Le programme hexagonal de développement rural : quelle contribution à l'attractivité des territoires ?

Marielle Berriet-Solliec, Abdoul Diallo, Cédric Gendre, Vincent Larmet, Denis Lépicier, Lionel Védrine

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Household Inflation Expectations in France: Lessons from a New Survey and the COVID-19 Crisis

Erwan Gautier* and Jérémi Montornès*

Abstract – This article documents several stylised facts about household inflation expectations in France based on data from a new survey by the European Central Bank, the Consumer Expectation Survey, conducted online among thousands of households between 2020 and 2021. The results are compared with those from the INSEE CAMME survey (a monthly consumer confidence survey), which has been carried out for many years. The conclusions drawn from the results obtained through these two surveys converge: the level of inflation anticipated by households is higher than actual or forecasted inflation. During the period 2020-2021, inflation expectations were positively correlated not only with current inflation, but also with the expected level of unemployment. During the COVID-19 crisis, only the first lockdown had a positive effect on expectations. However, the methodology of the two surveys differs, leading to discrepancies in the extent of the bias on current inflation, the dispersion of expected inflation or the intensity of correlations with actual inflation or with unemployment.

JEL Classification: E31, D84
Keywords: expected inflation, households, survey

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Inflation expectations play a crucial role in the conduct of monetary policy. The inflation targeting strategy pursued by most central banks in the world presupposes anchoring inflation expectations to their target. This anchoring contributes in particular to stabilising the economy in the face of major shocks such as the 2008-2009 financial crisis or the COVID-19 crisis, as it makes it possible to avoid overreactions by economic actors in the face of temporary inflationary shocks. Keeping inflation expectations stable at around the target level then increases the effectiveness of the central bank when it varies the nominal interest rate. The anchoring of expectations is often assessed on the basis of market indicators or on the basis of forecasters' surveys. More recently, central bank communication has become more public-oriented (Haldane & McMahon, 2018) and monitoring household or company expectations has become increasingly important, resulting in the development of specific surveys (Bernanke, 2007; Cœuré, 2019; Banque de France, 2021).

Household inflation expectations play a role in their economic decisions. In theory, for a given nominal interest rate, expecting higher inflation has a negative effect on the real interest rate, which increases consumption and decreases saving. However, higher expected inflation also acts as a tax on nominal assets and can generate negative wealth and income effects, which reduces consumption. In practice, recent empirical work has investigated whether inflation expectations have a significant effect on household consumption and saving decisions (for a summary, see D'Acunto *et al.*, 2022): Bachmann *et al.* (2015) and Burke & Ozdagli (2021) based on US data do not find a positive effect whereas Dräger & Nghiem (2021) in Germany, Ichiue & Nishiguchi (2015) in Japan and Andrade *et al.* (2021) for France show that there is a positive link between expectations and consumption. Vellekoop & Wierdeholt (2019), using Dutch data, find that households expecting high inflation tend to save less. The link between consumption and inflation expectations can be heterogeneous across households, depending on cognitive biases (D'Acunto *et al.*, 2022) or financial constraints. Finally, recent literature has focused on demonstrating the existence of a causal link between expected inflation and consumption based on controlled experiments (Coibion *et al.,* 2021).[1]

However, the way in which the inflation expectations channel works in practice is still poorly understood based on data available from households or companies (Candia *et al.*, 2020). In particular, empirical studies have shown that household expectations deviate significantly from the standard framework of full-information rational expectations: households are on average less informed than other economic actors, as evidenced by their generally high level of inflation expectations and the wide dispersion of their responses. Inflation, defined as the general increase in prices, is difficult for households to understand because it is a concept that aggregates price developments in a basket of goods and services. Empirical literature (e.g. Accardo *et al.*, 2011) also shows that household perceptions of inflation can be influenced by relative price movements (gasoline and daily purchases). However, while relative price movements can also affect consumption choices at product level, it is the influence of inflation in the aggregate sense on consumption and saving choices (via its effect on the expected real rate) that is relevant from a macroeconomic point of view (Bachmann *et al.*, 2015). The objective of household surveys is then to analyse what households perceive and understand of aggregate inflation.

In this article, we propose to document stylised facts relating to household inflation expectations in France based on two sources. A first source, which has been available for several decades, is the monthly consumer confidence survey called CAMME, produced by INSEE.[2] It is conducted within a harmonised European framework for the European Commission and monitors inflation perceptions and expectations both qualitatively and quantitatively. The second source is more recent, the Consumer Expectation Survey (CES), launched in early 2020 by the ECB[3] and conducted in practice by the IPSOS institute in six countries (including France); its structure is inspired by the survey launched in the 2010s by the New York Fed. It aims to enrich the diagnosis of household expectations by central banks in the euro area.

An initial contribution by this article is methodological and consists in describing what a new survey can contribute to the measurement of inflation expectations in France and to what extent the two surveys produce a common diagnosis despite having different characteristics.

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1. Moreover, wage negotiations can also be affected by the inflation expectations of both companies and households. For companies, investment decisions and the setting of prices may also depend on their aggregate inflation expectations (Coibion et al.*, 2020), based on Italian company data.*
2. For studies on inflation perceptions and expectations from this survey, see Accardo et al. *(2011) and Andrade* et al. *(2021).*
3. https://www.ecb.europa.eu/stats/ecb_surveys/consumer_exp_survey/html/index.en.html

A second contribution is to use the period from February 2020 to December 2021, which covers not only the months of lockdown associated with the COVID-19 crisis but also the period during which inflation rose in 2021, whereas the empirical literature generally focuses on the recent period of low inflation and moderate economic shocks. Inflation expectations were in fact initially correlated with observed inflation, particularly at the point where inflation started to rise again. Subsequently, expectations reacted to the first lockdown due to COVID-19, but saw very little reaction to the second and third lockdowns. In particular, the average response and the dispersion of responses regarding expected inflation have increased (Weber *et al.*, 2022, show similar results for the United States). Finally, correlations between expected changes in unemployment or activity and inflation are analysed to try to understand how households link macroeconomic variables to each other (Candia *et al.*, 2020).

The rest of the article is organised in the following manner. The first section presents the differences and common points of the methodology of the two surveys used here. The second section then describes the bias, dispersion and determinants of inflation expectations. Finally, the third section analyses the response of expectations to recent shocks: the COVID-19 crisis, the rise in uncertainty and the rise in inflation, as well as the link between inflation expectations and household perceptions on economic activity or unemployment.

1. Two Surveys to Measure Household Inflation Expectations

The measurement of household inflation expectations usually involves conducting regular surveys to collect their opinion. Indeed, there is no direct way to observe household expectations as can be done for other economic variables, such as household consumption or income. However, asking households about their inflation expectations is far from easy, as the concept of inflation itself is often misunderstood or unfamiliar. The phrasing of the questions and the design of the survey are thus an essential issue as they affect both the response rate and the dispersion of responses (Bruine de Bruin *et al.*, 2008). In this article, we rely on two surveys (CAMME and CES) that are presented in this section.

1.1. Questions on Household Expectations

One of the first household surveys was the one launched in the 1960s by the University of Michigan, which still serves as a reference for monitoring household expectations in the United States (Thomas, 1999). The INSEE CAMME survey is similar in terms of both design and question phrasing. The Consumer Expectation Survey (CES) has been developed since early 2020 by the Eurosystem in order to enhance the measurement of inflation expectations with its own survey of euro area households; at present, it covers six euro area countries (Germany, France, Italy, Spain, the Netherlands and Belgium).[4] The methodology of this survey is largely based on the Survey of Consumer Expectations (SCE) launched in 2013 by the Federal Reserve Bank of New York (from which other central banks, such as the Bank of Canada, have already taken inspiration). CAMME has 38,370 individual responses for the period February 2020-December 2021 and the "pilot" version[5] of the CES contains 47,982 individual observations for France for the period April 2020-December 2021 (the design of the two surveys are described in more detail in the Box).

On the question of prices, the CAMME survey questions households about their perceptions and then their expectations using two questions, one qualitative and the second quantitative (Table 1-A). The quantitative question is not asked of households that answered "prices stayed about the same" or "prices will stay about the same" to the qualitative question and an expected inflation rate of 0% is attributed to them. The questions on inflation asked in this survey are the same in all EU countries and the European Commission uses these surveys to produce indicators to monitor household perceptions and expectations. Like INSEE, the European Commission publishes monthly balances of opinions based on the qualitative responses. Quarterly statistics are also published based on quantitative data for the period from 2004 to present for the euro area, while INSEE only publishes balances of opinion.[6] Online Appendix S1 presents the calculation of the aggregated indicators based on individual data (link to the Online Appendix at the end of the article).

In the CES, the questions on inflation (Table 1-B) follow a structure that is quite similar to that of

4. In addition, the Bundesbank is conducting its own ongoing survey in Germany. Since the start of the pandemic, the Banca d'Italia has also launched a specific household survey: the Bank of Italy – Special Survey of Italian Households, https://www.bancaditalia.it/statistiche/tematiche/indagini-famiglie-imprese/indag-straord-famiglie-italiane/index.html.

5. An initial evaluation of the data has been carried out (ECB, 2021). After the pilot phase, the ECB publishes aggregated indicators on inflation expectations for each participating country from August 2022.

6. https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys/download-business-and-consumer-survey-data/time-series.

the CAMME survey, which allows the results of the two surveys to be compared.

The two surveys have important similarities in the structure of the questionnaire (perceptions then expectations, qualitative then quantitative question) as well as in the phrasing of the questions. First of all, both questionnaires ask questions about prices in general and not about inflation. Indeed, there is a trade-off to be made between asking households about "prices", which is a fairly familiar concept for them, or "inflation", which is a less well-known concept but one that is more relevant for monetary policy. For example, the New York Fed's SCE questions households about inflation and so does the Bundesbank. Bruine de Bruin *et al.* (2012) showed in particular that asking questions using the term "prices in general" leads to higher and more dispersed expectations on average.[7] In the CAMME survey and the CES, the phrasing of the question referring to "prices" allows for comparison of the results and probably improves response rates. The second common point is that in both surveys, the quantitative question is not asked of households that respond that prices have not changed or will not change; a 0% answer is attributed to them. This attribution is explicit for respondents to the CES and it is done *a posteriori* in the CAMME survey (for a detailed discussion, see Andrade *et al.*, 2021).

1.2. Methodological Differences

There are, however, several differences in the exact phrasing of the questions. An initial difference is observed for the possible response options for qualitative questions: they express an intensity scale with two responses around 0 and are presented in an unordered manner in the CES, while in the CAMME survey they are ordered but are not symmetrical around "stable prices". The CES also gives respondents more guidance than the CAMME survey (e.g. "even very small differences interest us"), which can lead to variations in interpretation of the different response options. Finally, the response options for the qualitative questions in the CAMME survey may appear ambiguous, in so far as they refer sometimes to a future variation in price and sometimes to a future variation in price evolution.

Compared to the CAMME survey, the CES contains two additional questions on inflation. First of all, the CES asks households about their inflation expectations over the following three-year period, which is close to the period corresponding to the price stability objective of monetary policy. Next, it asks a probabilistic question making it possible to measure the

7. *See Savignac* et al. *(2021) for similar results on French companies.*

Table 1 – **Questions on price developments in CAMME and CES**

A – CAMME
How do you think that consumer prices have developed over the last 12 months? They have… *1. Risen a lot / 2. Risen moderately / 3. Risen slightly / 4. Stayed about the same / 5. Fallen*
By what percentage do you think prices have increased (or decreased) over the last 12 months? (Provide an answer as a %). *1. They have increased by... / 2. They have decreased by...*
By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will… *1. Increase more rapidly / 2. Increase at the same rate / 3. Increase at a slower rate / 4. Stay about the same / 5. Fall*
By what percentage do you think prices will icrease (or decrease) over the next 12 months? (Provide an answer as a %) *1. They will increase by… / 2. They will decrease by...*
B – CES
First, we would like to ask you about changes in the general level of prices for goods and services in France. Compared with 12 months ago, what do you think has happened to prices in general? *1. Prices went up a lot / 2. Prices went down a lot / 3. Prices went up a little / 4. Prices went down a little / 5. Prices stayed exactly the same (that is 0% change)*
How much higher/ lower do you think prices in general are now compared with 12 months ago in France? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place.
The next few questions are about future changes in prices in general in France. Looking ahead to 12 months from now, what do you think will happen to prices in general? We are interested in even very small changes. *1. Prices will increase a lot / 2. Prices will decrease a lot / 3. Prices will increase a little / 4. Prices will decrease a little / 5. Prices will be exactly the same (that is 0% change)*
How much higher / lower do you think prices in general will be 12 months from now in France? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place.

Notes: Quantitative questions are not asked to respondents who responded that prices have "stayed about the same" (CAMME) or have "stayed exactly the same" (CES), or that they "will stay about the same" (CAMME) or "will be exactly the same" (CES), and an expectation of 0% inflation is attributed to them.

Box – **Household surveys on the economic context and consumer confidence surveys**

The sample for the CAMME survey is randomly drawn from data based on the telephone directory and tax information. Conducted by telephone, it has been available since 2004 in its current form and it collects the opinion on their economic environment and personal situation of about 1,800 households per month. The interviewee is either the bill payer or their partner. Each household can be interviewed consecutively a maximum of three times; in the sample, the average number of responses per household is two. The questionnaire was supplemented during the COVID-19 pandemic in order to question households about the possible consequences of the health crisis on their income, but the usual questions, including those on prices, were not changed (Clerc *et al.*, 2021). The response rates for qualitative questions on inflation are very high (around 95%) but they are relatively low for quantitative questions (around 50%). A higher response rate is obtained among the population with a higher income and higher level of education, while the elderly and women are less likely to respond (see Online Appendix S2).

The sample for the CES is a combination of a random sample and a previously constituted IPSOS panel. This survey is collected online from around 10,000 households, including 2,000 in France, on a monthly basis. Households can be re-interviewed each month of the year, thus, participants responded to an average of six consecutive survey waves over the sample period. The samples are intended to be representative of the population by gender, age and level of education. Compared to a telephone or face-to-face survey, online collection, however, creates a selection effect among younger or better educated categories. Unlike the CAMME survey, answers are mandatory for qualitative and quantitative questions on inflation, which leads to response rates close to 100% for these questions.

Recruitment rates are low for this type of survey: 13% for the CAMME survey in 2017[(a)] and 4.3% for the random sample of the CES in 2020. For the latter, the order of magnitude is close to those generally observed for random telephone recruitment. Once participants are recruited, the rates of those returning to the survey range from 60% to 80%, depending on the survey waves. Participation in the CES panel is higher. Indeed, the retention strategies are effective and the survey has low attrition rates: of those surveyed in April 2020, 77% responded in July and 70% were still active in October 2020 (ECB, 2021).

The characteristics of the two surveys are compared in the table below:

	CAMME survey (INSEE)	CES (ECB)
Availability	Launch: 1958; latest redesign: 2004	Launch: 2020
Frequency	Monthly (before 2008, no interviews in August)	Monthly
Observations	~1,800 households per month	~2,000 households per month
Collection method	Rotating panel. Respondents are interviewed for 3 consecutive months	Rotating panel. Respondents are interviewed for up to 17 consecutive months
	Telephone	Internet
Sample	Random	Random and IPSOS panel
Other topics covered by the survey	Activity, unemployment, standard of living, consumption and savings, personal financial situation, platform module on well-being, housing or the COVID-19 crisis	Activity, unemployment, standard of living, consumption and savings, personal financial situation, specific questions on household financial behaviour, COVID-19 crisis

[(a)] *INSEE presentation for the CNIS (French National Council for Statistical Information), 31 May 2017.*

degree of uncertainty of households about their response. For this question, households must provide probabilities for the likelihood of inflation happening at predefined intervals (see Online Appendix S3). This question, the phrasing of which is more complex, can be used to approximate the underlying distribution of an individual's expectations and thus measure the moments where they are higher than 1 and, in particular, the standard error associated with the responses.

2. How Are Household Inflation Expectations Formed in France?

In this section, we describe the main stylised facts that the CAMME survey and the CES make it possible to establish in relation to household inflation expectations.

2.1. Household Inflation Expectations Are Higher than Actual Inflation

Table 2 presents descriptive statistics of household responses to quantitative questions on perceptions and expectations in both surveys. Between February 2020 and December 2021, average household inflation expectations were 3.2% according to the CES and 6.5% according to the CAMME survey, while inflation averaged 0.5% in 2020 and 2.1% in 2021 and inflation forecasts made in 2020 for 2021 or in 2021 for 2022 were below 2%. The median values of the distribution of expectations are lower, 2% for the CES and 4% for the CAMME survey, suggesting a significant dispersion of responses. The standard error of responses in the CES is 6.7%, compared to 9.9% in the CAMME survey. These values are high in comparison with those

Table 2 – **Household inflation perceptions and expectations**

	CES			CAMME	
	Perceptions	Expectations one year ahead	Expectations three years ahead	Perceptions	Expectations one year ahead
Average	3.25	3.21	3.09	8.13	6.54
Median	2.00	2.00	1.50	5.00	4.00
Standard error	6.74	6.66	6.99	10.64	9.86
Observations	46,953	47,979	46,953	21,172	18,278
Trimmed					
Average	2.92	2.88	2.70	7.31	5.76
Median	2.00	2.00	1.50	5.00	4.00
Standard error	4.19	4.10	4.05	8.02	6.77
Observations	45,356	46,359	45,480	20,763	17,749
Corrected for the learning effect					
Average	4.05	4.01	3.66	-	-
Median	2.00	2.00	2.00	-	-
Standard error	7.84	7.71	7.97	-	-
Observations	18,905	19,029	18,905	-	-

Notes: The statistics are calculated based on the responses to the quantitative questions of both surveys (the lower response rate for CAMME explains the relatively low number of observations compared to the total sample); the statistics are weighted by the survey weights. Zero responses are included for households that respond that prices are stable. In the central panel, truncation involves eliminating values below the 2nd and above the 98th percentiles of the distribution of responses. Correcting for the learning effect consists of only taking into consideration the first three responses per household.
Reading Note: The median inflation expectations three years ahead are 2.0% once the learning effects have been corrected.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

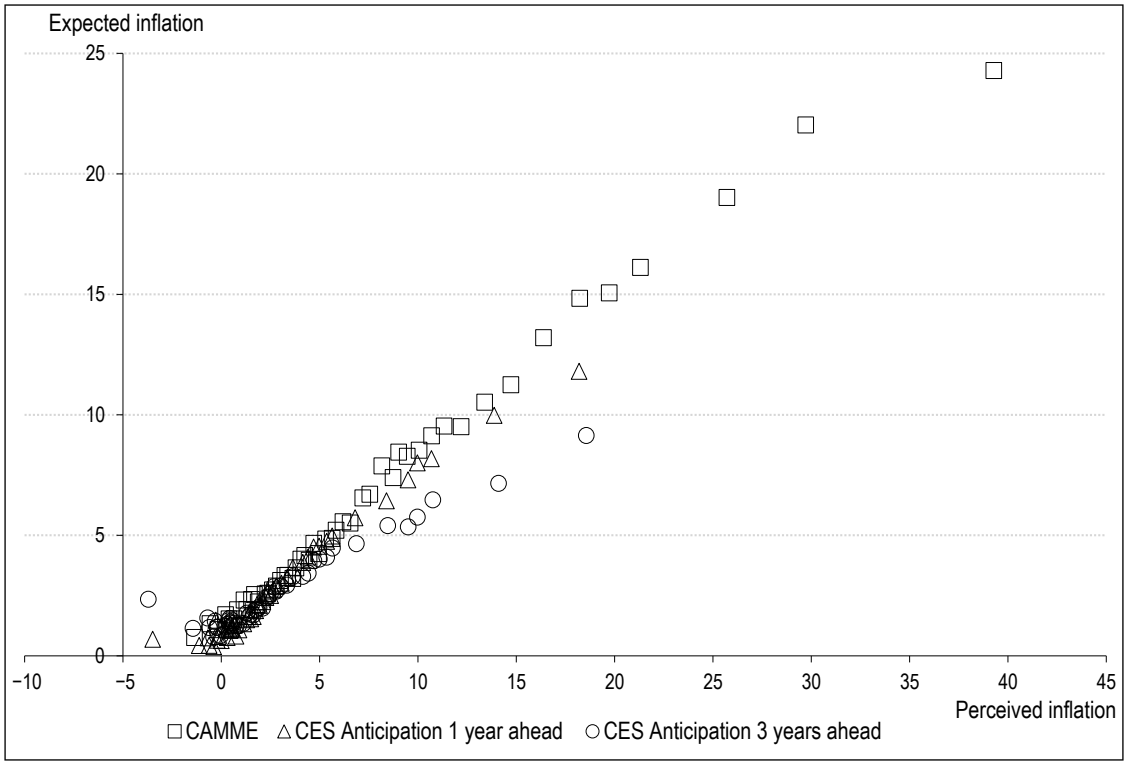
from professional forecasters, for whom the standard error of the distribution of inflation forecasts is often less than 1, or the values for firm managers (for a comparison between households and companies, see Savignac *et al.*, 2021). Part of this dispersion can be explained by the occurrence of high levels of household responses regarding their expectations. The second part of Table 2 shows the same statistics but excludes from the calculation the extreme responses, defined here as those below the 2nd percentile and those above the 98th percentile, i.e. responses within the range [0%, 30%] and [−5%, 20%]. The averages decrease but remain high, the medians are virtually unchanged and the dispersion tightens.

The CES provides longer-term information, over a three-year period: the median inflation expectation is 1.5% and the average is 3.1%, which is slightly lower than the average over a one-year period. The responses to this question make it possible, in particular, to shed light on the temporary or sustainable nature of the inflationary pressures observed in Europe or the United States from mid-2021 onwards (Reis, 2021).

One explanation for the high level of expectations is that households perceive current inflation to be higher than that measured by the Consumer Price Index (CPI) and extrapolate this perception on their expectations. In particular, Jonung (1981) documented the marked effect of inflation perceptions on expectations. The CES and the CAMME survey show a strong correlation between perceptions and expectations (Figure I): households that perceive inflation to be high have higher inflation expectations. However, the slope of the linear regression is less than 1 (close to 0.65 for both surveys for expectations over a one-year period and slightly lower (0.4) for expectations over a three-year period in the CES). Perceived inflation is higher than actual inflation over the period 2020-2021: average perceptions are 3.3% and 8.1% respectively for the CES and the CAMME survey, while inflation averages 1% over the period. This discrepancy between perceived inflation and measured inflation is a well-established stylised fact. In particular, Accardo *et al.* (2011) document that this discrepancy can be explained by an overweighting by households of their daily spending (see also D'Acunto *et al.*, 2020 or Cavallo *et al.*, 2017), a greater focus on price increases than on price decreases (D'Acunto *et al.*, 2020) or the fact that households can take into account information (media, rumours, social media, etc.) beyond their own shopping experience (Ehrmann *et al.*, 2017).

