibit a higher elasticity of employment to cost of labour than average elasticity, which is estimated at 0.5 in the Banque de France's macroeconomic forecasting model (FR-BDF), because they are less skilled than the average employee (if skills are assessed by experience and qualifications). Likewise, apprentices who are still minors have fewer qualifications and are assumed to exhibit a higher elasticity of employment to cost of labour than adult apprentices.

3 This is a partial equilibrium calculation that does not take into account, for example, the scheme's downside effect on value added (VA) prices, substitution effects that could lower employment of other employees, or the positive impact on market VA.

4 The number of minimum wage employees is estimated at 3.1 million on 1 January 2023, while the stock of private sector apprentices is estimated at 921,000 in the second quarter of 2023.

TA1 Estimated effect of the 2023 apprenticeship scheme on minimum wage jobs (including apprentices), in market sectors

(%)

Age bracket	Under 18	From 18 to 20	From 21 to 25
Share of apprentices aged under 26 (2022)	19	36	45
a) Total cost of an apprentice including exceptional assistance (as a % of a minimum wage employee)	3	19	29
b) Relative workload	0.75	0.75	0.75
c) Productivity of an apprentice compared with a minimum wage employee	0.95	0.95	0.95
d) Hourly ULC of apprentices (% of ULC at minimum wage = a / (b x c))	4.7	26.3	40.3
e) Share of apprentices in minimum wage jobs including apprentices	4.3	8.2	10.3
f) Decrease in hourly ULC of minimum wage jobs including apprentices (as a %) = e x (1 – d)	4.1	6.1	6.2
g) Elasticity relative to labour cost	1	0.6	0.6
h) Net employment effect = f x g	4.1	3.6	3.7
Net overall effect on minimum wage jobs (including apprentices)		**11.5**	

Source: Authors' calculations.
Guide: The apprenticeship scheme in place in 2023 resulted in a 16.4% decrease in the labour cost of minimum wage jobs (including apprentices) (sum of line f). The decrease in the cost of labour drove an increase in the volume of minimum wage jobs (including apprentices) of 11.5% (sum of line h with rounding).
Notes: The net effect on employment is greater for people under 18 because the cost of labour (before and after assistance is included) is lower, and because elasticity relative to the cost of labour is assumed to be higher for this age bracket, which is assumed to be less skilled (if qualifications are used as a proxy for skills).
ULC, unit labour cost.

steps to enhance the scheme compared with the 2019 scheme, we have to take out the jobs impact of the old scheme, which amounted to 139,000 people (based on the same approach, a net average effect of 5.2% is observed and applied to 2.7 million minimum wage earners and apprentices). The effect of boosting the apprenticeship scheme is thus assessed at approximately 320,000 additional net jobs in the medium term in market sectors relative to the pre-Covid period, representing an increase in total employment in these market sectors of approximately 1.6%.[5]

Effect on value added and productivity

This section assesses the effect of the increase in employment and the compositional change on value added (VA), which is then used to identify how modifying the scheme affects productivity. The approach here is based on the simplifying assumption that VA depends in the long term on employment and its composition and that the capital stock remains unchanged. This analysis does not include a general equilibrium effect linked to the decrease in the price of goods produced resulting from the fall in the aggregate cost index for production factors. Likewise it does not include effects on any jobs other than those earning minimum wage.

Let

$$N = N_{app} + N_{minimum\ wage} + N_{other} = N_s + N_{other}$$

where total employment N is the sum of apprenticeship employment N_{app}, employment of minimum wage employees $N_{minimum\ wage}$ and other jobs N_{other}. N_s denotes minimum wage employment including apprentices.

Let a constant elasticity of substitution (CES) type production function

$$Y = \varphi.\left[\beta^{1/\sigma}.(N_{other})^{\frac{\sigma-1}{\sigma}} + (1-\beta)^{1/\sigma}.(E_{minimum\ wage}.N_{minimum\ wage} + E_{app}.N_{app})^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

be given where Y denotes production, σ is the elasticity

5 The scheme to assist in hiring apprentices was amended on 1 January 2023, causing the reduction in the labour cost of an apprentice to fall from approximately 87% of minimum wage in 2022 to 80% in 2023. Based on these elements, the net overall effect of the scheme on minimum wage jobs (including apprentices) is estimated to have decreased from 12.5% to 11.5% in 2023, which is the percentage shown in Table 2.

of substitution of production factors, β is a distribution parameter, φ is an efficiency parameter and the two parameters E (indexed by *minimum wage* and *app*) are parameters for the relative efficiency of minimum wage jobs and apprentices compared to other jobs. These two types of jobs (minimum wage and apprentices) are assumed to be perfectly substitutable.