The CES provides a significantly lower average inflation expectation than the CAMME survey (3.2% vs 6.5%). This discrepancy may be linked to differences in the phrasing or the way in which questions are posed. In particular, it

Figure I – **Correlation between perceived and expected inflation (as a %)**



Notes: A "grouped" point cloud condenses the information by forming classes from the X-axis data and calculating the average of the Y-axis in these classes. The calculations are based on all quantitative responses to questions on perceived and expected inflation in one year (CAMME and CES) and in three years (CES).
Reading Note: Households that perceive current inflation to be 15% expect inflation to be close to 10% over the next 12 months in the CES.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

is more difficult to check that households do not access external information when they respond to the CES online, while the response is undoubtedly more spontaneous in the CAMME survey. Another source of difference, the implications of which can be assessed quantitatively, is related to the fact that the CES surveys the same household several months in a row, which can lead to so-called learning effects (i.e. individuals change their answers simply due to being surveyed multiple times). This effect was recently highlighted in the New York Fed's survey (Kim & Binder, 2020). The underlying assumption is that households voluntarily inform themselves about price developments after being surveyed during the first wave, are more attentive to short-term information or correct manifestly incorrect answers without any additional information. In order to assess these learning effects, we estimate the equation (1) in which the survey waves s specific to each household allow us to measure the average effect of the repetition of the surveys on the responses. The first survey wave corresponds to the date of recruitment of a household into the survey panels. The final survey corresponds to the third wave for the CAMME survey and the 17th wave for the CES. The coefficients of the variable correspond to each survey wave τ_s, measuring the effect of respondent learning.[8] We add control variables that take into account the characteristics of the individuals and a temporal effect γ_t to the model. The estimated model can be written as follows:

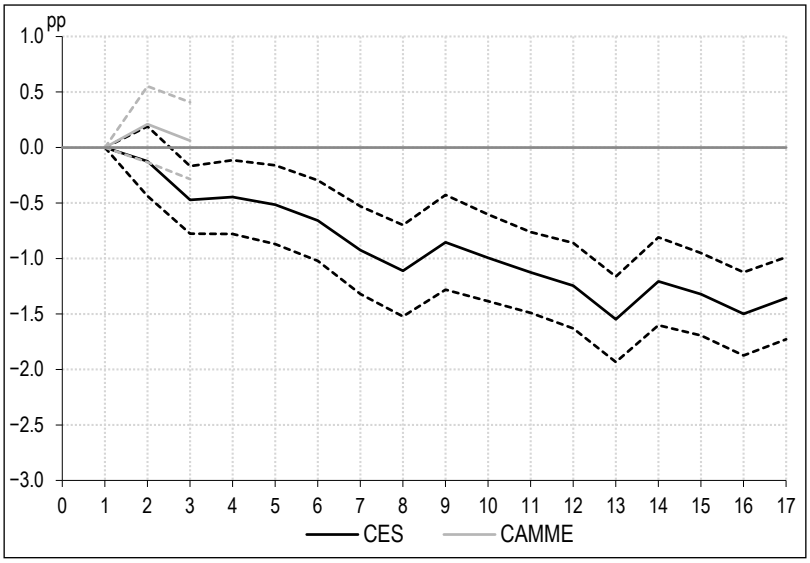
$$y_{its} = \sum_{s=1}^{S} \beta_s \tau_s + \alpha_i X_i + \gamma_t + \varepsilon_{it} \qquad (1)$$

where the dependent variable y_{is} is the inflation expectation of a respondent i, for the survey wave s. X_i is a vector of socio-demographic characteristics of an individual i (gender, age, level of education and income) and ε_{it} is a term of error.

The learning effect of respondents is estimated for each survey wave (Figure II). In the CES, expectations become lower the more the same household is surveyed. The learning effect is significant as early as the third month, at which point it is estimated to be −0.5 pp and then −1.5 pp after a year. In contrast, the learning

8. We have a variable identifying the household in the CES while for the CAMME survey this identifier is reconstructed based on the many observable characteristics of the household, which can lead to a measurement error regarding this variable.

Figure II – **Respondents' learning effect (in percentage points)**



Notes: Solid lines give the estimated effect (cf. Equation 1) in percentage points (pp) of each of the re-interviewing waves; the dashed lines give the 95% confidence interval of the estimates. All the answers to the questions on quantitative expected inflation over a one-year period are used.
Reading Note: In the CES, the inflation expectation of households surveyed for the third time is on average about 0.5 pp lower than that observed for households responding for the first time.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

effect is not significant in the CAMME survey during the two waves of re-surveying.[9]

If we restrict all responses to the CES to those collected in the first three waves only, we find that the average inflation expectation is 4% (cf. Table 2). Thus, learning effects could explain up to 1 point of the discrepancy between the average expected inflation values obtained on each survey.

2.2. The Dispersion of Responses Is High

The standard errors of the distribution suggest that in both surveys inflation expectations are highly dispersed. In both surveys, despite inflation being close to 0% in 2020, the distribution of responses is asymmetric around 0 and the proportion of households expecting a fall in prices is very low: 1% of households in the CAMME survey and 7.6% in the CES (Table 3). The discrepancy between the two surveys is partly due to the phrasing of the questions. Indeed, the CAMME survey offers three possibilities for price increases, while it uses only one option for price decreases. This asymmetry could bias responses against decreases. However, the proportion of decreases with the CES is within a high range compared to the surveys available. For example, Gorodnichenko & Sergeyev (2021) show that even during the deflation of the 2000s in Japan, less than 5% of households expected negative inflation.

9. In Online Appendix S5, we reproduce the analysis for the period 2004-2014 (Andrade et al.*, 2021) where a "household" identifier is available. We observe a significant learning effect of a similar scale to that observed for the CES.*

Table 3 – **Responses to the qualitative question on expectations over a one-year period**

CES		CAMME	
Prices will...	% of respondents	Prices will...	% of respondents
… decrease a lot	4.2	… fall	1.0
… decrease a little	3.4		
… stay exactly the same	28.2	… stay about the same	24.7
… increase a little	45.5	… increase at a slower rate	11.5
		… increase at the same pace	42.0
… increase a lot	18.7	… increase more rapidly	20.8
Total	100.0	Total	100.0

Notes: The calculations use the responses to the qualitative questions of both surveys, the proportions (in %) are weighted with the weights available in both surveys.
Reading Note: In the CAMME survey, 1% of household anticipate that prices will fall.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

Next, a significant proportion of households say they expect price stability: 24.7% in the CAMME survey and 28.2% in the CES. In the latter, the proportion is lower (20.7%) if we limit ourselves to the first three waves, in which the learning effects are low. This may reflect the fact that households do not think that prices can fall, which creates an accumulation point around 0 (Gorodnichenko & Sergeyev, 2021). This may also come from rounding effects in household responses that poorly perceive differences in inflation levels, or even in scale, especially when inflation is low (Andrade *et al.*, 2021).

In order to analyse the heterogeneity of quantitative expectations, Figure III presents the distribution of responses relating to perceived inflation and expected inflation in both surveys. The comparative distributions confirm that the two surveys share several common points in their responses (asymmetry and peak at zero). However, in the CES, the proportion of households expecting moderate inflation, between 0 and 2%, is higher than in the CAMME survey. The phrasing of the question in the CES, indicating that even small differences are of interest to the ECB, could help explain this difference. In total, in both surveys, a large proportion of household responses are between 0 and 2%, i.e. almost one third of the CAMME survey responses and about 40% of the CES responses (see Online Appendix S4 for details).

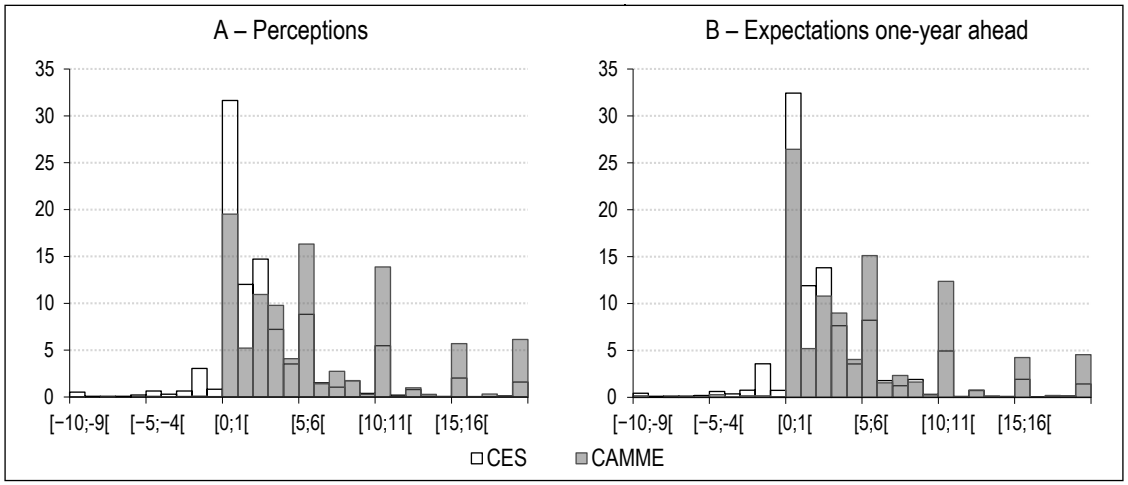
Next, a large proportion of the responses are integers: 73% in the CES and almost 95% in the CAMME survey.[10] Among the rounded responses, multiples of 5 are associated with peaks in the distribution. Thus, more than 10% of households perceive or expect inflation to be exactly equal to "5%". In addition, responses giving multiples of 5% are relatively rare. These multiples of 5, chosen by default by households that, in principle, have no response to the question, are interpreted in the literature as an indicator of uncertainty (see *infra*). Finally, the proportion of households with expectations above 10% is higher in the CAMME survey, even though learning effects play a special role for these values. In total, 14.7% of households expect inflation above 10% when surveyed in the first three months, while less than 11% do so for all waves in the survey. This result suggests that "extreme" values correspond to values for which households are less sure of their response and the greater focus on inflation seems to weaken their perception in subsequent waves.

2.3. Determinants of the Dispersion of Responses

In order to better understand the origin of the dispersion of responses, we link expected inflation to different observable household characteristics. In Table 4, we present the effect of the observable characteristics of respondents (gender, age, level of education and income) on the dispersion of expectations and the marginal effect of these characteristics on the probability of responding "more than 5%", "between 0 and 5%", "0% exactly", or "less than 0%".

10. Precision to within one decimal place is asked of respondents to the CES, while with the CAMME survey this is one possibility. The discrepancy between surveys may also result from differences in the way in which they are collected. Responses reported on a screen may be more accurate than those reported by telephone without visual inspection.

Figure III – **Distribution of inflation perceptions and expectations (% of respondents)**



Notes: The graphs represent the proportion of households in % of the responses grouped by 1% interval; the proportions are weighted by the weights available in the surveys.
Reading Note: About 5% of respondents to the CES estimate that inflation in the past 12 months is between 10% and 11%.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

Table 4 – **Determinants of household inflation expectations**

		(1) Expected inflation	(2) Higher than or equal to 5	(3) Between 0 and 5	(4) Equal to 0	(5) Negative
A – CES						
Sex (*Ref.* Male)	Female	0.76*** (0.06)	5.23*** (0.00)	−3.06*** (0.00)	0.61 (0.00)	−2.67*** (0.00)
Age (*Ref.* Aged 18-34)	35-54	0.37*** (0.08)	2.55*** (0.00)	6.88*** (0.01)	−7.19*** (0.01)	−2.16*** (0.00)
	55-70	0.65*** (0.09)	5.21*** (0.01)	14.32*** (0.01)	−12.56*** (0.01)	−6.85*** (0.00)
	71+	0.49*** (0.11)	4.43*** (0.01)	17.35*** (0.01)	−11.23*** (0.01)	−9.13*** (0.00)
Level of education (*Ref.* Primary)	Secondary	0.20 (0.14)	−0.47 (0.01)	11.69*** (0.01)	−3.04*** (0.01)	−8.90*** (0.01)
	Higher	0.14 (0.13)	−1.41** (0.01)	20.40*** (0.01)	−9.42*** (0.01)	−10.12*** (0.01)
Income (*Ref.* Below the 1st quartile)	Between the 1st and 2nd quartiles	−0.95*** (0.11)	−4.53*** (0.01)	2.44*** (0.01)	−0.39 (0.01)	2.50*** (0.00)
	Between the 2nd and 3rd quartiles	−1.18*** (0.10)	−7.30*** (0.01)	7.39*** (0.01)	−2.89*** (0.01)	2.98*** (0.00)
	Above the 3rd quartile	−1.23*** (0.11)	−8.96*** (0.01)	13.86*** (0.01)	−5.71*** (0.01)	0.36 (0.00)
	Constant	4.70*** (0.27)				
	Learning effect	Yes	Yes	Yes	Yes	Yes
	Temporal effect	Yes	Yes	Yes	Yes	Yes
	N	47,979	47,979	47,979	47,979	47,979
B – CAMME						
Sex (*Ref.* Male)	Female	1.41*** (0.15)	6.18*** (0.01)	−6.22*** (0.01)	0.99 (0.01)	−0.91*** (0.14)
Age (*Ref.* Aged 18-34)	35-54	−0.34 (0.26)	0.69 (0.01)	3.90*** (0.01)	−3.99*** (0.01)	−0.47 (0.29)
	55-70	−1.53*** (0.26)	−6.24*** (0.01)	11.00*** (0.01)	−3.84*** (0.01)	−0.88*** (0.28)
	71+	−2.82*** (0.27)	−12.27*** (0.01)	11.52*** (0.01)	1.79 (0.01)	−0.96*** (0.30)
Level of education (*Ref.* Primary)	Secondary	−0.16 (0.49)	0.20 (0.02)	2.38 (0.02)	−2.50 (0.02)	−0.09 (0.41)
	Higher	−1.97*** (0.47)	−6.76*** (0.02)	6.20*** (0.02)	0.50 (0.02)	0.11 (0.42)
Income (*Ref.* Below the 1st quartile)	Between the 1st and 2nd quartiles	−1.15*** (0.23)	−2.55** (0.01)	5.44*** (0.01)	−2.46*** (0.01)	−0.30 (0.24)
	Between the 2nd and 3rd quartiles	−1.46*** (0.23)	−3.30*** (0.01)	7.36*** (0.01)	−3.78*** (0.01)	−0.24 (0.23)
	Above the 3rd quartile	−2.83*** (0.21)	−11.47*** (0.01)	13.47*** (0.01)	−1.87** (0.01)	−0.18 (0.23)
	Constant	7.84*** (0.61)				
	Learning effect	Yes	Yes	Yes	Yes	Yes
	Temporal effect	Yes	Yes	Yes	Yes	Yes
	N	18,252	18,252	18,252	18,252	18,252

Notes: Ordinary least squares in column (1), marginal effects estimated using the Logit model in columns (2) to (5). Robust standard errors in brackets. * p<0.10, ** p<0.05, *** p<0.01. The variable explained in (2) is the variable indicative of inflation expectations higher than or equal to 5%. Same for columns (3) to (5).
Reading Note: Other things equal, the fact that the respondent is a woman entails an increase in the expected inflation of 1.4 pp compared to the average of the reference category.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

Inflation expectations appear higher for women than for men: the effect is almost twice as strong in the CAMME survey as in the CES (+1.4 vs +0.8 pp). In particular, this difference is related to the fact that women more frequently expect inflation above 5% but fewer price decreases. D'Acunto *et al.* (2020) show that this result can be explained by a differentiated experience of purchasing between men and women. The effects of age are ambiguous: in the CES, older households report price decreases or stable prices less frequently and more frequently respond between 0 and 5%, which has a positive effect on their expectations; in the CAMME survey, older households also report increases of between 0 and 5% more frequently, but they report increases of more than 5% much less often, which has a rather negative effect on average expectations. Holding a higher level of education is associated with lower inflation expectations: the effect of the level of education is more pronounced in the CAMME survey (−2 pp) than in the CES (non-significant). In the CES, a high level of education is associated with many more responses between 0 and 5% (+20 pp) and with many fewer negative or zero responses, whereas in the CAMME survey, it is associated with fewer responses higher than 5% but more responses between 0 and 5% (+6 pp). Finally, income level has a negative effect on the

average and the dispersion of inflation expectations in both surveys: households with higher income less often respond zero or above 5% and more often respond between 0 and 5%.

As noted above, the dispersion of expectations largely reflects the dispersion of inflation perceptions between households. The effects of household characteristics documented for expectations are broadly in line with those obtained for perceptions (see Online Appendix S6). The results of Accardo *et al.* (2011) also show that gender, age or income have similar effects on quantitative perceptions of inflation in the CAMME survey as we obtained for expectations. Moreover, if the response in relation to inflation perception is added to the regressions, the effect of observable characteristics on expected inflation is greatly diminished.

3. How Do Household Expectations Vary Over the Period 2020-2021?

The years 2020 and 2021 were marked by several shocks that impacted the French economy. First of all, the COVID-19 epidemic led to three periods of lockdown of varying degrees of strictness, inducing a slowdown in production and a simultaneous drop in demand with potentially ambiguous effects on inflation. Then, during 2021, the gradual recovery in activity generated a surge in inflation linked to supply difficulties, stronger demand and rising energy prices. In this section, we document how inflation expectations have responded to these shocks and what lessons can be learned about the formation of household expectations.

3.1. Inflation Expectations Are Correlated With Actual Inflation and Perceived Inflation

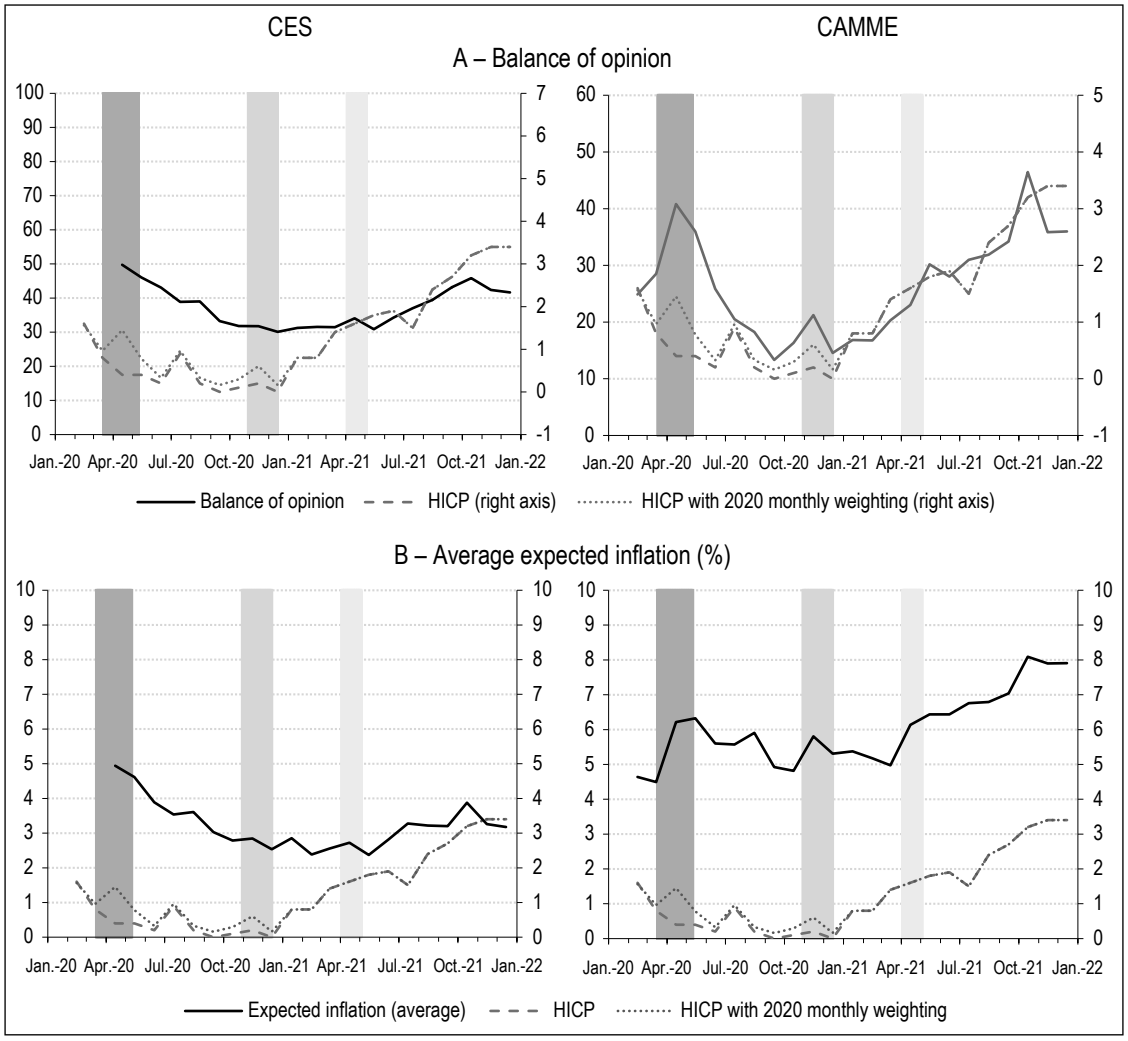
Based on the individual responses to both surveys, we recalculate the balances of opinion using the European Commission method (see Online Appendix S1) and the average of the quantitative responses, for each month of the period. Figure IV shows the comparison of these aggregated variables with the development of the Harmonised Index of Consumer Prices (HICP) (IV-A) and shows the average of the quantitative responses by date (IV-B).

The aggregation of responses to qualitative and quantitative questions from the CAMME survey is globally correlated with current inflation (Figure IV): average inflation expectations and perceptions were stable in 2020 and then rose in 2021. However, the first lockdown in the spring of 2020 generated a temporary disconnect between what households expect and actual inflation. Indeed, during this first lockdown, which was also the strictest (see *infra*), the sudden and major change to the basket of consumer goods disrupted the measurement of inflation (Casteletti-Font *et al.*, 2021). Inflation is generally calculated as the price evolution associated with a fixed basket of goods, which is updated annually and cannot take into account major changes in the structure of the basket during the year. An alternative price index taking into account the distortion of the consumer basket shows that the usual measure of inflation had underestimated the inflation experienced by households by around 1 pp during the first lockdown (Casteletti-Font *et al.*, 2021), which could explain partly the disconnect between INSEE inflation and expected inflation. A measurement of inflation that takes into account the distortion of the basket indicates a rise in both inflation at the time of the first lockdown and in the inflation expected by households (see *infra* for the effect of lockdowns on inflation expectations). Finally, in line with the cross-sectional results presented earlier (see Section 2), the temporal correlation between perceived and expected inflation is strong over the period (see Online Appendix S9).[11]

The evolution of the balance of opinion and the average expectation measured based on the data from the CES gives a different picture (Figure IV). In particular, the correlation between these variables and actual inflation is lower than that obtained with the CAMME survey. During 2020, there was a gradual decrease in expected inflation. The learning effects (quantified in Section 2) have contributed to lower expected inflation as the number of survey waves increases for households that joined at the start the survey. Then, during 2021, expected inflation increases but less significantly than in the CAMME survey and the average expected inflation is even lower than the actual level of inflation at the end of the period. In total, in the CES, expected inflation reacts less strongly to changes in inflation, or with a delay, compared to what is observed in the CAMME survey. The lesser dispersion of responses between households and the smaller gap with actual inflation are associated with a lower sensitivity of expected inflation to actual inflation. Finally, perceived inflation and expected inflation over a three-year period are closely correlated with expected inflation over a one-year period (see Online Appendix S9).

11. It can be noted, however, that while the first lockdown is associated with a drop in perceived inflation, perceived inflation then remained higher for several months after the first lockdown.

Figure IV – **HICP Inflation and inflation expectations 2020–2021**



Notes: The balance of opinion of each qualitative question is obtained by calculating the difference between the number of positive responses and the number of negative responses. Differences in the level of balances of opinion between the surveys cannot be interpreted given the differences in the phrasing of the questions. Expected inflation averages are obtained from individual quantitative responses. The statistics are weighted by the weights available in the surveys. Greyed out areas represent periods of lockdown related to COVID-19. The HICP is the Harmonised Index of Consumer Prices (allowing comparisons of inflation rates between the countries of the Economic and Monetary Union), HICP inflation is calculated as the annual shift of this index.
Reading Note: The balance of opinion of households expecting an increase in prices is 40 in April 2020 in CAMME. Average expected inflation is 5% in April 2020 in CES.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

3.2. The COVID-19 Crisis

The COVID-19 crisis was a major shock during the period 2020-2021 but it also divided experts with regard to its nature: supply shock linked to the closures of "non-essential" sectors or demand shock linked to the slowdown in consumption, associated for some households with lower incomes or greater uncertainty. We will now examine how household inflation expectations responded to this shock.

We will link inflation expectations to the different lockdown periods by controlling the effects of socio-demographic characteristics and learning effects (Table 5). There were three lockdown periods established in 2020 and 2021. The first lockdown, from 17 March to 11 May 2020, was very strict: "non-essential" shops and companies, places for socialising and retail shops (except pharmacies and food shops) and schools were closed and travel was restricted to the maximum extent possible. The second, from 30 October to 15 December 2020, was a little less strict: schools remained open and activity was able to continue in many sectors (construction, factories, agricultural sector and some public services) but travel was largely restricted. Finally, during the third lockdown, from 3 April to 3 May 2021, schools and non-essential businesses and places for socialising closed, remote working was relaxed and conditions for travel were restricted.

Table 5 – **Effects of lockdowns on household inflation expectations**

	(1) Expected inflation		(2) Higher than or equal to 5		(3) Between 0 and 5		(4) Equal to 0		(5) Negative	
A – CES										
1st lockdown	0.99***	(0.21)	6.98***	(1.09)	−1.44	(1.19)	−7.40***	(0.71)	0.01	(0.68)
2nd lockdown	−0.10	(0.19)	−0.44	(1.00)	−1.07	(1.14)	1.35	(0.83)	−0.23	(0.66)
3rd lockdown	0.30	(0.19)	0.47	(1.26)	−1.90	(1.35)	1.44	(0.98)	−0.18	(0.79)
Uncertainty	0.33***	(0.02)	2.60***	(0.09)	−0.72***	(0.11)	−1.81***	(0.11)	−0.59***	(0.08)
Learning effect	Yes		Yes		Yes		Yes		Yes	
N	40,820		40,820		40,820		40,820		40,820	
B – CAMME										
1st lockdown	1.00***	(0.26)	7.68***	(1.43)	−5.35***	(1.21)	−2.76**	(1.14)	0.70**	(0.32)
2nd lockdown	0.36	(0.25)	1.75	(1.44)	−5.10***		4.14***	(1.26)	−0.60***	(0.18)
3rd lockdown	−1.02***	(0.34)	−6.33***	(1.83)	−0.08	(1.77)	7.05***	(1.84)	0.14	(0.56)
Learning effect	Yes		Yes		Yes		Yes		Yes	
N	18,252		18,252		18,252		18,252		18,252	

Notes: Ordinary least squares in column (1), marginal effects estimated using the Logit model in columns (2) to (5). Robust standard errors in brackets. * p<0.10, ** p<0.05, *** p<0.01. The (unreported) control variables are gender, age, level of education, income and year. The variable explained in (2) is the variable indicative of inflation expectations higher than or equal to 5%. Same for columns (3) to (5).
Reading Note: Other things equal, during the first lockdown, the average inflation expectation increased by 1 pp in the CAMME survey.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

In both surveys, the first lockdown is associated with an increase in expected inflation of around 1 pp, while the second and third lockdowns have no concordant effects: no significant effect in the CES, a non-significant effect for the second lockdown and a negative effect for the third in the CAMME survey.

While average inflation expectations have risen sharply, disagreement between households is also at a higher level than during the pre-crisis period. The results presented in Table 5 indicate that the proportion of responses above 5% increased by 7 to 8 pp during the first lockdown, while the proportion of responses below or equal to 5% decreased by equivalent or greater proportions. Finally, in the CAMME survey, the proportion of price decreases increased significantly compared to its usual average (+0.7 pp vs 1% on average). In total, these two movements (more frequent high expectations and slightly more frequent low expectations) contributed to greatly increasing the dispersion of the distribution of expectations during the first lockdown.[12] These results suggest that the first lockdown greatly increased disagreement between households and indicate a strong heterogeneity in the signal perceived. This heterogeneity could be linked to the dispersion of price changes by product at this time, particularly increases in the prices of fresh products and lower petrol prices (Gautier *et al.*, 2020). A similar increase in disagreement between households has been observed in the United States since the onset of the pandemic (Armantier *et al.*, 2021; Weber *et al.,* 2022). In comparison, the effect of lockdowns on perceptions is close to 0 in the CES and negative for all three lockdowns in the CAMME survey, with a higher proportion of "stable price" responses (see Online Appendix S9).

3.3. Uncertainty and Aggregated Expectations

The scale and nature of the COVID-19 crisis has led to an unprecedented increase in uncertainty: uncertainty indicators from financial market data or surveys reached or exceeded their highest historical level in March and April 2020 (Altig *et al.*, 2020). How was this reflected in household inflation expectations? Two types of indicators are generally used to measure the degree of uncertainty in inflation expectations.

The new generation of surveys, of the CES type, makes it possible to measure uncertainty using "probabilistic" questions relating to predefined intervals (Bruine de Bruin *et al.*, 2011). In this context, individual uncertainty is the standard error of the modal values of each interval completed. Uncertainty measures a level of vagueness surrounding the expectation of a respondent. This variable is then aggregated to produce an uncertainty indicator for all households.

12. Results shown in Online Appendix S6 confirms this finding based on the qualitative data of the survey. During the first lockdown, the proportion of households reporting a sharp increase in prices rose sharply (+22 pp for the CES and +9 pp for the CAMME survey) which was not observed during the subsequent lockdowns.

A second type of indicator is constructed from responses that are multiples of 5% for the quantitative estimate of expected inflation from the surveys; however, this variable is an indirect and approximate measurement of uncertainty. Binder (2017) shows, in the case of the University of Michigan's Survey of Consumers, that these round figures correspond to the responses of uncertain households.[13] Reiche & Meyler (2022), in the case of the euro area, or Binder (2017), in the United States, see a significant increase in the proportion of uncertain respondents at the time of the 2008-2009 financial crisis. The CES produces both types of indicator and appears to indicate that they are closely correlated over time (Figure V). If individual uncertainty is introduced as a determinant of the likelihood of expecting inflation above 5%, the effect is positive and significant (Table 5-A).

The measurement of uncertainty regarding inflation in the CES and in the CAMME survey give different signals over the period 2020-2021. In the CAMME survey, the uncertainty approximated by the proportion of responses that are multiples of 5 increased sharply during the first lockdown, reaching more than 40%, while actual inflation was low and gradually decreased. For comparison, Andrade *et al.* (2021) obtain an average proportion of multiples of 5 of about 25% over the period 2004-2018 and a maximum of close to 40% in 2008-2009, when inflation was around 3 to 4% in France. Starting in 2021, this proportion again rose steadily, reaching a historic high (50%), but in a context of higher inflation. The increase in the proportion of multiples of 5 mechanically supported the dynamics of aggregated expectations.

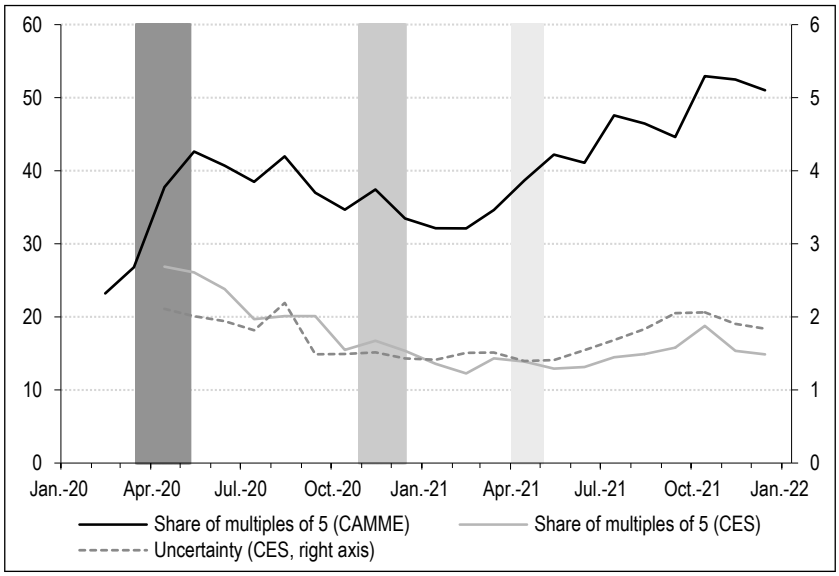
In the CES, the proportion of responses that are multiples of 5 is lower than in the CAMME survey, which is also linked with the lowest dispersion of responses described above. Both measurements indicate that uncertainty is at its maximum during the first lockdown and then decreases during 2020. However, learning effects contribute strongly to this decrease. Then, both indicators increase from 2021, but only slightly. A higher level of individual uncertainty is associated with a higher level of expected inflation (cf. Table 5-A) and this requires a higher probability of expecting inflation above 5% and a lower probability of reporting a low rise or price stability.

3.4. The Link Between Economic Activity, Unemployment and Expected Inflation

Based on the two surveys, we describe how households perceived the relationship between price and activity over the period 2020-2021,

13. A multiple of five does not systematically indicate uncertain response behaviour. For example, in the 1990s, when inflation was close to 5%, an expectation of 5% could be a certain estimate. Binder (2017) proposes a statistical method identifying the proportion of certain households and the proportion of uncertain households.

Figure V – **Changes in household uncertainty (%)**



Notes: Individual uncertainty is equal to the standard error of the distribution of individual responses to the probabilistic question (see Online Appendix S3), the aggregate indicator is the date-weighted average of this measurement. The proportion of multiples of 5 (as a %) is calculated as the ratio of the number of quantitative responses (excluding 0) that are multiples of 5% out of the total number of responses. The proportions are weighted.
Reading Note: Almost 40% of households may be considered uncertain in the CAMME survey in April 2020.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

Table 6 – **Household expected inflation and the actual economy**

		(1) Expected inflation		(2) Higher than or equal to 5		(3) Between 0 and 5		(4) Equal to 0		(5) Negative	
CES											
Expected growth		−0.10***	(0.01)	−0.57***	(0.00)	0.01	(0.00)	0.77***	(0.00)	−0.01	(0.00)
Expected unemployment		0.17***	(0.01)	0.65***	(0.00)	−0.26***	(0.00)	−0.26***	(0.00)	−0.69***	(0.00)
Learning effect		Yes		Yes		Yes		Yes		Yes	
Temporal effect		Yes		Yes		Yes		Yes		Yes	
N		47,979		47,979		47,979		47,979		47,979	
CAMME											
Expected growth	Increase	−2.77***	(0.18)	−16.85***	(0.01)	6.73***	(0.01)	9.21***	(0.01)	0.84***	(0.23)
	Stability	−2.19***	(0.17)	−11.81***	(0.01)	2.13**	(0.01)	9.64***	(0.01)	−0.11	(0.17)
	Decrease	*Ref.*		*Ref.*		*Ref.*		*Ref.*		*Ref.*	
Expected unemployment	Increase	1.50***	(0.21)	6.92***	(0.01)	−0.43	(0.01)	−6.06***	(0.01)	−0.72***	(0.27)
	Stability	−0.12	(0.20)	0.10	(0.01)	−0.93	(0.01)	1.08	(0.01)	−0.37	(0.31)
	Decrease	*Ref.*		*Ref.*		*Ref.*		*Ref.*		*Ref.*	
Learning effect		Yes		Yes		Yes		Yes		Yes	
Temporal effect		Yes		Yes		Yes		Yes		Yes	
N		17,741		17,741		17,741		17,741		17,741	

Notes: Cf. Table 5.
Reading Note: One additional pp of unemployment is associated on average with 0.17 pp of inflation in the CES.
Sources and Coverage: INSEE, CAMME survey (Feb. 2020-Dec. 2021) and ECB, CES (April 2020-Dec. 2021). Metropolitan France, ordinary households.

when experts' opinions differed on the nature of shocks affecting the economy. In both surveys, the results of regressions at individual level show that lower expected activity or higher unemployment are associated with higher inflation (Table 6). In the CES, a 1 pp decrease in the growth expected by households leads to a 0.1 pp increase in their inflation expectations, while an additional point for unemployment is associated on average with an additional 0.17 pp for inflation. Similar results are obtained from the qualitative expected unemployment and activity variables from the CAMME survey. Looking at the effects of expected growth or unemployment along the distribution of expectations, the negative correlation between growth and inflation is particularly strong for high expectations (see Online Appendix S8). In other words, households have a stagflationist view of the economy in which shocks to supply are dominant. This characterisation is important because households that expect higher inflation could reduce their spending rather than increasing it (Candia *et al.*, 2020).

Interpreting the pandemic as a supply shock leads households to expect higher inflation. Thus, during the first lockdown, the expectation of loss of activity by households is 4 pp in the CES, which corresponds to 0.4 pp of additional expected inflation. Similarly, the proportion of households that believe that the economic situation will deteriorate rose from a third to more than 80% between February and April 2020 in the CAMME survey, which would correspond to an increase in inflation of around one pp (i.e. +50 pp for the proportion of households expecting a decrease in activity, multiplied by a marginal effect close to 2, see Table 6-B). Overall, the deterioration of the general outlook for the economic environment contributed, in both surveys, to increasing inflation expectations, which would be consistent with the effect of a supply shock.

* *
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In this article, we document several stylised facts relating to expected inflation in France over the period 2020-2021 using two household surveys. First, average expected inflation is higher than inflation measured by statistical institutes or predicted by economic forecasters. Household inflation expectations are then characterised by a high dispersion, which largely reflects an initial dispersion of perceptions of price developments. The two surveys used in this study, however, give a rather different signal on the extent of bias and dispersion of expectations, which could be explained by the method of collection or the phrasing of the questions.

The analysis of the period 2020-2021 provides several pieces of information on the formation of expectations: they are closely correlated with

actual inflation; only the first lockdown had a significant and positive effect on expectations, linked with the health measures put in place and the increase in uncertainty. In addition, households associate high inflation more with high unemployment, suggesting that households have a stagflationist view of the economy.

The increases in the prices of raw materials seen in early 2022 continue to keep inflation at a high level in France and Europe. One of the important issues for monetary policy is to understand how increases in the prices of raw materials will affect the inflation expectations of economic actors, since they will then affect aggregate demand, wage bargaining and thus the persistence of inflation. □

Link to the Online Appendix: https://www.insee.fr/en/statistiques/fichier/6530556/ES534-35_Gautier-Montornes_Online-Appendix.pdf

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The Health Crisis and the Financial Situation of Households in France – A Study on Monthly Bank Data

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Abstract – In view of the magnitude and the sudden nature of the health crisis in 2020, economists and statisticians have explored new sources of data to describe the development of the financial situation of households. The bank data used in this study, an anonymised panel of La Banque Postale customers, offer the twofold advantage of being able to be used practically in real time and of recording monthly (or even daily) changes in income, spending and wealth. First, we show that while the crisis affected incomes in a limited and temporary way in 2020 for most households (regardless of income level), populations on the margins of the labour market suffered more. We then specifically study the situation of recipients of the revenu de solidarité active (RSA), the French guaranteed minimum income. Although their social security benefits did not decrease in 2020, their incomes increased less than in a normal year because more of them did not return to employment. The exceptional government support paid out in May and November 2020 only partially counterbalanced these lower employment opportunities.

JEL Classification: C23, C81, D31, E21, E24, H53, I32
Keywords: bank data, high frequency data, COVID-19, income, precariousness

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This article presents a study of the impact of the health crisis on household income, spending, wealth and the risk of being overdrawn using the data of a large French bank, La Banque Postale (referred to hereinafter as LBP), which had approximately 11 million individual customers in 2020.[1] First, the effect of the health crisis on customers, based on their income levels, is analysed. Then, we take advantage of the characteristics of LBP's customers, who are less affluent on average than the general population, in order to study the situation of a particularly precarious population, the recipients of the *Revenu de solidarité active* (RSA, the guaranteed minimum income). The article focuses on the short-term impact, at the time when the crisis was in full swing.

The health crisis related to COVID-19 abruptly slowed economic activity in 2020: in France, GDP fell by 7.9% and household consumption decreased by 7.1% (Amoureux *et al.*, 2021). In order to avoid too great an impact on household incomes, the State put in place exceptional measures to support employees (in particular a system for short-time working) and households (direct payment of financial support to the most precarious). Finally, despite a sharp drop in production and consumption, household gross disposable income increased by 1.0% and purchasing power per consumption unit remained stable (Amoureux *et al.*, 2021).

However, these average developments do not necessarily represent the diversity of individual situations in the light of the health crisis. Some populations have barely been affected or not affected at all in terms of income, such as retirees or most civil servants. Other populations, such as short-time workers, have been more impacted, while others, such as some self-employed or people in precarious employment, have been impacted particularly badly. Indeed, as a result of the crisis, the self-employed have experienced a downturn in their activities, some employees have been laid off or have been unable to renew their contracts and some unemployed or inactive people have been unable to find new jobs. Thus, in France, the volumes of food aid distributed by charities increased markedly in 2020 (INSEE and DREES, 2021): 57% of food aid distribution centres report an increase in the volumes distributed, in comparison with a situation in which there is no health crisis. In addition, the number of households in receipt of the RSA[2] rose by 7.4% between the end of December 2019 and the end of December 2020 (DREES, 2021).

In view of the magnitude and the sudden nature of the crisis, national statistical institutes and researchers in many countries have explored new sources of high-frequency data to describe the development of the situation of households practically in real time. Banking data are particularly relevant in this context: they have the twofold advantage of being available earlier than tax data and of recording monthly (or even daily) changes in income, spending and wealth. Furthermore, they contain specific information on banking difficulties encountered, such as the use of overdrafts.

This article provides two contributions. One is to provide an overview of the impact of the health crisis on the financial situation of households in 2020. However, its primary contribution is to study a population on the margins of the labour market and, therefore, impacted particularly badly by the crisis. This precarious population, namely single people in receipt of the RSA in January 2019, is overdrawn for an average of 7.3 days for the month in our sample, which is a quarter of the time. During the 2020 crisis, they saw their prospects of returning to employment decrease and, consequently, their chances of escaping poverty. The large size of our sample (300,000 customers) allows us to study specific situations and isolate groups particularly affected by the crisis. Our data thus make it possible to shed new light on precarious situations and how they developed during the crisis. Regardless of whether the customers belong to affluent groups or not, we see that the crisis has a limited and temporary impact on incomes. Spending was more impacted and savings were built up, thereby reducing the number of days they were overdrawn.

The rest of the article is organised as follows: Section 1 presents a brief review of the empirical work to which the study relates, Section 2 describes the data used, Section 3 explains the estimation method and, lastly, Section 4 presents the results.

1. Brief Review of Related Empirical Work

This article belongs to two distinct strands of empirical literature, one on the effects of the crisis related to COVID-19 using banking

1. *The initial results were presented in Bonnet* et al. *2021b.*
2. *The* Revenu de solidarité active *(RSA) ensures a minimum level of income for people without financial resources, the amount of which varies according to the composition of the household. The RSA is available, under certain conditions, for people aged 25 or over and to active young people aged 18 to 24 if they are single parents or can provide evidence of a certain period of employment. (https://www.service-public.fr/particuliers/vosdroits/N19775).*

data in particular and the other on financial precariousness.

1.1. Assessments of the Impact of the Health Crisis Related to COVID-19 Using Bank Data

High-frequency data are a valuable source of information for studying behaviour during the health crisis. In particular, many authors base their analysis on bank data, which are available at a transactional level. In the United States, Baker *et al.* (2020) show an increase in consumption levels before the lockdown, followed by a decrease during said lockdown. They detail the heterogeneity of this decrease on the basis of expenditure items and the level of liquidity. Cox *et al.* (2020), focusing on the cash savings of households, especially the poorest ones, highlight the significant impact of US public policies implemented to limit the effects of the crisis. Similar work has been carried out, in particular by Andersen *et al.* (2020) in Denmark and Sweden. In the United Kingdom, Chronopoulos *et al.* (2021) show a decrease in consumption, heterogeneous according to gender, income and age, for spending both in supermarkets and in restaurants. In Spain, Aspachs *et al.* (2020) document the increase in income inequality caused by the health crisis using CaixaBank data. In France, Bounie *et al.* (2020), Fize *et al.* (2021) and Bonnet *et al.* (2021a) describe the decline in consumption and the creation of savings as a result of COVID-19 restrictions, according to household income, age and socio-professional category, based on bank data from Crédit Mutuel Alliance Fédérale. Our article stands out from the initial French contributions using bank data by the focus on individuals in precarious situations. It details and confirms the results obtained through microsimulation approaches (Buresi *et al.*, 2021; Institut des politiques publiques, 2021[3]).

1.2. Approaches to Financial Precariousness

Financial precariousness is traditionally documented using tax data and survey data. Based on these data, national statistical institutes measure changes in the poverty rate each year, i.e. the proportion of people living below the poverty line (set, in the EU, at 60% of the median standard of living). In France, in 2018, 9.3 million people were poor based on this definition, which is 14.8% of the population. However, the poverty rate only partially reflects precarious situations, which is why surveys also provide information on other aspects of financial difficulties, such as over-indebtedness[4] and being overdrawn, together with more subjective elements such as households' perceptions of their own situation. According to INSEE's *Statistiques sur les ressources et les conditions de vie* surveys (SRCV, the French version of EU-SILC), which focus on statistics on income and living conditions, the proportion of households that were overdrawn at least once a year was 39% in 2019 and the proportion of households that considered their financial situation to be difficult was 17%.

Various indicators have been developed in the economic literature to describe wealth poverty, i.e. the situation of people without a financial "cushion" who consume almost all of their income immediately and have minimal savings. Haveman & Wolff (2004) set the wealth poverty threshold by comparing it to the income poverty threshold: a person is considered to be precarious if their wealth is less than three times the monthly income poverty threshold, or if liquidating their wealth cannot provide for their basic needs for three months. They apply these definitions to the Surveys of Consumer Finances[5] and find a wealth precariousness rate of 24.5% in 2001 in the United-States, for example. Aguiar *et al.* (2020) propose two possible definitions to describe so-called hand-to-mouth (HTM) situations, i.e. the situations of people who immediately consume the majority of their income. The first definition is based on all wealth: a person is living HTM if their wealth is less than two months' wages. The second definition focuses on cash wealth: a person is living HTM if the cash they own is less than one week's income. Lastly, Kaplan *et al.* (2014) use a notion of "rich HTMs", meaning people whose cash wealth is low in relation to their total wealth.

2. Data and Concepts Used

Based on the approaches to financial precariousness and taking into account the data we use, we will use three indicators of monetary precariousness. The first is similar to the poverty rate and is therefore based on income: a customer is precarious if the inflow into their accounts is less than €1,000 per month.[6] The second indicator is based on wealth: a customer is precarious if they

3. According to the IPP, the exceptional solidarity support represented more than 5% of pre-crisis income for the poorest twentieth of the population (Institut des Politiques Publiques, 2021).
4. Studied in particular by the Observatoire de l'Inclusion Bancaire *(OIB).*
5. These surveys conducted by the FED (Federal Reserve) provide information on the incomes, savings, pensions and general state of finances of the US population every three years.
6. This threshold of €1,000 was chosen rather than the poverty line because the income concepts used to calculate the latter do not correspond to those used in our study (for the record, the poverty line was €1,063 per month in France in 2018).

have less than €3,000 in their accounts. Finally, the third indicator corresponds to the average number of days for which the customer is overdrawn. We compute these indicators for different populations and measure monthly changes over the period.

Before analysing the impact of the crisis on different customer groups, we describe the strengths and weaknesses of the data used, then we define the concepts of spending, income and wealth used and we compare their changes with those published by INSEE and the Banque de France. Lastly, we describe the changes in the main precariousness indicators over the period from January 2019 to June 2021.

2.1. Description of the Data

The sample provided by LBP is an anonymised panel of 300,000 customers for whom LBP is the main bank for at least one month between January 2019 and December 2020.[7]

The data contain month-end account balances (individual or joint current accounts, savings accounts and securities accounts), all transactions made (amounts and dates of transactions by bank card, cheques, transfers, direct debits, withdrawals and deposits) and various socio-demographic data (age, gender, French department, marital status, urban unit segment where they live and socio-professional category). These data are available for each customer in the sample and over the entire period under consideration. The sampling carried out by LBP is stratified by age brackets (in multiples of five), and by department.