The impact of the increase in apprenticeship employment linked to the scheme in place in 2023 compared with the 2019 scheme is assessed in three stages:

1. We calibrate the production function for 2023, which we call Y_{2023} (2019 and Y_{2019} respectively), based on the volume of apprentices recorded in the second quarter of 2023 (fourth quarter of 2019 respectively). We obtain productivity per capita $prod_{2023} = (Y/N)_{2023}$ (resp. $prod_{2019} = (Y/N)_{2019}$);

2. We estimate production $\tilde{Y}_{2023}$ in a counterfactual world that assumes that the apprenticeship scheme does not exist in 2023 (2019, $\tilde{Y}_{2019}$ respectively), by calculating levels for different types of jobs in this counterfactual world. Employment $\tilde{N}_s$ is assumed to be $\tilde{N}_s = N_s (1 - \dot{N}_s)$, $\dot{N}_s$ being the net percentage effect of the apprenticeship scheme on minimum wage jobs including apprentices as measured in Table A1. Since employment of apprentices is zero in the absence of the scheme ($\tilde{N}_{app} = 0$), this covers minimum wage earners who are not enrolled in apprenticeships ($\tilde{N}_{minimum\ wage} = \tilde{N}_s$). N_{other} is assumed to be unchanged ($\tilde{N}_{other} = N_{other}$). We estimate VA and the corresponding productivity per capita $\widetilde{prod}_{2023}$ from these employment levels.

3. We measure the effect on production due to the scheme in place in 2023 and correct it for the effect attributable to the 2019 scheme. Let

$$\tilde{y} = \frac{prod_{2023} \Big/ \widetilde{prod}_{2023}}{prod_{2019} \Big/ \widetilde{prod}_{2019}} - 1$$

We normalise the productivity of other jobs to 1, and assume that the productivity of apprentices is worth $E_{app} = 0.5 \times 0.95 \times 0.75 = 0.36$ (see Table A2). The productivity of minimum wage employees is estimated at $E_{minimum\ wage} = W_{minimum\ wage} = 0.5$, which corresponds roughly to the ratio of the cost of minimum wage labour to the cost of labour at the median wage in 2018 (OECD, 2019). This is multiplied by the relative productivity of apprentices compared to minimum wage employees (0.95) and by the effective workload of apprentices relative to full-time equivalent employees (0.75).

Under these assumptions, we estimate that the apprenticeship scheme in place in 2023 results in an additional increase in VA of 0.4 pp relative to the 2019 scheme. The increase in value added is thus linked to the effect of the significant increase in apprentice employment, which surpasses the effect of the decrease in minimum wage jobs on value added despite their greater productivity.[6] Accordingly, the increase in apprenticeship employment is estimated to cause productivity per capita to fall by 1.2%, compared with 1.6% if VA is unchanged.

TA2 Data and parameters used to calibrate the production function

Year	2019	2023
N_{app}	432 k	921 k
$N_{minimum\ wage}$	2,250 k	3,100 k
N_{other}	20,253 k	21,789 k
W_{app}	0.5 x 0.42	0.5 x 0.2
$W_{minimum\ wage}$	0.5	0.5
W_{other}	1	1
σ	0.7	0.7
$E_{minimum\ wage}$	0.5	0.5
E_{app}	0.5 x 0.95 x 0.75	0.5 x 0.95 x 0.75
β	0.93	0.91
y	EUR 2,335 bn	EUR 2,350 bn

Sources: INSEE, DARES (Labour Ministry) and authors' calculations.
Note: W_s and E are obtained from the weighted average of minimum wage employees and apprentices. φ is estimated from the production function.
The β share is calculated using the following formula:

$$\frac{(W_{other})^{\sigma} N_{other}}{(W_{other})^{\sigma} N_{other} + E^{1-\sigma} (W_s)^{\sigma} N_s}$$

6 Since the number of other jobs N_{other} is assumed to be fixed, this increase in value added also leads to an increase in their apparent productivity, even if their efficiency is unchanged.

Appendix 2
Effects of posted work, regularisation of undeclared workers and sick leave

Posted workers and regularisation of undeclared workers

Posted employment, which is concentrated in construction and industry, shrank by 13,000 people, or 18%, between 2019 and 2022,[1] with industry especially affected (see table). Making the assumption that these jobs were replaced by domestic jobs that are counted in employment, this change is estimated to increase the share of employment, thereby lowering productivity.[2] Accordingly, the decrease in posted employment is estimated to result in a 0.06 pp decrease in productivity per capita.

Change in posted employment, by sector, between 2019 and 2022
(in thousands)

	2019	2022	Change
Agriculture	7	5	-2
Industry	25	17	-8
Construction	25	25	0
Services	15	13	-2
No data	1	0	-1
Total	73	60	-13

Source: DARES (Labour Ministry).