2.2. Methodological Challenges and Construction of the Final Sample

Banking data are a new, rich source of information for social science research. However, such data have a number of limitations, some of which are specific to the bank being studied. The methodological challenges posed by the use of such data are of various kinds:

- *Non-representativeness*: people without a bank account or those with accounts in alternative banking services, like tobacconists' shops, are excluded. Surveys that include populations without bank accounts (migrants and undocumented people, for example) are thus a crucial additional source of information to provide a more complete overview of precarious situations. In addition, LBP customers include lower proportions of executives and higher proportions of employees; the sample contains almost no customers under 20 years of age and the customers are on average more fragile than customers of other banks. This limits the way in which the results can be extrapolated to all people with bank accounts in France. On the other hand, this customer structure is an asset for studying people in precarious situations and in particular recipients of statutory minimum social security benefits.

- *People holding accounts with multiple banks*: LBP customers may have bank accounts with other institutions, even if the bank has taken care to select the sample from among its customers that it identifies as banking primarily at LBP.

- *A partial view of wealth*: by definition, property wealth and movable wealth held outside of banks are absent from this type of data.

- *Difficulty in reconstructing households*: banking information is provided by LBP at individual level, not at household level. An analysis in terms of consumption units is therefore impossible. Any bank accounts of any other members of the household are not observed, even if their accounts are also held with LBP**.** If the customer has a joint account (37% of the sample), all transactions and amounts relating to that account are divided by the total number of account holders. Furthermore, even if LBP were to gather all the information it has about a household, the fact that some household members hold accounts with other financial institutions would prevent full knowledge of the financial assets held by households.

- *Inactive accounts*: in the data provided by LBP, some accounts seem to be little used or not used at all (virtually no spending or income); the number of inactive accounts increases over the period under study.

- *The identification of income*: only a date and an amount are provided but the nature of transfers is unknown. Thus, a transfer can correspond equally to a transfer between accounts and to the payment of a wage. Accordingly, these data are less rich than those used in other countries where transactions are labelled by banks. The absence of labels therefore makes it difficult to identify income. Adding together all inflows into an account in order to determine income could lead to both overestimating or underestimating customers' actual incomes. Indeed, the inclusion of inter-household and inter-account transfers

7. We were able to access the data through the Secure Data Access Centre (CASD). All the processing operations to create the sample were carried out by the bank using its secure information systems, thus guaranteeing the protection of the digital privacy of their customers.

would lead to overestimating incomes, while the failure to take into account informal incomes that would not be deposited in bank accounts would lead to underestimating them.

In order to avoid changes being distorted by the increase in the number of inactive accounts over the period, only customers with outflows (cards, cheques, withdrawals and direct debits) and inflows of more than €150 over three consecutive months are included in the final sample. The self-employed are also excluded because their income is more difficult to identify.[8] Of the 300,000 LBP customers considered, only the 218,811 who are present continuously from January 2019 to June 2021 are retained. The sample is weighted based on the census by age (in multiples of five), and by department in order to match the sample to the general structure of the French population and to correct biases related to the stratification of the initial sampling.

2.3. The Concepts Used and their Measure

Due to the specific nature of these banking data, the income, spending and wealth studied here do not correspond to the concepts usually defined. Incomes are measured based on the sum of incoming transfers and cheques in amounts of less than €40,000.[9] Round amounts (expressed as integer numbers) are not taken into account, as they are more likely to correspond to transfers between individual accounts than to income; thus, for example, an amount of €500.00 is not taken into consideration, while an amount of €500.13 is. This restriction has the perverse effect of eliminating certain income from liberal professions.[10] In 2019, the average income calculated (without round amounts) in our sample is €1,710 (Table 1) and the median is €1,510. To refer to an order of magnitude, the average standard of living, i.e. gross disposable income divided by the number of consumption units of the household, was €2,054 in France in 2018 and the median level was €1,770 (INSEE, 2021a). In principle, the difference can be explained, aside from the difference in concept (we cannot calculate standard of living), by the fact that the customer base is less affluent than the general population and by people holding accounts with multiple banks. However, the main explanation for the difference seems to be the specific characteristics of the customer base. Indeed, for a given socio-professional category, the income levels of the LBP sample are close to those of the general population calculated using INSEE's *Enquêtes Revenus Fiscaux et Sociaux* (Tax and social incomes surveys) (see Online Appendix S1; link at the end of the article), except for self-employed people for whom it is difficult to identify income. We conclude from this that our measurement of incomes is not systematically biased compared with incomes actually received and that the lower levels observed in our sample are mainly due to the composition of LBP's customer base.

Gross financial wealth is the sum of all the assets in accounts, excluding debts and loans: current (individual and joint) accounts, savings accounts, life insurance and securities accounts. The average wealth is €24,500 and the median wealth is €4,150. For the purpose of comparison, the gross financial wealth of individuals is slightly higher in the INSEE *Histoire de vie et Patrimoine* survey on life history and wealth: €32,430 on average, with the median being €7,550.[11] Once again, this particularly reflects the specific nature of LBP's customer base.

Monthly spending is the sum of card spending, withdrawals (at ATMs or over-the-counter), outgoing cheques and direct debits. In 2019, average monthly spending was €1,850 and the median was €1,540. According to the *Budget de Famille* survey on family budgets, average consumption was €1,450 and the median was €1,260. The amounts are slightly lower because some of the amounts we include in spending do not correspond to consumption.[12]

2.4. Comparison of Changes Using Aggregated Data

The observed changes in LBP data differ from those observed overall in France over the period. Indeed, aside from the economic conditions which are not different on average, the specific nature of LBP's customer base and the absence of incomings and outgoings in the sample contribute to differences. As the panel is composed of the same customers from the beginning to the end of the period, the observations of June 2021 correspond, by design, to individuals who are older than those of January 2019. Also by design, customers have a higher average length of time with the bank at the end of the

8. They can receive a greater number of incoming transfers and it is more difficult to distinguish between income and simple transfers between accounts.

9. Transfers over €40,000 are more likely to be transfers between households or the result, for example, of property sales.

10. The results without restrictions on income are presented in Online Appendix S2 and are not qualitatively different.

11. Calculation by the authors at individual level on the basis of the Histoire de vie et Patrimoine 2017-2018 *survey.*

12. Some of the cheques correspond to transfers between households. In addition, some of the direct debits correspond to taxation (property tax, housing tax and income tax catch-ups).

Table 1 – **Monthly financial statistics of the sample**

	2019	2020
Number of observations	218,811	218,811
Total spending (cards, cheques and direct debits) (€)		
average	1,850	1,770
median	1,540	1,490
Card spending (€)		
average	980	940
median	880	840
Income (excluding round amounts) (€)		
average	1,710	1,740
median	1,510	1,540
Total income (including round amounts) (€)		
average	2,470	2,520
median	1,890	1,940
Financial wealth (€)		
average	24,500	26,350
median	4,150	5,160
Illiquid financial wealth (€)		
average	13,460	13,890
median	0	0
Liquid financial wealth (€)		
average	11,040	12,450
median	3,010	3,800
Average authorised overdraft amount	810	830
Average number of days within authorised overdraft	3	3
Average number of days outside authorised overdraft	1	1
Average number of days overdrawn	4	4
Proportion in wealth insecurity (%)	46	43
Proportion in income insecurity (%)	30	28
Recipient of the May 2020 support (%)	8	8
Recipient of the November 2020 support (%)	9	9
Average age	51	52
Women (%)	55	55
Craftspeople, traders and company managers (%)	1	1
Managers and senior intellectual workers (%)	7	7
Middle-management professions (%)	6	6
Employees (%)	29	29
Blue-collar workers (%)	10	10
Retirees (%)	25	25
Other people without professional activity (%)	20	20

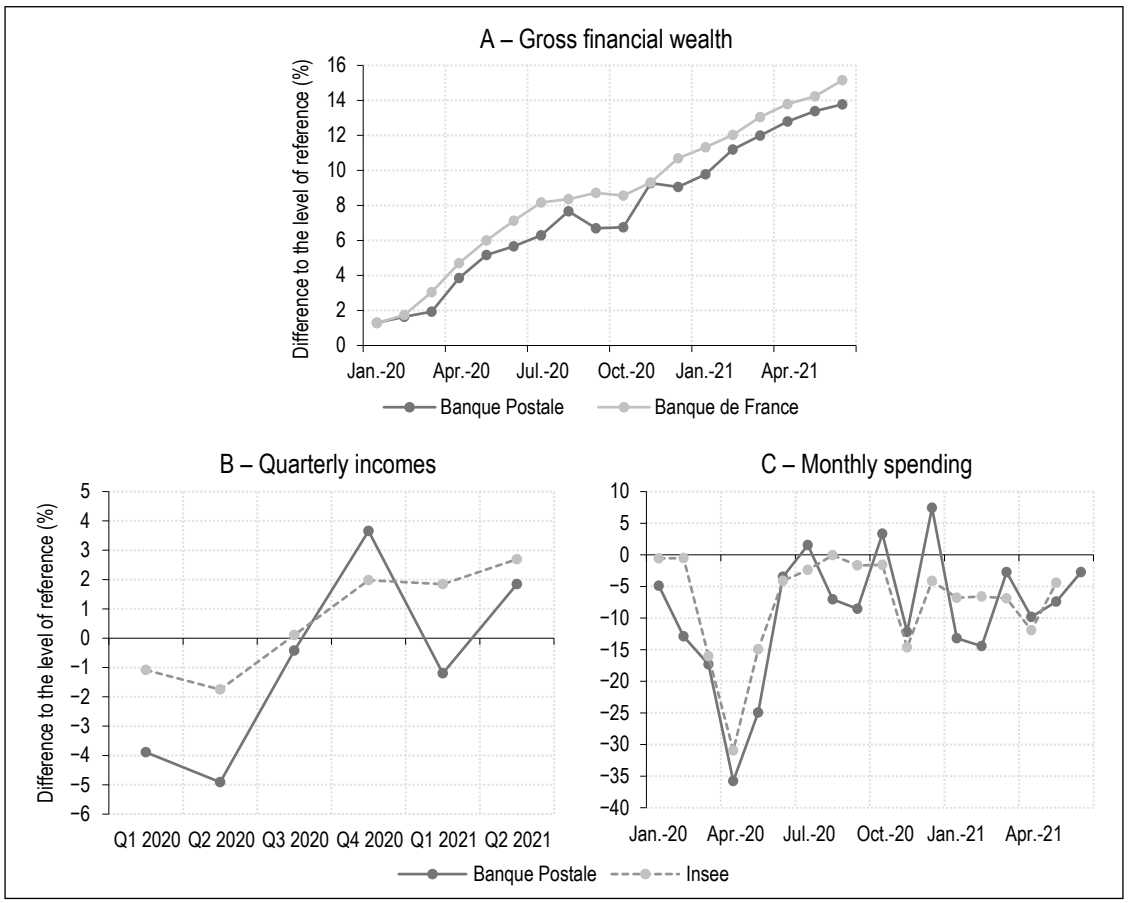
Notes: Observations are weighted using a marginal calibration on age and department based on the census.
Sources and coverage: La Banque Postale. France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

period than at the beginning. In particular, this can affect the balances in the accounts.

Changes in spending measured on the basis of LBP accounts are similar to the changes in consumption published by INSEE (Figure I). Changes in income differ more: for example, growth in income was 1.5% between 2019 and 2020 in our sample, compared with 1.0% in the national accounts. This higher growth can be explained in part by the ageing of the sample. Moreover, in banking data, it is difficult to identify income perfectly on the basis of unlabelled inflows alone and the observed volatility is therefore more pronounced. In contrast, the change in gross financial wealth is almost identical to the change in total outstanding bank deposits of resident households and ISBLSMs[13] produced by the Banque de France. In this case, the concepts compared are much more similar.

13. *Non-profit institutions serving households (*Institutions sans but lucratif au service des ménages*).*

Figure I – **Changes in consumption, income and gross financial wealth in 2020 and 2021 compared with Q4 2019**



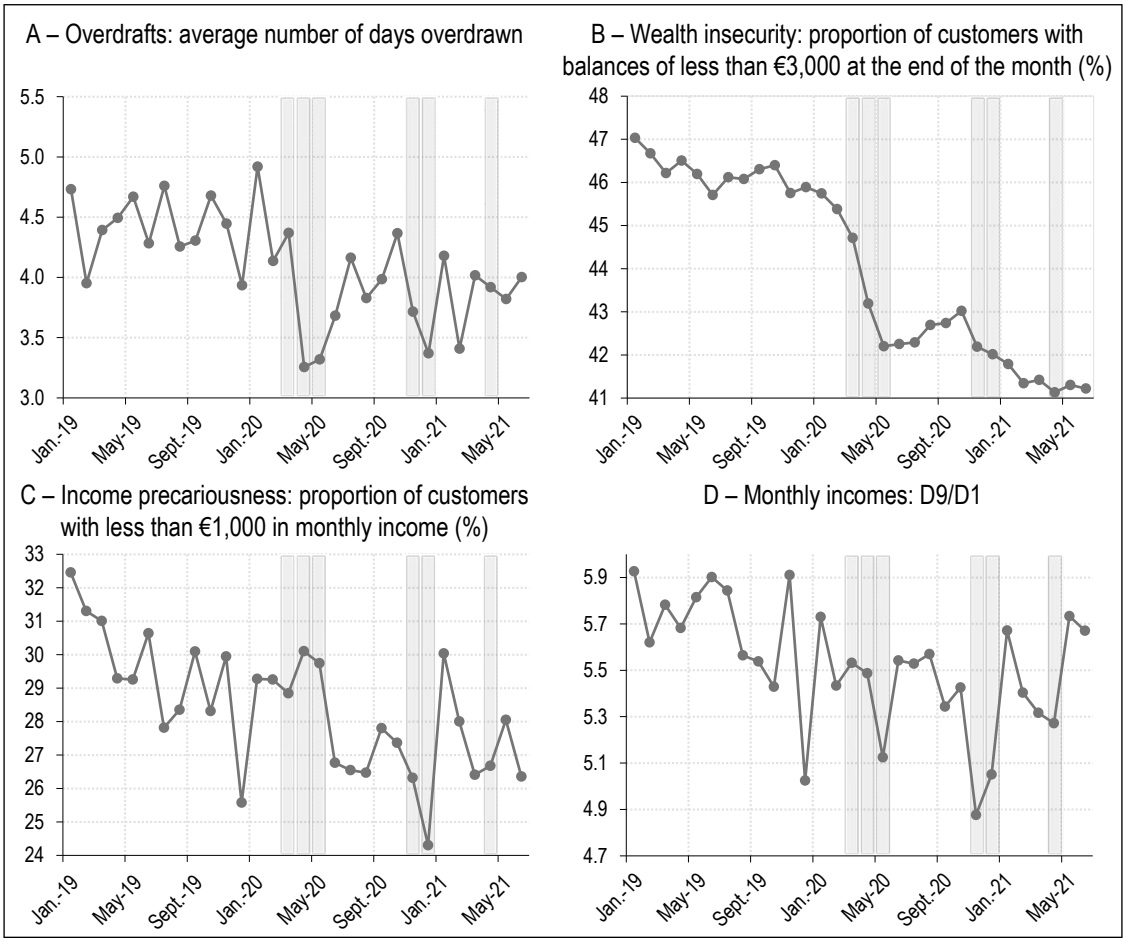
Notes: Observations are weighted using a marginal calibration on age and department based on the census. Changes in deviation from the last quarter of 2019.
Reading Note: according to INSEE data, consumption in April 2020 was 30% lower than over the last quarter in 2019.
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. *N*=218,811. INSEE, for quarterly incomes and consumption (INSEE, 2021b). Banque de France for gross financial wealth. Authors' calculations.

2.5. Changes in Indicators of Wealth Precariousness and Impact of the First Lockdown

Before studying the impact of the crisis on different populations, we measure changes in precariousness in our sample between January 2019 and June 2021. The three indicators used indicate a decrease in our sample (Figure II). However, again due in particular to the specific nature of LBP's customer base and the ageing of the sample this does not mean, *ipso facto*, that precariousness is falling in France over the period.

The changes in the precariousness indicators nevertheless provide information on how the health crisis played out. During the first lockdown, from 17 March to 10 May 2020, health restrictions caused a decrease in spending greater than the decrease in income, allowing supplementary savings to be accumulated. In this particular LBP sample, the proportion of customers with less than €3,000 in their accounts falls from 44% to 42%, marking a break, between March and May 2020. It then rises again slightly once the lockdown is lifted, but remains significantly lower than the pre-crisis level. Additional assets in the accounts reduce the number of overdrawn customers. The less stringent lockdowns in November 2020 and then in April 2021 have more moderate effects than the first: savings, wealth precariousness and the number of overdrawn customers per month are stable over the period. In addition, lockdowns affect incomes less than savings. Thus, the proportion of customers with an income of less than €1,000 per month increases, temporarily, by 1 percentage point during the first lockdown, while the trend across this sample was decreasing in 2019. Finally, we see that the decrease in the D9/D1 income ratio slows down in 2020. While the decrease observed in 2019 can be attributed in part to the ageing of the sample, this slowdown is due to the impact

Figure II – **Changes in precariousness and inequality indicators across a panel of LBP customers between 2019 and 2021**



Notes: Observations are weighted using a marginal calibration on age and department based on the census.
Reading Note: In March 2020, 29% of customers in the sample had an income of less than €1,000
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. *N*=218,811. Authors' calculations.

of the crisis, which was slightly higher for low incomes than for high incomes (see Aspachs *et al.* in Spain and our results below).

3. Empirical Analysis

3.1. Empirical Analysis Method

The next part of the study focuses on distinguishing between the impact of the health crisis itself and the trend observed in the data. To do this, we carry out an event study analysis.[14]

We estimate the impact of the health crisis on spending, incomes, wealth and overdrawn customers by measuring the difference between the values observed in 2020 and the expected or predicted values, had the pre-crisis trend measured between January 2019 and January 2020 continued. The identification of the effect is based on a comparison between a control group (customers in 2019) and a treatment group (customers in 2020). The model is written as follows:

$$Y_{i,p,A} = \alpha_i + \beta 1_{A=2020} + \gamma 1_{p=feb.-dec.} + \delta 1_{p=feb.-dec.} 1_{A=2020} + \varepsilon_{i,p,A} \quad (1)$$

where the terms $1_{j=j'}$ are binary operators equal to 1 if $j = j'$. p can have two values (*Jan.* or *Feb.-Dec.*), $Y_{i,p,A}$ represents the average of the variable studied over period p for an individual i, in the year A. The dependent variable (Y) alternately represents spending, income, gross financial wealth or number of days overdrawn. β is a fixed effect and reflects the trend.[15] α_i corresponds to the individual fixed effect. The coefficient of interest δ is interpreted as the average difference between the observed value of Y (over the period February-December 2020)

14. MacKinley (1997) provides a theoretical and practical presentation of this type of econometric model.
15. This coefficient β *is estimated only if the individual is present in both years. Although there are no incomings or outgoings in our sample, not all individuals are necessarily present each year in each regression due to the formation of sub-samples (by income group and specifically for RSA recipients) defined separately for each year.*

and the expected value had the pre-crisis trend continued. This coefficient corresponds to the estimator of difference-in-differences (Lechner, 2011): the effect of the crisis on Y corresponds to the difference observed between its average value between February and December 2020 and its average value over the same period in 2019, from which the difference observed between January 2020 and January 2019 is subtracted. Formally:

$$\delta = \left\{ \begin{array}{l} E\left(Y_{p,A} | A = 2020, p = feb. - dec.\right) - \\ E\left(Y_{p,A} | A = 2019, p = feb. - dec.\right) \end{array} \right\} - \left\{ \begin{array}{l} E\left(Y_{p,A} | A = 2020, p = jan.\right) - \\ E\left(Y_{p,A} | A = 2019, p = jan.\right) \end{array} \right\} \quad (2)$$

The effect of the crisis is decomposed month by month using the following model:

$$Y_{i,m,A} = \alpha_i + \beta 1_{A=2020} + \sum_{t=2}^{12} \gamma_t 1_{m=t} + \sum_{t=2}^{12} \delta_t 1_{m=t} 1_{A=2020} + \varepsilon_{i,m,A} \quad (3)$$

where γ_t represents the fixed effect of the month t (the reference being January), α_i corresponds to the individual fixed effect, and δ_t corresponds to the effect of the month t specific to 2020 by controlling the pre-crisis trend. This coefficient therefore corresponds to the estimator of the difference-in-differences. Formally, for each month:

$$\delta_t = \left\{ \begin{array}{l} E\left(Y_{m,A} | A = 2020, m = t\right) - \\ E\left(Y_{m,A} | A = 2019, m = t\right) \end{array} \right\} - \left\{ \begin{array}{l} E\left(Y_{m,A} | A = 2020, m = 1\right) - \\ E\left(Y_{m,A} | A = 2019, m = 1\right) \end{array} \right\} \quad (4)$$

The effect of the crisis is thus measured month by month by the coefficients. For example, if Y represents wealth and δ_t equals 100, this means that on average, for month t, wealth is €100 higher than expected by extrapolating the pre-crisis trend.

In order to interpret the coefficients as semi-elasticities, the income and spending variables are studied in log (after the zeros are replaced by half the smallest positive value).[16] This transformation allows us to interpret the coefficients as percentages after the 100*(exp(δ)-1) transformation. Other concepts, such as overdrawn customers and wealth, are studied based on their level.

Regardless of the estimated model, the reported coefficients correspond to the within estimators and the standard errors are clustered at the individual level.

The method is therefore based on a comparison between 2019 and 2020, by controlling the pre-crisis trend, which is assessed between January 2019 and January 2020. The underlying identification hypothesis of the model is that in the absence of a crisis, the monthly changes to variable Y would be identical in 2019 and 2020. By definition, the counterfactual levels, i.e. which would have prevailed in 2020 in the absence of a crisis, are unknown and this hypothesis can be tested only in February 2020. Indeed, as of that date, the economic crisis had not yet broken out: if the hypothesis is valid, the differences between the observed values and the predicted values should not be significant for that month. In the majority of estimates, we cannot reject the null hypothesis of a common trend in February at a 5% level. We reject it for some of them (such as for the estimate relating to the overdrafts of customers in receipt of the RSA), however, the difference observed in February remains minor compared with the differences estimated for the following months. This gives us greater confidence in the idea that the common trend hypothesis is respected. In any event, the significant differences observed in 2020 due to the crisis economically dominate the possible different trends.[17]

Moreover, to interpret the observed differences as differences from a normal situation, it is still necessary to view 2019, which acts as the reference year, as a normal year. This seems to be the case, in the sense that the change in the growth of household consumption and gross disposable income in 2019 compared with previous years is negligible compared with the decrease observed in 2020. Indeed, according to INSEE's National accounts, there was an increase in actual household consumption of 2.1% in 2018 and 2.3% in 2019 (compared with the previous year), which contrasts with the decrease of 4.2% in 2020.

16. We can also use the reciprocal function of the hyperbolic sine (rather than the classical logarithmic transformation): arcsinh(x) = ln(x + sqrt(1 + x^2)), *which is defined in particular at zero. Zero values have very little presence in our observations (1.2% for income and none for spending). Thus, the results obtained are identical if the reciprocal function of the hyperbolic sine is used rather than the logarithmic function (see Online Appendix S3).*

17. To test the sensitivity of our results to the pre-crisis trend estimation period, we replicate part of the analysis using January-February as the reference period (see Online Appendix S4). Including February in the reference period allows us to more precisely estimate the pre-crisis trend (the estimate is not based on January alone), but it deprives us of the possibility to test the common trend hypothesis (because the health crisis begins in March 2020). The results are qualitatively similar.

Similarly, gross disposable income increased by 2.6% in 2017, 3.1% in 2018 and 3.4% in 2019, compared with only 1.0% in 2020. These results support the assumption of normality for 2019: the differences between 2017, 2018 and 2019 are negligible compared with the differences between 2019 and 2020.

3.2. Construction of Income Groups and the Group of RSA Recipients

Whether to assess the impact of the crisis on different income groups or on the group of customers in receipt of the RSA, we chose not to construct the groups in 2019 and then follow their development in 2020. Indeed, the difference seen in 2020 would then be the sum of the effects of the health crisis, the ageing of the population and a natural effect of return to the mean. This would lead to underestimating the impact of the crisis for the less affluent and overestimating it for the more affluent. Indeed, each year, some of the individuals move from the poorest group to the richest group and *vice versa*. Even in a society with stable inequalities, the group of the least affluent people in a given year still sees its income increase more the following year than that of the most affluent, as long as there is upward and downward mobility. To avoid the latter two effects (ageing of the sample and return to the mean), we construct the income groups and the group of RSA recipients at the beginning of each year. We thus define four income groups based on income in January 2019 and four other groups based on income from January 2020 (see Appendix, Table A-1). For example, some individuals may be classified in the poorest group in 2019, but in a wealthier group in 2020, as the poorest customers in 2019 are not exactly the same as in 2020. The advantage of this procedure is that it provides income groups for 2020 that are comparable to their counterparts in 2019, in order to isolate the effect of the crisis.[18]

Measuring the standard of living using a single month of income introduces measurement errors: wealthy customers may be mistakenly classified in the low-income group if their incomes are exceptionally low in that month and *vice versa* (especially for self-employed workers). To correct this misclassification of customers on the basis of their income, we apply two restrictions: first, observations for which income is strictly below the maximum lump sum amount of the RSA in January are excluded; then, those for which spending in January is more than two standard errors from a group average are removed. With these restrictions applied, the groups are ultimately not all of the same size.

Before presenting our results, we introduce the concept of pay day. It may differ for each customer. In the pay day analyses in this article, the income groups and the group of RSA recipients were constructed by retaining only individuals whose monthly income is paid on a given day in the month and is not subject to several substantial payments spread over the entire month. Specifically, only customers whose two highest incoming transfers into their accounts are at least 25 days apart and do not differ by more than 10%. This filter excludes 34% of individuals in Group 1, 36% of individuals in Group 2, 37% of individuals in Group 3, 50% of individuals in Group 4 and 24% of RSA recipients. These individuals are excluded only for analyses relating to pay day but are retained in the rest of the study.

4. Results

We first analyse the effect of the crisis by income group and then focus on the case of RSA recipients.

4.1. Analysis by Income Group

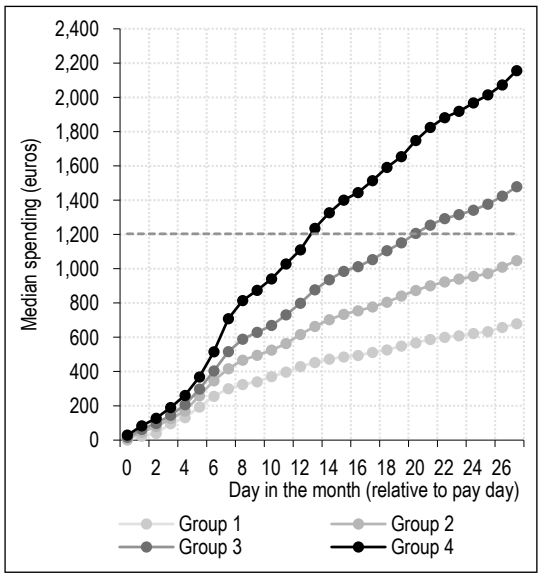
The four groups formed on the basis of income levels show significant differences in levels of spending, wealth and precariousness (see Appendix, Table A-2). Spending during the month reflects differences in the budget constraints that customers experience depending on their level of income. In accordance with the sample construction described in Section 3.2, the median amount of cumulative spending based on the number of days since pay day was calculated for a sub-sample of each group (Figure III).[19] The higher the group's incomes in January, the higher the median amount of cumulative spending, regardless of the time passed since pay day. In addition, the lower the group's incomes, the more concave the curve. Our interpretation is that while high-income groups manage to spread out their spending over the month, the lowest income groups consume more in the days following pay day and must limit their spending afterwards.[20]

18. The advantage of the method is that it neutralises the effects of a reversion to the mean and ageing by assuming that these two factors act in the same way in 2019 and 2020.

19. Online Appendix S5 presents complementary analyses of monthly spending by income group and for RSA recipients.

20. An alternative explanation might be that there is an alignment between the dates of pay day and the main direct debits (energy, rents, etc.), but this explanation would not be sufficient given that when limiting the analysis to spending by card and withdrawals, the curves are similar.

Figure III – **Changes in spending based on number of days passed since pay day by income group in January (€)**



Notes: Observations are weighted using a marginal calibration on age and department based on the census. The dotted line corresponds to the net monthly SMIC (French minimum wage) amount (€1,204) for a full-time employee as of 1 January 2019.
Reading Note: 12 days after their January 2019 pay day, 50% of individuals in the first income quartile in January 2019 had spent more than €400.
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 with regular incomes over the period January 2019-February 2019, after filtering out inactive accounts.

4.1.1 Effect of the Crisis on Incomes and Spending

During the first lockdown from March to May 2020, spending and incomes were far below their expected level, i.e. as can be determined by extrapolation based on the pre-crisis trend (Figure IV). In April, incomes were 12.0% lower than expected for the less affluent and 11.0% lower for the more affluent. Spending, in turn, was 33.8% lower for the less affluent and 38.7% lower for the more affluent. Outside this period, spending and incomes in 2020 were close to expected levels. The November lockdown had a much lower impact. We even see a slight recovery in incomes, which is more marked for the less affluent due to the exceptional support related to COVID-19 (€150, plus €100 per dependent child under 20 years of age), granted in particular to recipients of the RSA and the *Allocation de Solidarité Spécifique* (ASS, an unemployment benefit for those no longer entitled to standard unemployment benefits).

Over the year as a whole, the income deficit was significantly greater for the group with the lowest incomes than for the other groups, contributing to driving inequalities (this results in a slowdown of the decrease in the D9/D1 ratio in our ageing sample): the incomes of the lowest income group are 2.7% lower than expected, compared with 1.9% for the second group, 1.2% for the third group and 1.6% for the fourth group (Table 2). The impact on spending is similar across the groups (the differences are not significant).

4.1.2. Effects on Savings and Overdraft Use

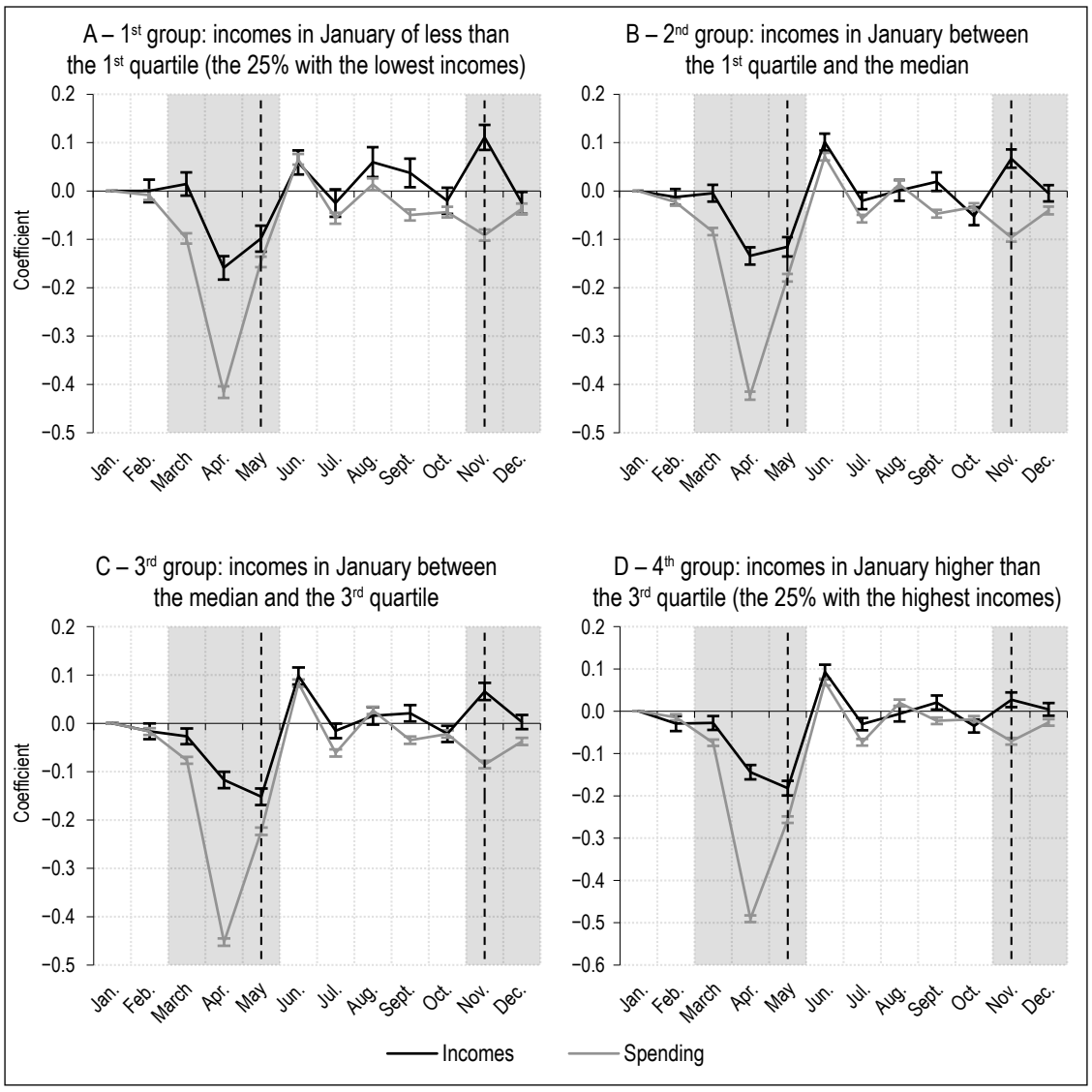
In all income groups, the decrease in spending has bolstered savings: wealth precariousness and the frequency of overdraft use have decreased. In value, people with high incomes saved most and built up their financial wealth: in December 2020, the gross financial wealth of the group of customers with the highest incomes at the beginning of the year was €1,190 higher than expected, compared with €380 for the group of customers with the lowest incomes (Figure V).

Table 2 – **Average annual difference in incomes, spending and overdrafts compared with the level expected from extrapolating the pre-crisis trend**

Income group		Dependent variable		
		Log Incomes	Log Spending	Overdrafts
1st group: incomes in January of less than the 1st quartile	Coefficient (std. error)	−0.027 (0.003)	−0.074 (0.004)	−0.863 (0.046)
	R^2	0.217	0.065	0.030
2nd group: incomes in January between the 1st quartile and the median	Coefficient (std. error)	−0.019 (0.002)	−0.077 (0.003)	−0.671 (0.033)
	R^2	0.086	0.036	0.021
3rd group: incomes in January between the median and the 3rd quartile	Coefficient (std. error)	−0.012 (0.002)	−0.075 (0.003)	−0.973 (0.032)
	R^2	0.026	0.028	0.019
4th group: incomes in January higher than the 3rd quartile	Coefficient (std. error)	−0.016 (0.003)	−0.078 (0.003)	−0.792 (0.030)
	R^2	0.064	0.011	0.014

Notes : The coefficients correspond to the within estimation of parameter δ in equation (1). A different regression is therefore estimated for each income group and each variable. For incomes and spending, the interpretation of a difference of $100*X$ in % is an approximation of $100*(\exp(X)-1)$. Standard errors (shown in brackets) are clustered at the individual level. The number of observations in each group is detailed in Table A-2. For example, in the first income group, N=31,189 individuals in 2019 and N=35,162 in 2020.
Sources and coverage: La Banque Postale. France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

Figure IV – **Differences in spending and incomes between the levels observed in 2020 and the expected levels**

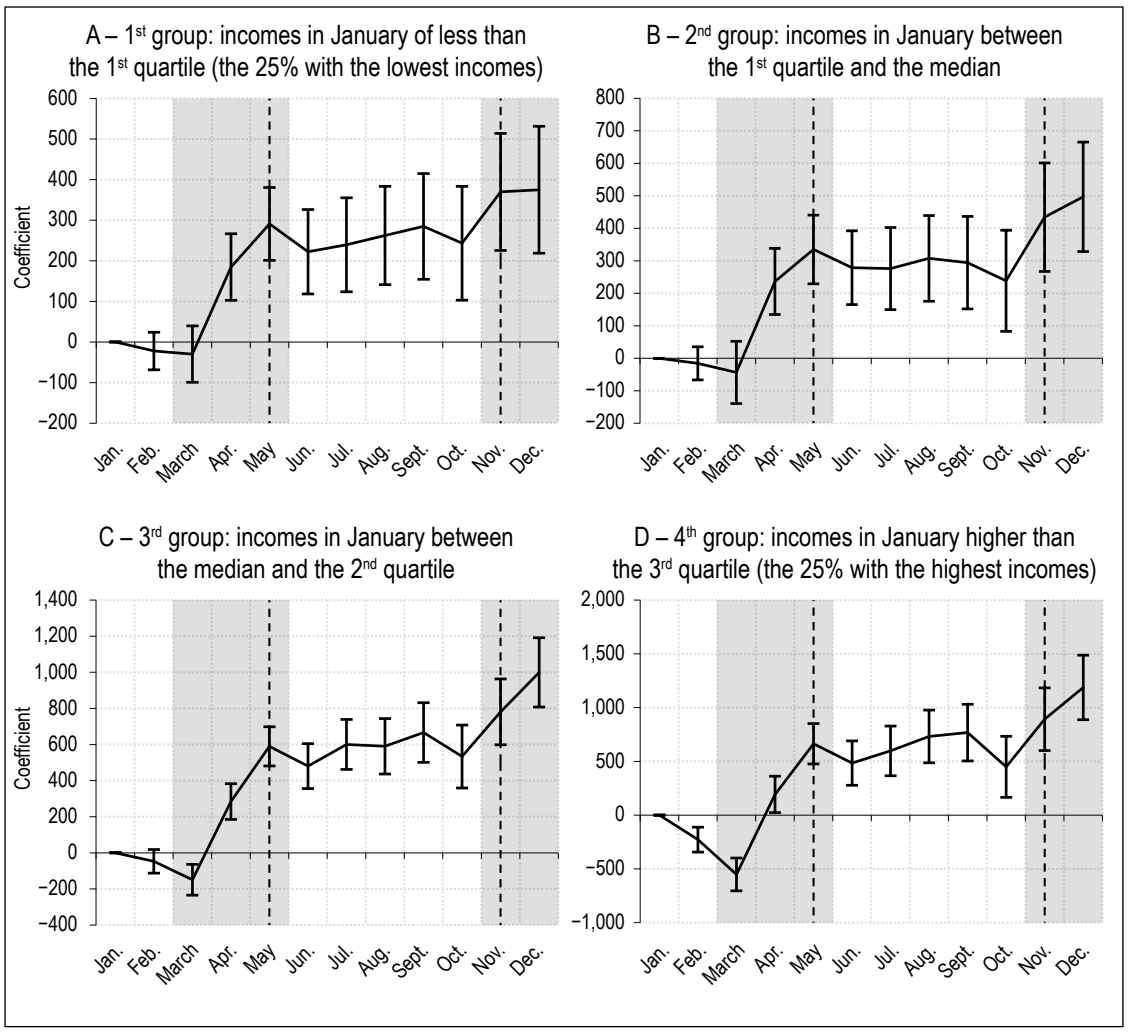


Notes: Observations are weighted using a marginal calibration on age and department based on the census. The lockdown periods are represented by grey bands. The values displayed are the estimates of the coefficients δ_t of the equation (3) where the dependent variable is log(*Y*), with *Y* representing spending and incomes. A different regression is therefore estimated for each income group and each variable. The interpretation of a difference of 100**X* in % is an approximation of the actual difference equal to 100*(exp(*X*)-1). For April, when spending fell sharply, the approximation is less accurate. The intervals provided are 95% confidence intervals. The standard errors are clustered at the individual level. The number of observations in each group is detailed in Table A-2. For example, in the first income group, *N*=31,189 individuals in 2019 and *N*=35,162 in 2020. The dates of payment of the exceptional government support taken into account in the study are shown in dotted lines.
Reading Note: In April 2020, the quarter of customers with the lowest incomes in January had spending 16% below the level expected had the pre-crisis trend continued (the figure corresponds to the logarithmic approximation, but the exact effect is reported in the text).
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

The average number of days overdrawn is lower than expected over the entire crisis period (each month, starting in March), particularly for the group with the lowest incomes (Figure VI).

These results, which show a decrease in the number of days overdrawn and an increase in savings, may seem contradictory to the results obtained from surveys. Thus, a quarter of the respondents to the EpiCov survey on epidemiology and living conditions linked to COVID-19 report a deterioration in their financial situation on average and the lower the initial standard of living, the higher this proportion becomes (Givord & Silhol, 2020). However, the perception of a deteriorated financial situation does not necessarily translate into a fall in the balances of bank accounts. If their income from work falls and the economic outlook darkens, households may see their financial situation as deteriorating even if their ability to save improves temporarily. The CAMME survey on monthly household consumer confidence thus shows that the proportion of households reporting an accumulation of debts or needing to dip into their savings decreased in 2020 (Clerc *et al.*, 2021). Similarly,

Figure V – **Difference between the levels of gross financial wealth (in €) observed in 2020 and the expected levels**



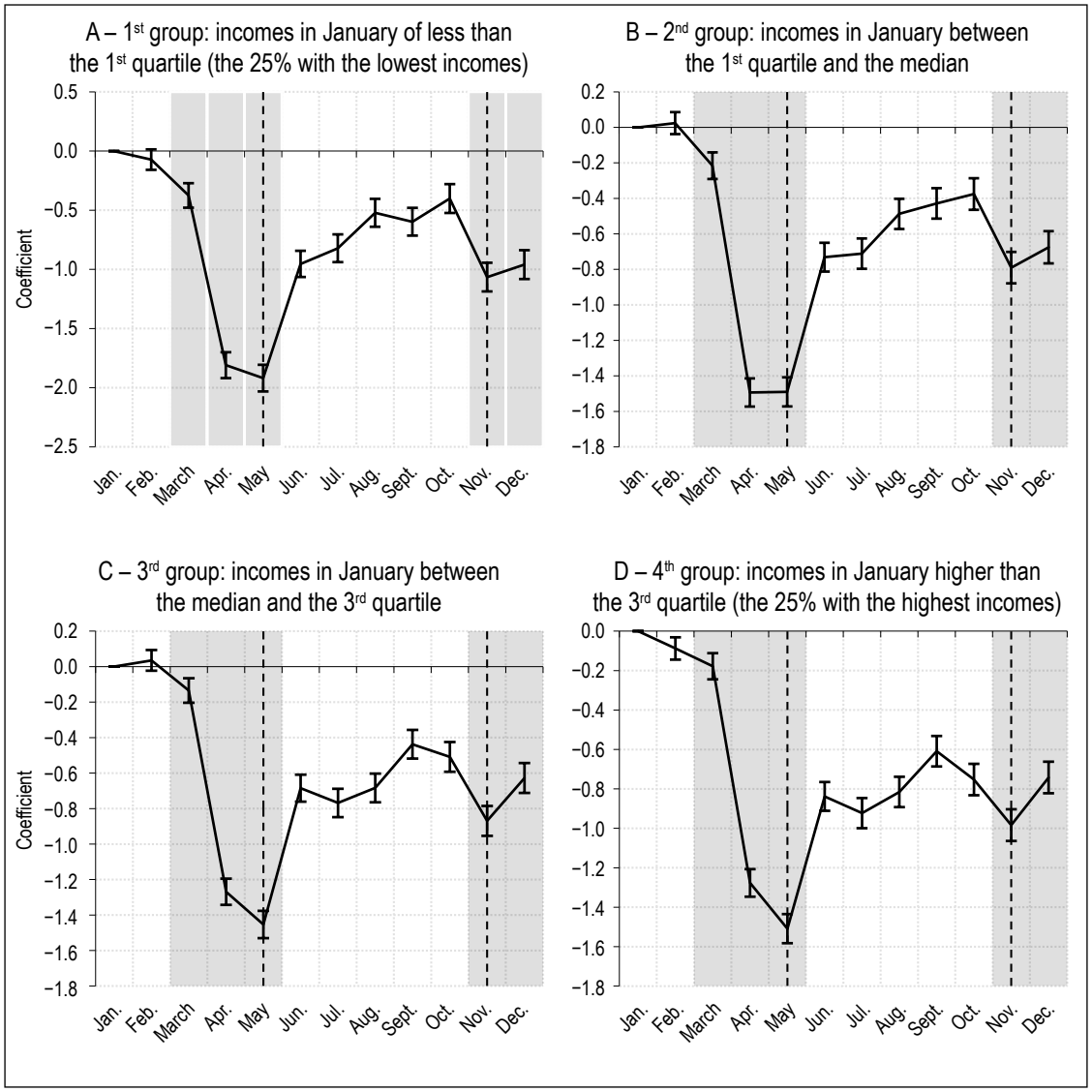
Notes: Observations are weighted using a marginal calibration on age and department based on the census. The lockdown periods are represented by grey bands. The values are the estimates of the coefficients δ_j of the equation (3). The intervals provided are 95% confidence intervals. The standard errors are clustered at the individual level. The number of observations in each group are detailed in Table A-2 in the Appendix. For example, in the first income group, *N*=31,189 individuals in 2019 and *N*=35,162 in 2020. The dates of payment of the exceptional government support taken into account in the study are shown in dotted lines.
Reading Note: In April 2020, the quarter of customers with the lowest incomes in January had an average gross wealth of €180 higher than the level expected had the pre-crisis trend continued.
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

the Observatoire de l'Inclusion Bancaire indicates that the number of excessive debt management proceedings initiated decreased in 2020.

4.2. The Situation of RSA Recipients in 2020

In 2020, fixed-term employment and part-time employment fell: the most precarious jobs and the least skilled jobs suffered more from the crisis than others (INSEE, 2021). In order to compensate for the increase in precariousness due to this fall in employment, the State paid exceptional support to certain recipients of social security benefits, in May and November in particular. The LBP banking data make it possible to measure the capacity of such support to prevent the deterioration of the situation of certain specific populations, such as RSA recipients. At the end of 2019, there were 1,916,100 RSA recipients, 55% of whom were single people without dependants (DREES, 2021). Since the latter represent the majority of RSA recipients and are easy to identify in our data when they receive the maximum amount of the benefit (with or without housing benefit), we can specifically study this population. In our filtered sample, there were 4,160 of these recipients in 2019 and 3,830 in 2020. The recipients are identified in the data if they receive a transfer in January or February corresponding to the maximum lump sum of the RSA for a single person without dependants (with or without housing benefit) to the nearest cent (€550.93 or €484.82 in January and February 2019, €559.74 or €492.57 in January and February 2020).