The method for estimating regularisations of undeclared workers is based on the percentages of undeclared workers estimated by the Central Agency of Social Security Organisations (ACOSS) using sector surveys conducted prior to the Covid crisis. These surveys show that during spot checks, the accommodation-food services, food retail, construction & public works, security and transportation sectors have the highest rates of non-compliant companies. The excess number of undeclared workers in these sectors relative to the national percentage is estimated at 180,000 jobs that could potentially be regularised.

This number can be used to estimate the effect by 2026 of enhanced inspections by the bodies in each of France's *départements* responsible for collecting social security and related contributions (URSSAFs), based on adjusted contribution amounts following these inspections. These amounts have increased by 11% since 2019, while employer social security contributions in market sectors have risen by 8.9% over the same period. Corrected for the steady increase in contributions, adjustments are therefore estimated to have risen by 2.1% over three years. If we project this increase at the same pace over a three-year horizon and assume that the effect of enhanced inspections is spread over time,[3] this would result in 9,000 regularised jobs over three years,[4] for a –0.04 pp effect on productivity.

Effect of sick leave

Since 2020, the health crisis has resulted in a sharp increase in sick leave. In the absence of official statistics on the number of hours not worked due to sick leave, we use daily compensation expenditures published by France's national health insurance scheme (CNAM) and deflated by wage inflation at the level of the minimum wage (see Chart a below) to measure this effect. A sharp increase is found in hours not worked between 2020 and 2022, which are well above their pre-Covid trend. The high rate of absences during this period contributed 0.6 pp to the decrease in hours worked per job (–4.4% on average between 2020 and 2022, largely due to job retention arrangements). However, the number of hours covered by sick leave compensation appeared to revert to the pre-Covid trend in early 2023. This was also the case for hours worked per job, which made a small positive contribution to the change in productivity

1 See "L'emploi de salariés détachés en 2022", *Dares Résultats*, No. 1, January 2024.

2 A maximum productivity impact is calculated in this study, assuming unchanged value added. National accounts data on productivity per sector may be affected by the decrease in posted employment over this period, via a reduction in inputs in the affected sectors, which theoretically affects value added. This effect, which is not included here, would mitigate the impact of the decrease in posted employment on the loss of productivity.

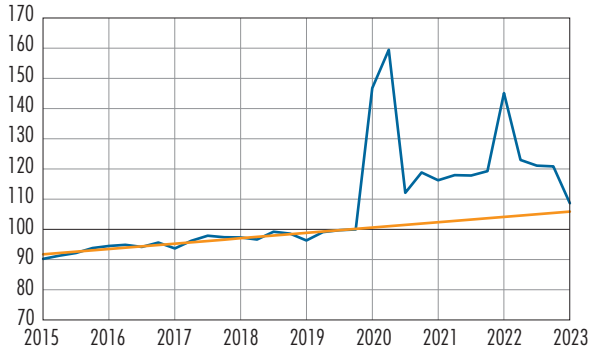
3 We also assume unit elasticity of regularisations to adjustments.

4 While this effect is of minor relevance in the analysis of the fall in the second quarter of 2023, we look at its possible rising importance in the coming years, because it would represent a factor with a permanent downside impact on productivity. We find that it remains extremely weak, even on a three-year horizon.

Effects of the increase in sick leave

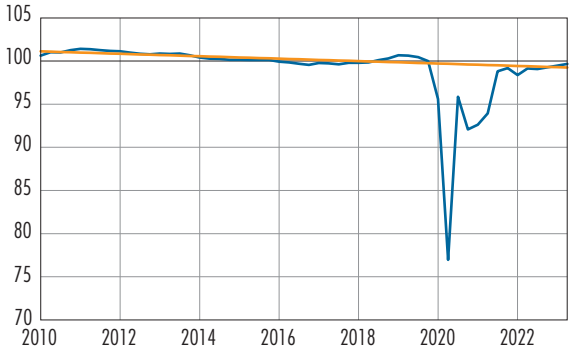
(Q4 2019 = 100)

a) Number of hours covered by sick leave, per job



Sources: INSEE, CNAM, authors' calculations.
Note: The Q1 2015-Q4 2019 trend is shown in orange; the most recent value is Q1 2023.

b) Number of hours worked per job, market sector



Sources: INSEE, authors' calculations.
Note: The Q1 2010-Q4 2019 trend is shown in orange; the most recent value is Q2 2023.

per capita in early 2023, when compared against the pre-Covid trend (see Chart b). The exceptional increase in sick leave thus appears to have been temporary and had already faded by early 2023. It does not account for the productivity losses observed in the second quarter of 2023. The possibility remains that sick leave is on an upward trend that predates the Covid crisis and is thus contributing to the ongoing decrease in the number of hours worked per job observed over a long period.