Figure VI – **Difference between the number of days overdrawn observed in 2020 and expected**



Notes: Cf. Figure V.
Reading Note: In April 2020, the quarter of customers with the lowest incomes in January were overdrawn for an average of 1.8 days less than expected had the pre-crisis trend continued.
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

4.2.1. RSA Recipients at the Beginning of 2019

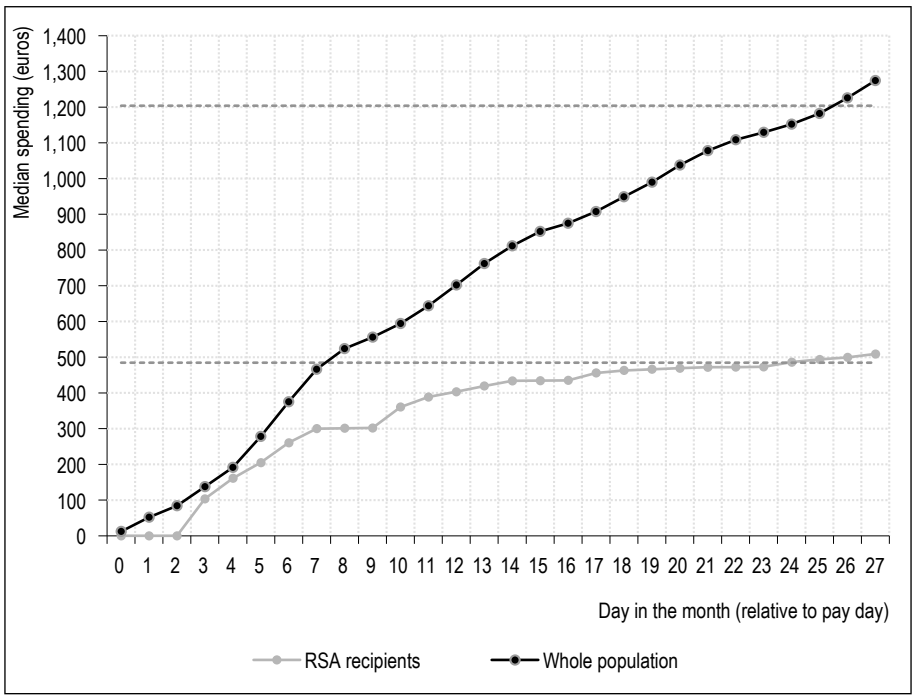
This population is characterised by a very marked precariousness, regardless of the indicator used. In January 2019, their average gross financial wealth was €3,020, their median wealth was €70 and it is negative[21] (−€30) in the first quartile (see Appendix, Table A-3). The average wealth of these recipients is €7,240 lower than that of the customers in the sample in the group with the lowest incomes. For RSA recipients, spending constraints are significant: the average amount of their spending is €860 and the median amount is €560. They are overdrawn for 7.3 days in the month, i.e. a quarter of the time (compared to 5.8 days for the group with the lowest incomes), and the proportion of those who are precarious in terms of income (inflows of less than €1,000) or wealth (balance less than €3,000) is around 90%.[22]

The profile of the changes in their spending appears to be particular: the curve representing the median level of spending, in accordance with the number of days elapsed since pay day, is highly concave (Figure VII). This means that

21. This negative wealth corresponds to a negative amount in current accounts (debts and loans are not taken into account for the calculation of the financial wealth)

22. The proportion of customers who are precarious in *terms of income in January in this group is not 100%, even if the amount of the benefit is well below the threshold of €1,000, for two reasons. The first is that the group includes customers who are RSA recipients in February but not in January. The second is that some customers have just returned to work and still receive the benefit.*

Figure VII – **Changes in spending (in €) based on the number of days passed since pay day for people receiving the RSA at the beginning of the year compared with the general population**



Notes: Observations are weighted using a marginal calibration on age and department based on the census. The dotted lines correspond to the net monthly SMIC (French minimum wage) amounts for a full-time employee as of 1 January 2019 (€1,204) and the maximum RSA amount for a single person with no dependent children and without the housing benefit as of 1 January 2019 (€484.82). The curve of RSA recipients plateaus on days 1, 2, 8 and 9: the RSA was paid on Friday 4 January in 2019 and the days in question correspond to weekends.
Reading Note: 10 days after their January 2019 pay day, 50% of individuals who were full-rate RSA recipients in January or February had spent more than €350.
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers with regular incomes over the period January 2019-February 2019, after filtering out inactive accounts. Authors' calculations.

spending is concentrated in the first few days after pay day. This high level of concavity can be a sign of the use of food support at the end of the month, when the balance of bank accounts is zero or almost zero. Ten days after payment, 50% of the RSA recipients studied have already spent more than two thirds of the maximum amount of the RSA (without housing benefit).[23]

The *Budget de Famille* survey on family budgets helps to shed light on the budgetary constraints faced by RSA recipients on two levels. First of all, the recipients live on tight cashflows and do not save (spending accounts for 100% of the total monthly income, compared with 78% on average). Second, basic necessities account for a major part of their spending: housing and food represent more than half of their spending, compared with an average of one third for the rest of the population.

4.2.2. Fewer Returns to Work, More Social Transfers

For these RSA recipients, the impact of the health crisis on spending is lower at the beginning of the year than for the rest of the population. In 2020, their annual spending was only 5.1% lower than expected. This is due to the specific nature of the structure of their consumption, which is mainly focused on basic necessities. As with the rest of the sample, this negative spending gap is accompanied by a reduction in the number of days overdrawn, throughout the year (Figure VIII). Over the whole of 2020, the level of the number of overdraft days is 1.5 days below the expected level (Table 3).

In contrast, the impact of the crisis on their incomes is greater than for the rest of the sample. For 2020 as a whole, the incomes of RSA recipients are 3.5% lower than expected (Table 3). Without the exceptional support in May and November, it would have been 7.0%. In addition, incomes are below the expected level in every month of the year, with the exception of May and November, when exceptional support was paid out (Figure IX). As we will see, this difference is likely due to less frequent returns to employment.

In order to estimate the proportion of returns to work, we calculate the proportion of RSA

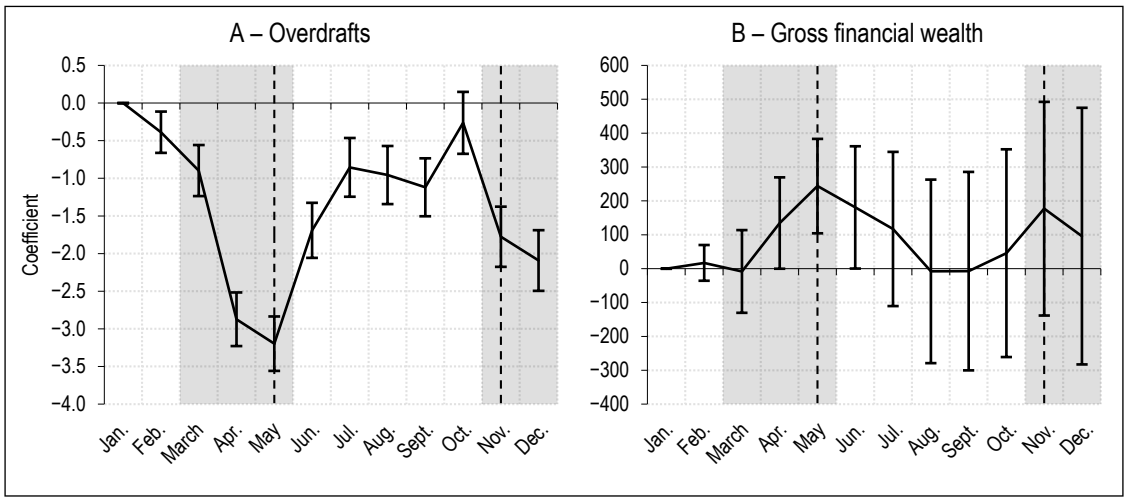
23. However, the benefit does not necessarily correspond to all of the income received in a given month.

Table 3 – **Average annual difference in incomes, spending and overdrafts compared with the level expected from extrapolating the pre-crisis trend, for full-rate RSA recipients at the beginning of the year**

	Dependent variable			
	Log Incomes	Log Incomes excluding support	Log Spending	Overdrafts
Coefficient (std. error)	−0.036 (0.019)	−0.073 (0.019)	−0.052 (0.016)	−1.464 (0.178)
R^2	0.590	0.589	0.695	0.816

Notes: Observations are weighted using a marginal calibration on age and department based on the census. The coefficients correspond to the within estimation of parameter δ in equation (1). The interpretation of a difference of $100*X$ in % is an approximation of $100*(\exp(X)-1)$. Standard errors are shown in brackets and clustered at the individual level. N=4,284 individuals in 2019 and N=3,958 in 2020.
Sources and coverage: La Banque Postale. France. Sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Single customers with no dependants in receipt of the full-rate RSA at the beginning of the year. Authors' calculations.

Figure VIII – **Difference for full-rate RSA recipients at the beginning of the year, between the levels observed in 2020 and those expected based on the pre-crisis trend, in number of days overdrawn and gross financial wealth (in €)**



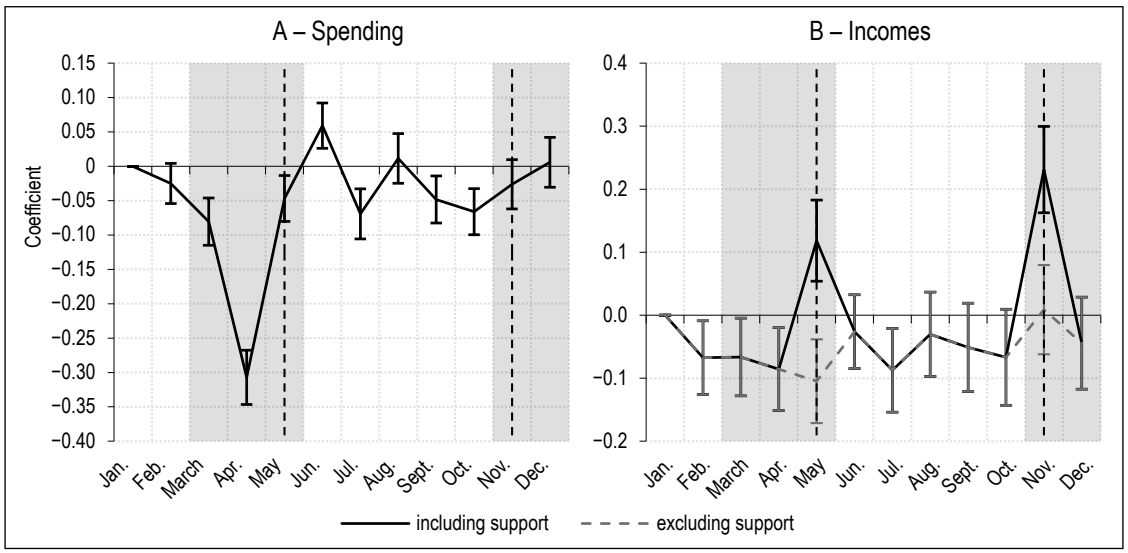
Notes: Observations are weighted using a marginal calibration on age and department based on the census. The lockdown periods are represented by grey bands. The values displayed are the estimates of the coefficients δ_t of the equation (3). The intervals provided are 95% confidence intervals. The standard errors are clustered at the individual level. N=4,284 individuals in 2019 and N=3,958 in 2020. The dates of payment of the exceptional government support taken into account in the study are shown in dotted lines.
Reading Note: In April 2020, single people without dependent children and in receipt of RSA at the beginning of the year were overdrawn for 2.9 days less than expected had the pre-crisis trend continued.
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Single customers with no dependants in receipt of the full-rate RSA at the beginning of the year. Authors' calculations.

recipients at the beginning of the year whose main source of income is not the family benefit payments (from the *Caisse d'allocations familiales*, CAF). Specifically, this corresponds to the proportion of observations that do not receive the majority of their income on the day on which RSA payments are made (usually the 5th of each month). In both 2019 and 2020, this proportion increased as people returned to work throughout the year (Figure X). However, from the first lockdown in 2020, this increase slowed down. At the end of 2020, this proportion was 4 percentage points lower than in 2019.

The payment agency points out that the number of people becoming RSA recipients remained stable at around 100,000 per month over the period from January to August 2020, while the number of people ending their receipt of the RSA fell to around 60,000 between March and May of the same year (CNAF, 2020).

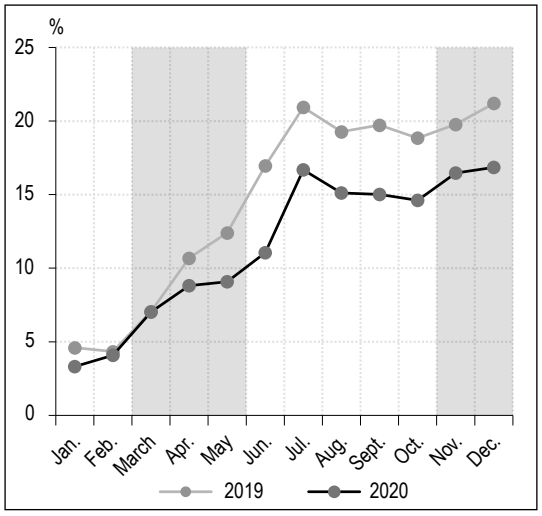
While average income in 2020 was below the expected level, the median income was the same, except in May and November, when it was higher. The majority of the RSA recipients studied therefore did not experience a drop in income. Indeed, whatever the year under consideration, the majority of recipients at the beginning of the year do not find employment in that year: only 24% of RSA recipients at the end of 2019 had been recipients for less than a year (DREES, 2021). The income of recipients at the beginning of the year therefore depends exclusively on social transfers (and possibly family transfers); however, social transfers did not decrease in 2020, they even increased thanks to exceptional assistance. In order to study the

Figure IX – **Difference in spending and incomes between the levels observed in 2020 and those expected based on the pre-crisis trend, for full-rate RSA recipients at the beginning of the year**



Note: Cf. Figure VIII.
Reading Note: In April 2020, full-rate RSA recipients in January and/or February 2019 had incomes 9% lower than the level expected had the pre-crisis trend continued (the figure corresponds to the logarithmic approximation, but the exact effect is reported in the text).
Sources and Coverage: La Banque Postale. France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Single customers with no dependent children in receipt of the full-rate RSA at the beginning of the year. Authors' calculations.

Figure X – **Proportion of RSA recipients at the beginning of the year for whom CAF benefit payments are no longer the main source of income**



Notes: Observations are weighted using a marginal calibration on age and department based on the census. The fact that this proportion is not 0 in January and February is due to customers who received the RSA for only one of the two months. *N*=4,284 individuals in 2019 and *N*=3,958 in 2020.
Reading Note: In April 2019, the proportion of single customers with no dependants and in receipt of the full-rate RSA at the beginning of the year whose main source of income was no longer CAF benefit payments was 11%.
Sources and Coverage: La Banque Postale; France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

case of long-term recipients, we restricted our sample to RSA recipients at the beginning of 2020 who were still recipients in December. For this population, the impact of the health crisis on spending is zero for the whole year, despite the decrease during the first lockdown (see Online Appendix, S6). Incomes are at the expected level except for the months in which exceptional support is received, when they were higher. Thus, their financial situation improved in 2020 with the crisis and the support. The negative impact on the incomes of RSA recipients at the beginning of the year was therefore focused on the minority of recipients who would have been able to find work without the crisis.

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*

Banking data allow monthly, and even sub-monthly, monitoring of the financial situation of households. They have the dual advantage over surveys of being available practically in real time and, given the size of the sample, of making it possible to study very specific situations, such as that of RSA recipients. Our work thus highlights the importance of exceptional support measures for this specific population. We highlight the entry of a section of the population into precariousness, which was also seen both through the increase in the number of RSA recipients and increases in demand for food aid.

The speed of access, frequency and size of the sample of banking data are all assets that

statisticians can use to assess the impacts of a sudden crisis and the effects of support measures in detail. Compared with administrative and especially tax data, these data are among the few sources (together with the *Budget de Famille* survey) to provide information on income, wealth and consumption, which is crucial for measuring household financial fragility. However, the *Budget de Famille* survey, which is a cross section survey conducted every five years, does not make it possible to assess the impact of shocks such as those of the health crisis, due to a lack of longitudinal household monitoring.

Nevertheless, several limitations affecting this study need to be highlighted. Representativeness is imperfect, individuals without bank accounts (migrants or undocumented people, for example) or those with accounts in alternative banking services, such as tobacconists' shops, are completely absent from traditional bank data. Surveys must therefore be conducted to study these populations. Furthermore, the lack of differentiation of incoming transfers between income, social transfers and family transfers prevents a granular description of the trajectories of precariousness. In-depth partnerships between researchers, statistical institutes and banking networks should ultimately allow for a better differentiation of income and thus a better understanding of the trajectories of financial precariousness.

Lastly, our study focuses solely on the impact of the crisis in the short term, i.e. when it was in full swing in 2020. Further studies will need to be carried out to investigate its long-term effects once the support measures have been suspended. Similarly, our study focuses on monetary precariousness and other data should be used to study the other aspects of precariousness: food insecurity, poor housing, energy insecurity or other more psychological forms of insecurity related to technology or social isolation. □

Link to the Online Appendix:
www.insee.fr/en/statistiques/fichier/6530558/ES534-35_Bonnet-et-al_Online-Appendix.pdf

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APPENDIX

ADDITIONAL FINANCIAL STATISTICS ON LBP CUSTOMER GROUPS

Table A-1 – **Income quartiles (in €) in January used to form the income groups.**

	January 2019	January 2020
1st quartile	850	910
Median	1,370	1,430
3rd quartile	1,980	2,040

Notes: Observations are weighted using a marginal calibration on age and department based on the census.
Sources and coverage: La Banque Postale. France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

Table A-2 – **Monthly financial statistics in January by income group**

	Group 1		Group 2		Group 3		Group 4	
	2019	2020	2019	2020	2019	2020	2019	2020
Number of people	31,189	35,162	53,129	52,893	53,060	52,614	54,392	53,750
Total spending (cards, cheques and direct debits) (€)								
average	930	980	1,320	1,370	1,790	1,820	2,850	2,850
median	760	800	1,130	1,190	1,560	1,610	2,290	2,310
Card spending (€)								
average	540	570	690	730	860	890	1,180	1,210
median	490	500	640	670	790	830	1,070	1,100
Income (excluding round amounts) (€)								
average	660	710	1,110	1,170	1,650	1,710	3,260	3,340
median	670	720	1,100	1,170	1,630	1,690	2,560	2,630
Total income (including round amounts) (€)								
average	1,000	1,080	1,520	1,630	2,260	2,360	4,570	4,740
median	770	830	1,230	1,310	1,820	1,900	3,130	3,250
Financial wealth (€)								
average	9,920	11,260	16,530	18,000	26,050	27,390	41,950	44,330
median	590	700	1,820	2,130	5,530	6,090	14,200	15,170
Illiquid financial wealth (€)								
average	5,220	5,860	8,930	9,650	14,540	15,010	23,920	25,070
median	0	0	0	0	0	0	100	80
Liquid financial wealth (€)								
average	4,710	5,400	7,590	8,350	11,510	12,380	18,030	19,260
median	500	600	1,420	1,630	3,620	4,010	8,360	8,860
Authorised overdraft amount (€)	360	380	550	570	850	860	1,460	1,430
Average number of days within authorised overdraft	4	4	4	4	4	4	3	3
Average number of days outside authorised overdraft	2	2	1	1	1	1	1	1
Average number of days overdrawn	6	6	5	5	4	4	4	4
Proportion in wealth insecurity (%)	69	66	56	54	41	40	24	24
Proportion in income insecurity (%)	100	100	30	17	0	0	0	0
Recipient of the May 2020 support (%)	22	22	8	7	4	4	2	2
Recipient of the November 2020 support (%)	24	24	10	10	5	5	3	3
Average age	51	53	53	54	53	53	51	52
Women (%)	57	57	58	57	57	56	53	53
Craftspeople, traders and company managers (%)	2	2	1	1	1	1	1	1
Managers and senior intellectual workers (%)	2	2	2	2	4	4	19	19
Middle-management professions (%)	3	3	3	3	6	6	11	11
Employees (%)	21	20	26	26	35	36	32	32
Blue-collar workers (%)	9	9	11	11	11	11	7	7
Retirees (%)	24	25	32	31	3	29	22	22
Other people without professional activity (%)	37	36	24	24	12	13	7	7

Notes: Observations are weighted using a marginal calibration on age and department based on the census.
Sources and coverage: La Banque Postale. France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

Table A-3 – **Monthly financial statistics in January for RSA recipient groups**

	RSA 2019	RSA 2020
Number of observations	4,284	3,958
Total spending (cards, cheques and direct debits) (€)		
average	860	840
median	560	590
Card spending (€)		
average	640	650
median	470	480
Income (excluding round amounts) (€)		
average	690	720
median	480	490
Total income (including round amounts) (€)		
average	970	950
median	510	530
Financial wealth (€)		
average	2,970	2,760
median	60	60
Illiquid financial wealth (€)		
average	1,050	960
median	0	0
Liquid financial wealth (€)		
average	1,920	1,800
median	50	50
Average age	44	45
Women (%)	36	36
Craftspeople, traders and company managers (%)	3	3
Managers and senior intellectual workers (%)	1	1
Middle-management professions (%)	1	1
Employees (%)	15	14
Blue-collar workers (%)	8	8
Retirees (%)	4	3
Other people without professional activity	64	66
Authorised overdraft amount	170	170
Average number of days within authorised overdraft	5	5
Average number of days outside authorised overdraft	2	3
Average number of days overdrawn	7	9
Proportion in wealth insecurity (%)	87	86
Proportion in income insecurity (%)	87	87
Recipient of the May 2020 support (%)	72	84
Recipient of the November 2020 support (%)	73	84

Notes: Observations are weighted using a marginal calibration on age and department based on the census. The statistics correspond to the January amounts for those single customers with no dependants who received the full-rate RSA in January or February.
Sources and coverage: La Banque Postale. France, sample of LBP main bank account customers present over the entire period of January 2019-June 2021 after filtering out inactive accounts. Authors' calculations.

Recruitment Difficulties and Firms' Characteristics: An Analysis of French Company Data

Antonin Bergeaud*, Gilbert Cette and Joffrey Stary*****

Abstract – This article uses a survey conducted in 2019 among companies in the manufacturing sector on the recruitment difficulties they may encounter. By linking this information with the companies' income statements, we show that those facing these difficulties are, on average and other things equal, more productive than others. This suggests a potential misallocation of production factors, which would not be attracted by the most efficient companies. A very simplified estimation suggests that these inefficiencies could reduce the average productivity in the manufacturing industry by around 0.10% to 0.15%, which is low. The survey also enables us to analyse the causes of these difficulties. In addition to the problems of matching supply and demand in terms of skill levels in the labour force, the wages offered and the competition with other companies also appear to be key factors behind recruitment problems.

JEL Classification: J63, M5, J21, D22
Keywords: recruitment difficulties, productivity, unemployment, employment

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Recruitment difficulties reported by companies reached a peak, and in some cases even a record high, in numerous countries before the COVID-19 pandemic. The crisis led to a fall in these tensions, which, however, quickly rose again from late 2020/early 2021. In France, the high proportion of companies facing recruitment difficulties measured by INSEE as part of a European survey, or a survey conducted by Banque de France as part of its Monthly Business Survey, together with the number of vacancies as measured by the French Directorate for Research, Studies and Statistics (DARES), attest to these high tensions. The high mismatch between labour supply and demand reflected by the high levels of these indicators may seem paradoxical in a country such as France, which is still suffering from high unemployment. There is a fear that the post-COVID economic recovery and, beyond this, medium-term growth and reduction in unemployment, are being hamstrung by the difficulties faced by companies in finding suitable labour for their needs.

There may be a wide range of reasons behind these labour market shortages. They may equally be due to the supply of or demand for labour or a mismatch between the two. Recruitment difficulties may also reflect a misallocation of production factors, in particular depending on company size, and impact productivity.

The analysis below aims to improve the diagnosis of the nature and potential consequences of the recruitment difficulties encountered by French companies. It is based largely on responses given by industrial companies to a survey conducted in September 2019 by Banque de France as part of its *Enquête annuelle sur l'utilisation des facteurs de production* (Annual survey on the Use of Production Factors – UFP), which asks companies about their recruitment difficulties and the characteristics and consequences of these difficulties. The responses to this survey were matched with the FiBEn data (*Fichier bancaire des entreprises*) based on tax returns. These data were then used to develop, over the 2014-2019 period, indicators for company characteristics and performance (business growth, labour productivity, total factor productivity, economic or financial profitability, etc.). Combining these two sources of information, we develop an original dataset covering around 1,300 companies from the manufacturing sector.

Using these data, we estimate various models with the aim of studying the origins of these recruitment difficulties and their consequences on production factor utilisation and production performance. To our knowledge, this analysis is the first of its kind to be based on data relating to recruitment difficulties from the company perspective.

The main results of the analysis are as follows. Firstly, productivity is significantly higher in companies experiencing recruitment difficulties than in others. Depending on various characteristics, the productivity of companies reporting recruitment difficulties is on average around 8% higher than other companies that had sought to recruit new employees in 2019. This suggests that recruitment difficulties are likely to lead to a misallocation of production factors, at a global level. Secondly, in companies identifying insufficient starting salary as the reason for their difficulties, the average salary is, on average, almost 2% lower than in other companies. Conversely, in companies identifying competition from other companies as the reason for their recruitment difficulties, the average salary is around 1.5% higher. Companies attributing their recruitment difficulties to insufficient salaries have lower profitability than other companies experiencing recruitment difficulties, which probably represents a constraint should they want to increase salaries.

The rest of the article is structured as follows. After a brief literature review (Section 1), Section 2 presents the changes in recruitment difficulties in France and other developed countries over the last few decades. The individual company data used in the empirical analysis are presented in Section 3, the results of the estimations are presented and discussed in Section 4, followed by our conclusion.

1. Recruitment Difficulties in Recent Empirical Literature

This sections offers a brief literature review of the sources and potential consequences of recruitment difficulties.

1.1. Factors of Mismatch in Labour Supply and Demand

An initial factor of imbalance between the supply and demand of labour may come from demographics, for example in countries such as Germany, which is characterised by an enduring low fertility rate and an ageing population. Garloff & Wapler (2016), however, show that the demographic factor generally has a very weak impact, even in Germany and including in the future, as it is largely offset by other labour market adjustments, particularly the increase

in participation rates. A second factor may be insufficient geographical mobility of the labour supply compared with business demand. In the case of the United States, Marinescu & Rathelot (2018) found a geographical mobility reluctance in the labour supply (see also Kline & Moretti, 2013 and Rodríguez-Pose, 2018). However, according to their evaluation, significantly increasing worker mobility would provide only a minor contribution to reducing the mismatches on the US labour market. These results confirm those previously obtained, also in the USA, by Sahin *et al.* (2014) and Manning & Petrongolo (2017).

The imbalances on the labour market may also be one of the consequences of ongoing technological changes, which are profoundly changing the structure of the labour demand, while the labour supply is not changing quickly enough to meet this. Haskel & Martin (2001) show a growing mismatch in this regard in the United Kingdom. Autor *et al.* (2003) posit that technological changes, including computerisation and digitalisation, are eliminating manual and non-manual routine jobs and increasing the labour demand for non-routine positions, leading to a polarisation of the labour market. This perspective has generated a high volume of literature attributing to technological transformations a growing imbalance between the labour supply and demand in terms of qualification, and consequently an increase in structural unemployment (for a literature review and perspective on this, see for example Restrepo, 2015) and Aghion *et al.* (2019) show, using British data, that this structural change does not just affect qualified employees. The most innovative companies are also looking for less qualified employees with specific non-cognitive skills. Despite this significant upheaval on the labour market, associated with technological changes, there is less consensus on the extent of their impact on recruitment difficulties. For example Weaver & Osterman (2016) show that lasting imbalances in which the labour supply does not meet the demand relate, in the USA, only to very specific qualifications that are associated with new technologies. For Cappelli (2014), the labour supply in the USA is, in general, overqualified for the demand and the country is not suffering from a structural imbalance whereby the supply does not meet demand due to the unsuitability of qualifications. Furthermore, the unemployment rate in the USA and numerous other developed countries before the COVID-19 pandemic was at historically very low levels, which does not seem to reflect growing structural unemployment, even though this overqualification of the labour supply for low- or medium-skilled jobs could have a long-term impact on employment, as suggested by Zago (2021).[1]

These mismatches between worker qualifications and the positions they hold have also been the subject of extensive literature. For example, Büchel (2002) shows that, in Germany, workers who are overqualified for the positions they hold have higher productivity than those whose qualifications match their positions. Kampelmann & Rycx (2012) also show, using Belgian data, a favourable impact of employee overqualification on labour productivity. Recruiting overqualified employees could therefore be a deliberate choice on the part of companies.

1.2. Potential Consequences of Recruitment Difficulties

Barstelman *et al.* (2013) show that this misallocation based on company size could have a significant impact on average productivity. Garicano *et al.* (2016) estimate that, in France, the social thresholds, and more specifically the 50-employee threshold, lead to an unfavourable distribution of company sizes, the cost of which, in terms of GDP, is 1.3% to 3.4% of GDP.[2] Klinger *et al.* (2011), however, show that the recruitment difficulties encountered by German companies before the 2008 financial crisis had no significant impact on the retention of workers during the crisis.

More generally, the misallocation of production factors between companies depending on their productive efficiency can have very considerable effects on aggregate productivity. On the basis of individual company data from the late 1990s and early 2000s, Hsieh & Klenow (2009) show that an allocation comparable to that of the USA alone would increase the total factor productivity of the manufacturing sector by 30% to 50% for China and even 40% to 60% for India. In an evaluation carried out in France, Libert (2017) obtains similar orders of magnitude and shows that these effects can essentially be explained by a misallocation of labour over the 1990-2010 period, excluding the early 2000s. Hsieh *et al.* (2019) take the evaluation of labour misallocation even further by analysing the impact of racial and sexual discrimination in the USA, which causes some companies to miss out on talent. They show that the gradual reduction

1. For a recent literature review of the issues surrounding the skill mismatch on the labour market, see in particular Asai et al. *(2020).*
2. Aghion et al. *(2021) show that these same thresholds reduce innovation and may therefore have an even greater impact on GDP.*

in these forms of discrimination alone accounts for around 40% of the increase in GDP per capita in this country between 1960 and 2010. Even if this does not relate directly to recruitment difficulties, this discrimination could lead to significant losses in productivity if it concerns efficient companies in particular and leads to a misallocation of production factors.

2. Recruitment Difficulties and the Functioning of the Labour Market

Quantitative mismatches on the labour market can be characterised by recruitment difficulties and vacancy rates. The change in these indicators in France is presented here, followed by a comparison of labour market tensions with four other large EU countries.

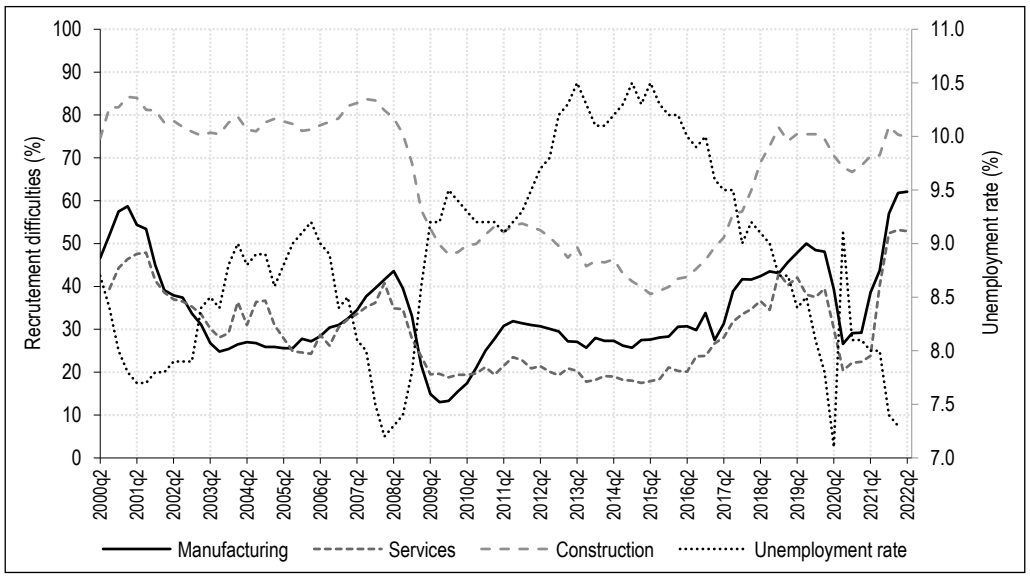
2.1. Indicators of the Imbalances on the Labour Market in France

Recruitment difficulties experienced by companies are examined on the basis of a quarterly European Commission survey carried out in France by INSEE since the early 1990s as part of its *Enquête trimestrielle de conjoncture* (Quarterly Business Survey). The proportion of companies reporting recruitment difficulties has been on the rise in France in manufacturing industry, services and construction since mid-2015, a time when the unemployment rate was experiencing a downward trend (Figure I). This proportion reached very high levels in late 2019, just before the COVID-19 pandemic, with around 50% of companies in industry reporting difficulties, 40% in services and 75% in construction. These levels had not been seen since the early 2000s in industry and since the mid-2000s in services and construction. It then fell in 2020, with the emergence of the COVID crisis, before rising again at the end of 2020 (in industry) and in early 2021 (in services and construction). The levels reached in the third quarter of 2021 are similar to the high levels seen before the COVID crisis.

The Banque de France *Enquête mensuelle de conjoncture* (Monthly Business Survey), which, in 2021, asked companies about their recruitment difficulties, confirms this high tension level, with 48% of companies stating at the start of August that they experienced recruitment difficulties compared with 44% in June.

The other measure used to assess the difficulties in achieving a balance on the labour market is the vacancy rate. This rate has been measured quarterly by DARES since 2003 using the *Enquête sur l'activité et les conditions d'emploi de la main-d'œuvre* (ACEMO, Labour force activity and employment conditions survey). This survey considers the number of vacancies in relation to potential employment, which is total employment plus vacancies. The vacancy rate may change in a different way from the proportion of companies stating recruitment difficulties for multiple reasons, including the following three. Firstly, the sources of the two indicators are not the same. Secondly, recruitment difficulties do not necessarily mean immediate vacancies. Finally, if a company experiencing recruitment difficulties has the same weighting in the INSEE indicator described above, whatever the extent of those difficulties, it may have a different impact on the DARES

Figure I – **Recruitment difficulties and unemployment rate in France**



Source : INSEE, *enquête de conjoncture*.

indicator depending on the number of actual vacant positions.

The vacancy rate in France and the proportion of companies reporting recruitment difficulties have seen a sharp rise since 2015 and a downward trend in the unemployment rate (Figure II). At the start of the COVID-19 crisis in 2020, it fell in industry and services, while stabilising in construction, before starting to rise again and reaching historic peaks in the first quarter of 2021, at 1.2% in manufacturing industry, 1.4% in services and 1.7% in construction.

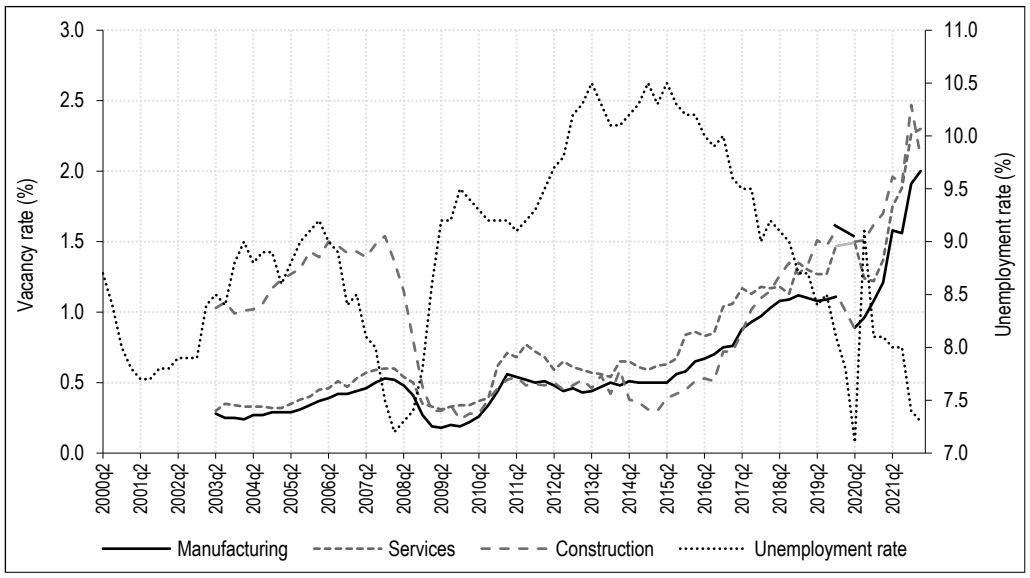
2.2. Labour Market Tensions: France Compared to Four Other EU Countries

The two types of indicator show high tensions on the French labour market both before the COVID crisis and following the lockdown measures over the most recent quarters. Such a situation may be worrying if these tensions hinder the economic activity recovery over the next few years. To better understand these fears, INSEE also asks the companies, in its *Enquête trimestrielle de conjoncture*, whether the lack of labour is limiting their capacity to supply their goods or services. The proportion of industrial companies answering this question affirmatively changes relatively similarly to the question about recruitment difficulties, but at significantly lower levels as the question is more restrictive. After a fall at the start of the COVID crisis, this proportion has risen over the last few quarters, reaching 11.4% in the third quarter of 2021, which is a historically high level and just 3 percentage points below the historic peak seen in the first quarter of 2020 (Figure III). Among the four other large countries of the euro zone, it appears that in the third quarter of 2021, this proportion was significantly lower in France than in Germany and the Netherlands (26% in both) but much higher than in Italy (3.3%) and Spain (5%).

The proportion of industrial companies whose service offer is limited due to a lack of labour in the euro zone reveals a hierarchy that seems to be consistent with that seen in relation to the rate of unemployment which, in recent times, has been significantly lower in Germany and the Netherlands than in France, where it is in turn lower than in Italy and Spain. To illustrate this relationship more accurately and compare these countries, we have calculated Beveridge curves.

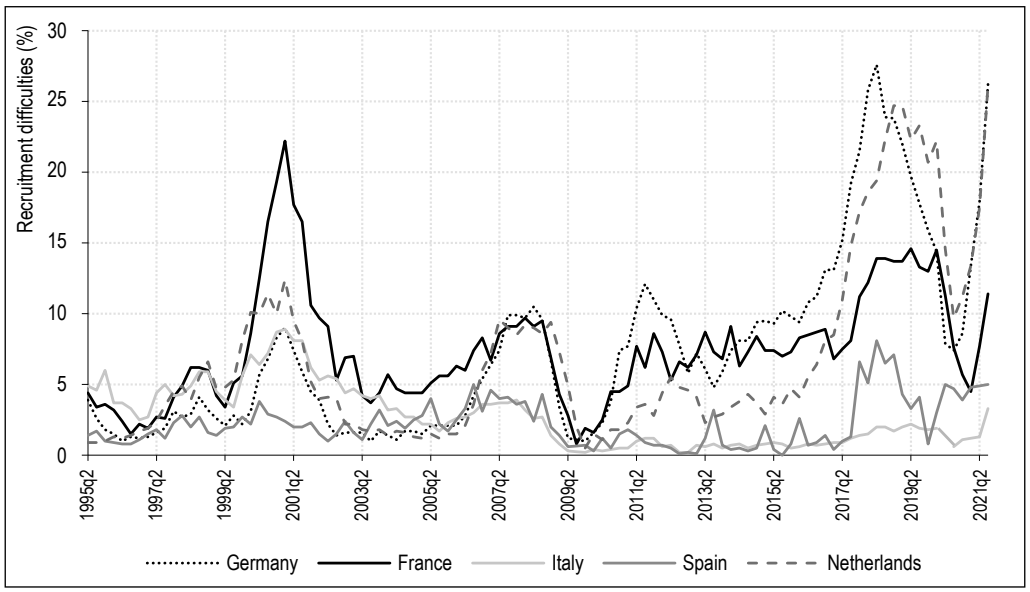
Deriving its name from the English economist William Beveridge (1879-1963), the Beveridge curve represents, on one quadrant, the vacancy rate and the unemployment rate. It is normally a downward curve: the higher the unemployment rate, the lower the vacancy rate. A movement of this curve along the bisector provides information on the change in how the labour market is functioning. For example, an upward movement along the bisector shows a deterioration in the balance between the labour supply and demand: the same employment rate is associated with a higher vacancy rate. Conversely, a downward movement along this bisector shows an improvement in the balance: the same employment rate is associated with a lower vacancy rate. One of the aims of structural labour market reforms is therefore to move the Beveridge curve towards the bottom of the bisector and to improve the

Figure II – **Vacancy rate and unemployment rate in France**



Sources: DARES, ACEMO survey.

Figure III – **Proportion of industrial companies (in %) reporting supply restrictions due to recruitment difficulties**



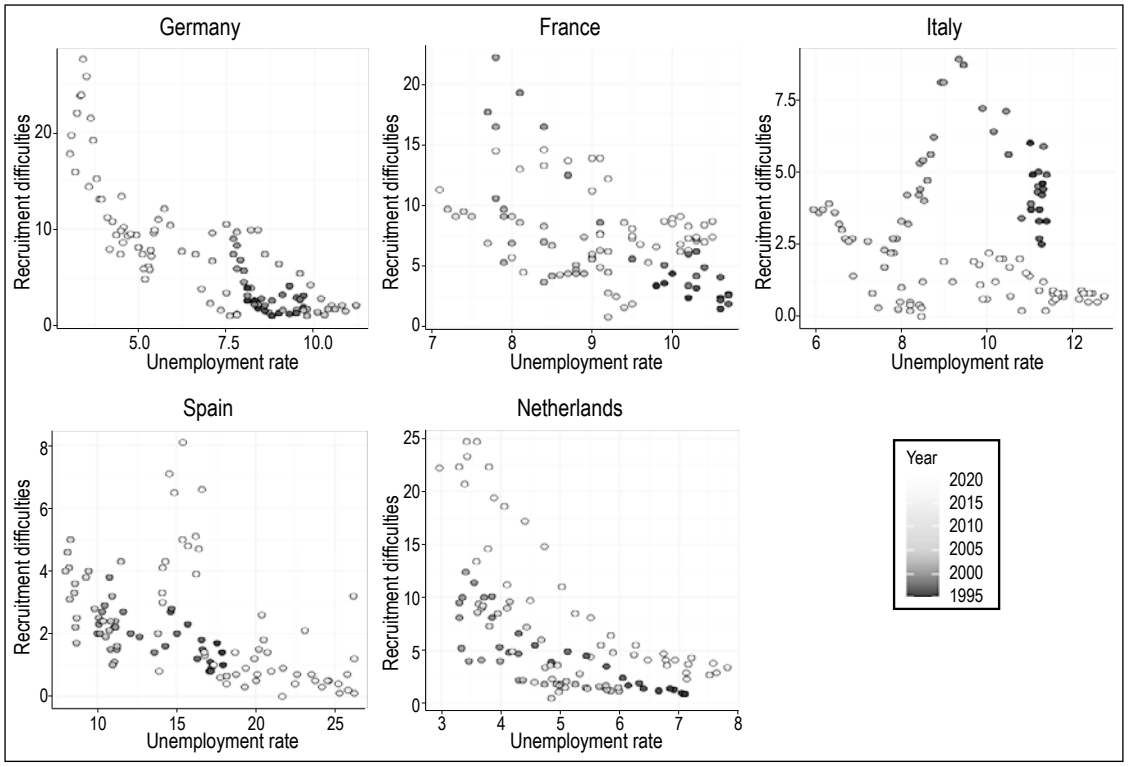
Sources: European Commission, Quarterly Business Survey.

match between the labour supply and demand and thereby the quality of the functioning of the labour market. Figure IV shows the Beveridge curves for the five largest countries in the euro zone for each quarter since 1995. The unemployment rate is measured in the meaning of the ILO and the vacancy rate here is replaced by the number of industrial companies whose service offer is limited due to recruitment difficulties. The most recent points of these curves (from the second quarter of 2020 onwards) are weakened by an unemployment rate measurement affected by transitional changes in working behaviour in the context of the COVID crisis, especially during the lockdown periods.

Germany is characterised by a relatively stable Beveridge curve over this period, with the situations observed shifting from high unemployment rates and low recruitment difficulties at the start of the period to situations of low unemployment and high recruitment difficulties. This shift on the relatively stable Beveridge curve occurred from the mid-2000s and was brought about as a result of the Hartz reforms on the labour market (for a literature review and analysis of the Hartz reforms, see for example Bouvard *et al.* 2013). Although blurred by considerable fluctuations in recruitment difficulties, the Beveridge curve also seems relatively stable in France, although it sits higher on the bisector than in Germany (the same unemployment rate being associated with greater recruitment difficulties), which suggests a labour market functioning less efficiently. The curve in Spain also seems to be relatively stable, although also relatively blurred by considerable fluctuations in the unemployment rate and consistently minor recruitment difficulties. In the Netherlands, the curve shifted sharply towards the top of the bisector after 2010, which suggests a deterioration in the functioning of the labour market in this country (the same unemployment rate associated with more significant recruitment difficulties at the end of the period than at the start). Conversely, the Beveridge curve for Italy moved sharply towards the bottom of the bisector after 2000, even though the country maintained consistently minor recruitment difficulties, which here suggests an improvement in the functioning of the labour market (the same unemployment rate here is associated with less significant recruitment difficulties at the end of the period than at the start).

The situation in France, compared with the other large euro zone countries, is characterised by levels of recruitment difficulties that seem high given the relatively high unemployment rate. The analysis carried out by Niang & Vroylandt (2020) of the tensions on the French labour market before the COVID crisis shows that, in addition to the short-term imbalances in an economy where employment experienced significant growth, these tensions relate to two types of professions. Firstly, more qualified professions, for example in industry. The tensions here result from a structural lack of labour supply for business needs and reflect a lack of training and suitability of this labour supply. Secondly, less qualified professions, for example home help, or even in hotels, cafés and

Figure IV – **Beveridge curves for the five largest countries in the euro zone, 1995 to 2021**



Note: Each point represents, for a given quarter, the unemployment rate and the proportion of companies whose service offer is limited by recruitment difficulties.
Reading Note: In France, in the first quarter of 2005, the unemployment rate was 8.7% and 4.4% of companies reported recruitment difficulties.
Sources: INSEE.

restaurants. For this second type of profession, the tensions reflect a lack of attractivity in a country that still has a high unemployment rate, such as France.

Finally, the *Enquête Besoins en main-d'œuvre* (Labour force needs survey) carried out by Pôle emploi makes it possible to measure the geographic heterogeneity of the labour market balance difficulties. Figure V, based on the 2019 survey, shows significant geographic variation that is negatively correlated to the variation in the unemployment rate, with greater recruitment difficulties in the departments with a lower unemployment rate.

The findings from the responses given to the survey on production factors conducted among industrial companies by Banque de France in September 2019, in which several questions were added to ask about recruitment difficulties, can be used to improve this diagnosis.

3. Data and Indicators

In this section, we begin by describing the construction of the database and the variables available in relation to recruitment difficulties before providing greater detail on the indicators used in the analysis.

3.1. The Database

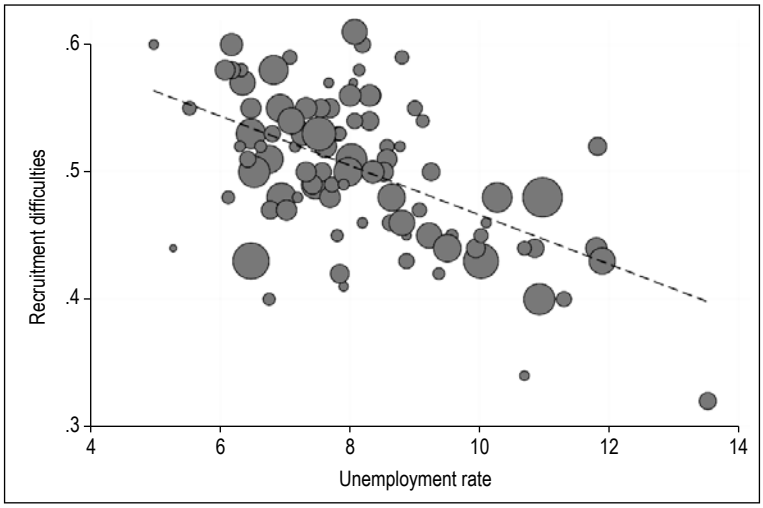
This analysis uses two very extensive databases: the FiBEn data and the responses to a survey carried out in September 2019[3] on the use of production factors and recruitment difficulties (UFP). These two databases have been developed by Banque de France.

FiBEn contains annual accounting data for companies with turnover of over €750,000 or loans of over €380,000. These data cover around 200,000 companies. They provide information on the characteristics of the companies, such as their sector of activity and staff numbers, as well as on numerous accounting elements, and make it possible to conduct an annual estimation of labour productivity, capital stock, total factor productivity for labour and capital, their profitability, etc.