Appendix 3
Other published analyses of productivity losses

Other institutions have tackled the question of the fall in French productivity in recent publications, including the *Observatoire français des conjonctures économiques* (OFCE – French Economic Observatory), the *Institut national de la statistique et des études économiques* (INSEE – France's national statistics office), the *Direction de l'Animation de la recherche, des Études et des Statistiques* (DARES – the French Labour Ministry's Directorate for Research, Studies and Statistics) and Rexecode. Only the OFCE published a multifactor quantitative analysis comparable to the one presented in this article. Based on an econometric study at end-2022 (Heyer, 2023), the OFCE analysis was updated to the second quarter of 2023 in the October 2023 issue of "Perspectives économiques 2023-2024" (see the table below, which compares the findings to those of the Banque de France). In its December 2022 *Economic Outlook*, INSEE compares changes in French productivity (until the third quarter of 2022) to those in the euro area's other three major countries, offering a sector-by-sector analysis.

Among the various explanatory factors, all institutions highlight the increase in the number of apprentices. According to the OFCE, apprenticeship accounts for approximately 260,000 additional jobs, compared with our estimate of 322,000 (see Table 2). However, factoring in a positive impact on value added (see Appendix 1) results in an identical effect on productivity (1.2 pp). DARES estimates a "quality-adjusted" impact of apprenticeship on employment, which corresponds to a 1.3% decrease in productivity for the economy as a whole. INSEE, meanwhile, suggests that the rise of apprenticeships led to a 1.6% downturn in productivity in the non-farm market sector in the third quarter of 2022.

Rexecode alone stresses the dominant role of workforce composition effects (4 pp of productivity in the second quarter of 2023 including the effect of apprenticeships, which is far greater than the 2.6 pp identified in this paper for the two effects combined). More surprisingly, given the attention paid to this issue during the Covid crisis, no analysis besides that presented in this article identifies long-term effects directly linked to the 2020 and 2021 lockdowns. The OFCE examines labour hoarding with regard to the company support policies put in place during the health crisis; labour hoarding due to other factors, such as hiring challenges or anticipation of the end of supply difficulties, is mentioned only as likely

Comparison with the OFCE's analysis of productivity losses in the second quarter of 2023
(contributions to the deviation from the pre-Covid trend, in percentage points)

Explanatory factor	OFCE	Banque de France
Apprenticeship	1.2	1.2
Workforce composition	–	1.4
Working time/job retention scheme	0.7	0.1
Failures and assistance to companies	1.3	–
Cost of labour	0.6	–
Permanent effects of the Covid crisis	–	0.4
Posted workers and regularisation of undeclared work	–	0.1
Sector labour hoarding	–	1.7
Unexplained	2.2	3.6
Total	6	8.5

Sources: OFCE (French Economic Observatory), authors' calculations.
Scope: OFCE: non-farm market sector; Banque de France: market sector.
Notes: The OFCE's analysis is based on contributions to additional salaried employment relative to what would be implied by the change in value added assuming an unchanged productivity trend. The contributions are converted into productivity points for the market sector based on the impact of factors as a % on total market employment in Q2 2023.
The overall effect analysed by the OFCE differs from that of this study owing to the different approaches taken to estimate the effect.

to contribute to the unexplained portion of additional employment in the second quarter of 2023, especially in manufacturing. INSEE similarly mentions the effect but does not quantify it. According to the OFCE, the effect of assistance provided to companies during the Covid crisis could account for 1.3 pp of the decrease via two mechanisms: by allowing companies to hoard labour (increased employment intensity of growth), but also by propping up companies that might otherwise have collapsed (reduced productivity owing to less efficient allocation of production factors). This is a temporary effect that overlaps in this analysis with the "labour hoarding" effect.

The OFCE includes an effect due to the decrease in the real cost of labour relative to the pre-Covid period, which is assumed to have encouraged companies to hire more, contributing 0.6 pp to the productivity drop-off. However, this factor seems less compelling, as in theory it should lead to substitution between production factors at the expense of capital investment, which is not observed. Conversely, the broader concept of employment composition effects captures a possible cost-of-labour effect.

DARES published a study on reduced use of posted workers in 2022 compared with 2019. It identified a marginal effect on average productivity, with a maximum contribution of 0.1 pp to the fall, consistent with this study. Among other factors analysed in this article and whose effects appear to be weak or zero, the downturn in undeclared labour is mentioned by both the OFCE and INSEE, while only the OFCE discusses the upturn in absenteeism. However, these factors are not quantified, merely flagged as potential explanatory factors.

Other factors that are not examined here but that could have played a role in the productivity disconnect are mentioned. The OFCE talks about work-from-home arrangements, while Rexecode points to the potential role of the adjustments that companies have been forced to make in response to the environmental transition, the energy crisis and changes on their global markets more generally.

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