The UFP database comes from a survey carried out each September since 1989 and provides information on the use of the capital and labour production factors. It is conducted among

3. The survey uses the first week of September (in which all days fall within September) as the reference week. For 2019, the establishments were invited to answer the questions using the week from 2 to 8 September as the reference week, but were permitted to choose another week within this month if they did not deem the week specified to be suitable.

Figure V – **Unemployment rate and proportion of planned recruitments that were difficult in 2019**



Note: Each point represents a department of metropolitan France and its size is proportional to its population. The equation of the linear regression is as follows: Unemployment rate = (−16.7 * Recruitment difficulty) + 16.59 (R^2=0.32).
Sources: Pôle emploi, Enquête Besoins en main-d'œuvre 2019.

establishments in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees. This original survey asks the establishments about their staff numbers, their production capacity utilisation rate, their use of shift work, the working time of their employees, and the variations in the utilisation of their equipment. Since 2015, a new section of the survey relates to a specific subject each year. In 2019, it focused on recruitment difficulties, and 1,369 complete responses were received by Banque de France.

The 2019 edition of the UFP survey included questions on companies' vacant positions and recruitment difficulties. The four questions asked in the survey and used in the analysis are the following:

(i) How many positions are you currently seeking to fill?

(ii) For how many of these positions are you experiencing recruitment difficulties?[4]

(iii) Have your business activities been hampered by these potential recruitment difficulties?

(iv) Are the following factors [insignificant, minor, significant or major] recruitment obstacles?

- Lack of labour force with the required skills in the proximity of the establishment or company or on the local labour market or throughout the French territory;
- Low attractivity of starting salaries;
- Difficult working conditions (physical strain, aggressive environment, repetitive tasks) or employment conditions (employment contract, restrictive working hours);
- Competition from other employers;
- Poor image of the establishment or company, business sector or position.

In order to reconcile the UFP database to the FiBEn database, we first reconstruct company data from the UFP database where multiple establishments had been surveyed. For each variable, this reconstruction uses weighted averages for which the weighting coefficients were the staff numbers of each establishment.

The two databases were merged using SIREN identifiers.[5] The merged database underwent the usual clean-up in order to remove unusable observations, outliers or extreme values at the edge of the distribution.[6] Once this clean-up was complete, the database covered 1,282 companies from the manufacturing industry and provided information on numerous economic variables about the companies for the period 2015-2019 as well as their production factor utilisation and recruitment difficulties for 2019 only. The estimations are generally made for a more limited number of companies, those for which all the variables, including control variables, are available.

4. The definition of a difficult-to-fill position is at the respondent's discretion.
5. The FiBEn database covers accounting data for all of a company's establishments, while the UFP survey provides information of the situation at an establishment. Merging the two databases assumes that establishments belonging to the same company are homogeneous in terms of accounting data. A large majority of the observations, however, relate to single-establishment companies.
6. The clean-up method is the same as that used on a comparable sample by Cette et al. *(2021), which can be referred to for more details.*

While the UFP survey relates to one company establishment, this is not the case for the FiBEn database, which covers the entire company (all establishments together). In the case of multi-establishment companies, we assume the company's establishments are homogeneous. As part of our analysis, we assign the company the recruitment patterns of the establishment responding to the survey.

Our sample relates to a restricted proportion of establishments in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees. To make this representative of the reality in the manufacturing industry, it has been adjusted using weighting coefficients applied to each company. These individual weighting coefficients adjust the sample so that the weighting (in terms of number of employees[7]) of the four sectors by five company sizes considered here corresponds to that of the total population of companies. All the results presented in this article use this adjustment, which makes the descriptive statistics and the econometric estimations more easily transposable to the entire French manufacturing sector.

3.2. Construction of the Analysis Variables

The variables available in the UFP survey have been presented above. The accounting information from the FiBEn database makes it possible to calculate numerous indicators. The construction of these indicators is explained here for value added, productivity indicators and profitability indicators.

The volume of value added (Q) is the value added in nominal terms divided by a sector-based value added price index calculated at the NAF (French classification of business activities) division level and published by INSEE. The simplest measure of productivity, labour productivity (LP), compares the volume of value added (Q) to FTE staffing levels (L). We can therefore define the labour productivity for each company i:

$$LP_i = \frac{Q_i}{L_i}$$

This measure has the advantage of being conceptually simple, but it does not take into consideration differences in capital intensity between companies. We therefore use another measurement, total factor productivity (TFP):

$$PGF_i = \frac{Q_i}{K_i^{\alpha_K} H_i^{\alpha_L}}$$

where K is the productive capital stock and H is a measurement of human capital. The capital stock is calculated by adding the estimates of the real value of capital stock in terms of buildings, transport equipment, other physical equipment and immaterial capital. These values are obtained using the gross value of property, plant and equipment for each asset class and an estimation of their age based on the amortised portion of the asset and on an assumption regarding the standard lifetime of that asset.[8] To calculate the capital volume, the value of each asset is deflated using a national price index for each investment type.[9] In this calculation, the price index of each asset class is set back by the average age of that asset. We approximate the human capital H using the sum of salaries and wages received by employees. The Online Appendix (see link at end of article) presents the results with different options for measuring these different quantities.

In order to estimate the parameters α_L and α_K, we estimate a production function by using the method put forward by Ackerberg *et al.* (2015). As explained in Online Appendix S2, the TFP measurement obtained in this way is the one that we use in our primary results as the estimation methodology is more general than those often used elsewhere, specifically that used by Levinsohn & Petrin (2003). However, we have also included in the appendix the resutls obtained using the different TFP calculations, firstly using the method put forward by Levinsohn & Petrin (2003), then by calculating the α_L and α_K coefficients by assuming that α_L is equal to the share of the labour cost in value added, calculated on average for each sector and $\alpha_L = 1 - \alpha_K$ (assumption of constant returns to scale).

Our central TFP measurement is therefore that obtained by estimating a production function following Ackerberg *et al.* (2015) using a value added approach (rather than a production-based approach) and approximating the human capital stock using the total salary level within the company (the alternative measures are briefly presented in Table S1-1 in the Online Appendix).

Different measures of company profitability are also calculated. Firstly, an indicator of the share of profits in value added, or the profit margin (MR), which corresponds to the residual part of value added once all labour-related expenses

7. These weightings are those provided by the survey; however, please note that they are affected by recruitment difficulties.
8. With an assumed average lifetime of 15 years for buildings, 5 years for transport material, 8 years for other equipment and 6 years for immaterial assets.
9. As for labour productivity, in the absence of a price index at company level, the TFP and labour productivity measurements that we develop include potential differences in price between the company and the sector average.

have been paid. In accounting terms, this is therefore equivalent to the share of the gross operating surplus in value added, or in other words, the unit minus the labour cost share. Secondly, a markup indicator (*markups*) for the labour cost, corresponding to the ratio of the value added to the labour cost, both considered in nominal terms. Finally, two profitability indicators: the economic profitability rate (*ERR*) and the financial profitability rate (*FRR*). The economic profitability rate compares the gross operating surplus to capital committed to production (equity and borrowed capital). The financial profitability rate compares the net profit (gross operating surplus minus interest charges, exceptional expenses and taxes) to the company's equity.

Finally, we construct different variables to be used as controls in the regression: the average number of hours worked per employee and the production capacity utilisation rate, both taken directly from the UFP survey, and a measure of the level of use of external staff calculated using FiBEn data by taking the ratio between expenditure for staff provided by a temporary staff agency and loaned staff, and the total wage bill (including external staff). These variables make it possible to measure the extent to which the company is over- or under-using its production capacity, which may be measured incorrectly in the productivity measurement that we use and could also change as a result of potential recruitment difficulties.

3.3. Descriptive Statistics

Table 1 describes the final database synthetically. Our study covers around 1,200 companies operating in 2018 and 2019 and for which we can measure both total factor productivity and the level of recruitment difficulties.

Regarding behaviour in terms of recruitment, the vast majority (79%) of the establishments in this sample are looking to recruit employees irrespective of socio-professional category and a large proportion of them have difficulty in filling these positions (69% of the total or 87% of companies looking to recruit).

These proportions may seem high but should be qualified by the absence of establishments with fewer than 20 employees, which are less likely to recruit than larger establishments. As regards the high proportion of establishments facing recruitment difficulties, this can be explained by the average size of the establishments surveyed and by the broad definition of 'recruitment difficulties', which was left at the respondents' discretion.

However, recruitment difficulties are deemed to be significant in numerous analyses[10] and have been on the rise since at least 2016 (INSEE, 2018; 2022), as shown also in Figure II using DARES figures. According to Niang & Vroyland (2020), 50.1% of planned recruitments in 2019 were deemed difficult by companies compared with 32.4% in 2015, across all sectors. This last figure is consistent with the DARES Ofer 2016 survey (DARES, 2016 and Lhommeau & Rémy,

10. The analyses and surveys adopt different definitions of the term 'recruitment difficulties'. This explains the wide differences in levels between the surveys, some of which refer to 'anticipated', 'experienced' or 'current' recruitment difficulties, with even the same term hiding, in some cases, more or less specific assumptions.

Table 1 – **Descriptive statistics of the main variables of the working database**

	Mean	Standard error	1st quartile	3rd quartile
Looking to recruit	0.79	0.41	1	1
Recruitment difficulties	0.69	0.46	0	1
Sales (in thousand euros)	127,154	1,901,620	6,775	45,172
Employment (number of employees)	265	1,525	38	182
LP (log)	4.13	0.44	3.88	4.40
PCU	0.77	0.16	0.70	0.90
RatOut	0.31	0.18	0.17	0.41
Average hours	36.2	3.15	35	38
Average salary (in thousand euros)	35.7	8.38	29.9	40.2
Number of observations	1,175			

Notes: The PCU variable measures the rate of production capacity utilisation (between 0 and 1) and the RatOut variable the cost of external personnel compared to the total labour cost (internal and external). The values given here are not adjusted for weighting. The average salary is calculated by comparing the ratio of salaries and wages on the company's balance sheet to the average employment for the year.
Reading note: In 2019, 79% of companies were seeking to recruit and 69% experienced recruitment difficulties. Average sales were 127 million euro.
Sources and coverage: Banque de France, UFP 2019 and FiBEn; companies in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees, that were in operation in 2018 and 2019 and for which we can measure productivity and the presence of any recruitment difficulties.

2019) according to which 17% of recruitments made in 2015 were difficult. While the level of recruitment difficulties varies depending on sector or qualification level, it has been experiencing an upward trend across all sectors of the economy since 2015 (Niang & Vroyland, 2020). Nevertheless, a hierarchy remains, with some sectors worse affected than others, primarily industry, in which tensions are much higher than for the rest of the economy, with 20% of recruitments deemed to be difficult in 2015 (Lhommeau & Rémy, 2019). Regarding the dynamics, recruitment difficulties are rising sharply against a background of falling unemployment and are affecting the manufacturing sector in particular, which is seeing recruitment difficulties rise more quickly (from an already high level) than the other sectors of the French economy: indeed, as Figure I shows, recruitment difficulties have been constantly higher in industry than in services since 2010.

4. Analysis of Recruitment Difficulties in 2019

This section attempts to provide an explanation to answer the following question: are the companies that have experienced recruitment difficulties different from those that have not and to what extent do these differences inform on the reasons for these difficulties?

Unfortunately, the data we have do not enable us to implement an identification strategy based on the change in a company's status in terms of recruitment difficulties that we can monitor over time. In fact, we only have one snapshot, from 2019, of the sample of companies in the industrial sector. We therefore use a simple model that allows us to directly measure productivity differences between the group of companies experiencing recruitment difficulties and other companies, conditional upon a number of observables. These control variables play two distinct roles. Firstly, they allow us to compare companies based on size and sector; secondly, they allow us to check for a certain number of factors likely to impact the productivity level observed in 2019: average salary and intensity of production factor utilisation. To limit simultaneity problems, we use these different variables from 2018 where possible.[11]

We therefore assume that the TFP level (in log form) for a company in 2019 is explained linearly by these control variables and introduce an order 1 autoregressive structure to better capture the inertia in changes in the TFP level. This model is therefore similar to that described by Cahn & Saint-Guilhem (2010) and corresponds to the equation (1) below:

$$y_{i,2019} = \alpha \cdot y_{i,2018} + \beta \cdot D_i + X_i \cdot \gamma + \nu_{s(i)} + \varepsilon_i \quad (1)$$

in which y is our variable of interest (in log form), α is the coefficient of an autoregressive term and D is a variable measuring recruitment difficulties (1 if the company experienced difficulties in 2019, 0 if not). X is a vector of control variables from both the balance sheet data and the survey and which allow us to record any potential measurement errors associated with the use of production factors and size effects. Lastly, $\nu_{s(i)}$ is a sector-based fixed effect (NAF code level 2). We estimate this model by the generalised least squares method using a weighting matrix as described in the section above. The error vector ε is estimated so as to allow for a correlation within the same department-sector cell in order to take into account the existence of possible local shocks (clustering method).[12] In this model, the average TFP difference between the group of companies for which D=0 and the other group corresponds to the value of $\beta / (1-\alpha)$.

4.1. Recruitment Difficulties and Productivity in Companies

While the variable of interest is productivity, the estimated value of β is the average productivity difference in percentage points in a company with recruitment difficulties depending on the control variables. For each model, we only use companies stating a desire to recruit in 2019 (79% of companies surveyed). This restriction does not have any significant impact on the estimation outcomes. Among these companies, only 13% did not state that they had experienced recruitment difficulties over the course of the year. These companies are therefore our control group (D=0). The results of this estimation are shown in Table 2.

The most complete model, which covers all the control variables (column 4), only includes companies that sought to recruit in 2019 (932 observations) and introduces sector-based fixed effects and controls for the production capacity utilisation (PCU) rate, average hours worked and the ratio between the costs of outsourced labour and the total wage bill. The coefficient β is estimated with an average value of 0.077, which suggests that, other things equal,

11. i.e. where we can obtain a measurement of these variables using the FiBEn master index. Where this variable comes from the master index of the UFP survey, which only covered recruitment difficulties in 2019, this time difference is not possible.

12. We use the UFP survey sector classification (4 sectors).

Table 2 – **Total factor productivity (TFP) and recruitment difficulties**

	(1)	(2)	(3)	(4)	(5)
TFP in 2018 (log)	0.714*** (0.089)	0.696*** (0.087)	0.685*** (0.087)	0.684*** (0.087)	
Recruitment difficulties	0.072** (0.035)	0.070** (0.035)	0.073** (0.034)	0.077** (0.034)	0.126** (0.063)
Employment in 2018 (log)		0.002 (0.008)	−0.001 (0.008)	−0.005 (0.008)	−0.005 (0.019)
Average salary in 2018 (log)		0.187*** (0.057)	0.197*** (0.057)	0.173*** (0.053)	0.287*** (0.079)
Average hours (log)			0.187*** (0.057)	0.177*** (0.055)	0.340*** (0.120)
PCU				0.032 (0.082)	0.110 (0.158)
RatOut				0.151*** (0.049)	0.165** (0.069)
Adjusted R^2	0.655	0.672	0.679	0.682	0.259
Number of observations[(i)]	935	935	935	932	947

[(i)] In the estimations presented in this and the following tables, the number of observations may change slightly from one estimation to the next as information for some variables is not always available.
Notes: Each column corresponds to an OLS regression of model (1) where the dependent variable is the TFP level (in log) calculated in 2019. Each line corresponds to an explanatory variable. The recruitment difficulty variable is valued at 1 if the company states that it has positions that are difficult to fill. The model includes a sector-based fixed effect (NAF code, level 2) and is weighted by using the weightings in the survey (cf. Section 3). The standard errors given in brackets are estimated by allowing an autocorrelation within the same sector of activity of the same department; ***, ** and * indicate a *p*-value of below 1%, 5% and 10%, respectively.
Sources and coverage: Banque de France, UFP 2019 and FiBEn; companies in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees, that were in operation in 2018 and 2019 and for which we can measure productivity and the presence of any recruitment difficulties.

a company experiencing recruitment difficulties is 7.7% more productive than a comparable company not experiencing such difficulties. The other columns in Table 2 show variations around this specification.

The introduction of control variables has little quantitative impact on the estimation of β (columns 1, 2, 3 then 4). The coefficients of control variables 'average salary', 'PCU' et 'RatOut' are positive and meaningful. In relation to average salary, this corresponds to an implicit inclusion of the average qualification level. In terms of the production capacity utilisation (PCU) rate, this corresponds to a direct inclusion of the intensity of utilisation of the production factors available within the company. Lastly, regarding the use of subcontracting (RatOut), this relates to a more indirect inclusion of factor utilisation, as this use of external resources may logically increase with the lack of internal production capacity. Including companies not seeking to recruit in the control group ($D = 0$) reduces the estimated value of the coefficient, which still remains statistically different from zero.

The productivity gap of companies encountering recruitment difficulties could indicate that those companies are more productive and therefore potentially focus more on seeking specific and rarer skills. However, it is also possible that these companies are also more restricted and therefore seek to maximise their production capacities to offset the lack of labour force, which could increase their productivity. In order to limit this bias, we control the estimations made using various measurements of production factor utilisation in the most complete models. This only marginally affects the estimation results. There are also other elements that could bias the estimation of coefficient β. For example, local labour market conditions could be an omitted variable that explains both productivity levels and recruitment difficulties. Table S1-2 in the Online Appendix, however, shows that the outcomes are affected to only a minor extent by adding a department-based fixed effect to the model.[13] In relation to potential measurement errors linked to the TFP calculation, Figure S1-I in the Online Appendix shows how the estimations of β are affected when the model presented in column 4 is estimated by changing the productivity measurement. In general, the average effect estimated lies between 5 and 10% and is significantly different from zero at the usual thresholds.

Using these estimation outcomes, we conducted an exercise to estimate the total factor productivity gains that could be obtained if there were no recruitment difficulties. This calculation corresponds to a comparative statics exercise and is based on very simplistic assumptions. Its sole value lies in the fact that it gives an idea of the consequences of recruitment difficulties on the average production performance of the French manufacturing industry. Two calculations are carried out. In the first one, we assume that recruitment difficulties disappear suddenly and that the companies affected find the personnel they require, without their productivity changing. This increases total employment, this increase

13. The estimation uses the same weightings as the other estimations presented in this article, although it should be noted that these weightings were not designed to guarantee representativeness at departmental level.

being equal to the number of positions with recruitment difficulty. In the second calculation, we assume that instant job transfers take place from companies without recruitment difficulties to those with recruitment difficulties, whereby total employment remains unchanged. In the two calculations, the average productivity of the manufacturing industry is increased as employment and production in companies experiencing recruitment difficulties, which have a higher average productivity level than those without recruitment difficulties, are increased.[14] Based on the estimation outcomes given in Table 2, we assume that the average productivity gap between companies with and without recruitment difficulties is 7%. This simplistic calculation is also carried out on the recruitment difficulties reported by companies in 2019 in the Banque de France survey used here for the estimations. This exercise shows that the gain in average productivity in the manufacturing industry that would result from an instantaneous disappearance of recruitment difficulties would be between 0.10% and 0.15%. This does not put aside the important issue of recruitment difficulties, but this potential gain appears to be of limited scope.

4.2. Reasons for Recruitment Difficulties

To better characterise the sources of these recruitment difficulties, we estimate the extent to which the positive productivity gap of companies facing recruitment difficulties can be explained by one or another of the potential obstacles reported by the company. As explained in section 2, these obstacles may fall into five categories (not mutually exclusive): (1) lack of labour force; (2) unsatisfactory hiring conditions (salary, contract, etc.); (3) difficult working/employment conditions; (4) competition on the job market and (5) company image problem. We define a variable D_i^k with value 1 if obstacle $k = 1,...,5$ is described as significant or major by company i. It should be noted that almost all establishments give the reason of a lack of labour force, which assumes a lack of candidates, *a fortiori* candidates with suitable skills (Table 3). Establishments admit that their starting salaries may be too unattractive, but also point to the high level of competition with other employers. These results are consistent with those of other surveys. The DARES survey on successful recruitments for the entire French economy, indicate that 60% of employers report a lack of candidates or unsuitable candidates (Lhommeau & Rémy, 2019). Competition with other employers is cited by 29% of these companies, while 23% state an image problem for the establishment, the sector of activity or the position.

We therefore calculate model (1) (in the version given in column 3 of table 2) by replacing variable D with variable D^k for each k value. The estimation outcomes are shown in Table 4. Column 1 of Table 4 includes all the obstacles at the same time while columns 2 to 6 each correspond to a particular obstacle.

The coefficient associated with the salary reasons is positive but not significant in column 1 and significantly correlated to productivity in column 3. The result is the same when different productivity measures are used (see Online Appendix, figure S1-III). The coefficients associated with a lack of labour force are positively correlated to the lack of labour force when they are estimated in column 2, but are not accurately

14. *If we take* G1 *and* G2 *as the average productivity gain for these two assumptions, we have:*

G1 = EP·[(Edif + Ndif) / (Edif + Endif + Ndif) – Edif / (Edif + Endif)] and G2 = EP·[Ndif / (Edif + Endif)],

where EP *is the average productivity gap between companies with and without recruitment difficulties,* Ndif *is the number of positions affected by recruitment difficulties,* Edif *is the total employment of companies experiencing recruitment difficulties and* Endif *is the total employment of companies not experiencing recruitment difficulties . This necessarily gives* G2 > G1. *With the data used here, we have* Edif = *69%,* Endif = *31%,* Ndif = *2%, as a percentage of total employment in the manufacturing industry.*

Table 3 – **Proportion of companies (%) reporting a 'significant' or 'major' obstacle to recruitment in 2019**

Reason for recruitment difficulties	All companies	Companies with recruitment difficulties
Lack of labour force	83	94
Low attractivity of starting salaries	48	54
Difficult working and employment conditions	27	31
Competition from other employers	59	67
Image problem for the company, sector or position	23	26
Recruitment difficulties	88	100

Notes: The results are weighted to more closely represent the reality in the French manufacturing sector. Only companies reporting that they attempted to recruit are included in the sample (934 observations). Several responses are possible at the same time.
Sources and coverage: Banque de France, UFP 2019 and FiBEn; companies in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees, that were in operation in 2018 and 2019 and for which we can measure productivity and the presence of any recruitment difficulties.

Table 4 – **Total factor productivity and recruitment difficulties for various reasons**[(i)]

	(1)		(2)		(3)		(4)		(5)		(6)	
TFP in 2018 (log)	0.692***	(0.085)	0.690***	(0.088)	0.697***	(0.088)	0.690***	(0.091)	0.690***	(0.091)	0.688***	(0.091)
Employment in 2018 (log)	−0.006	(0.008)	−0.005	(0.008)	−0.004	(0.008)	−0.003	(0.008)	−0.004	(0.008)	−0.004	(0.008)
Average salary in 2018 (log)	0.178***	(0.054)	0.173***	(0.054)	0.174***	(0.054)	0.175***	(0.052)	0.169***	(0.052)	0.168***	(0.053)
Average hours (log)	−0.019	(0.079)	−0.025	(0.082)	−0.026	(0.079)	−0.035	(0.080)	−0.035	(0.080)	−0.039	(0.080)
PCU	0.145**	(0.058)	0.171***	(0.056)	0.162***	(0.057)	0.168***	(0.057)	0.173***	(0.057)	0.166***	(0.056)
RatOut	0.154***	(0.050)	0.151***	(0.049)	0.139***	(0.047)	0.146***	(0.048)	0.142***	(0.047)	0.144***	(0.048)
Reasons for difficulties												
Lack of labour force	0.054	(0.036)	0.051	(0.032)								
Wages	0.032	(0.021)			0.032*	(0.018)						
Difficult conditions	0.007	(0.023)					0.020	(0.020)				
Competition	−0.017	(0.021)							0.004	(0.017)		
Image	−0.045**	(0.022)									−0.028	(0.019)
Adjusted R^2	0.684		0.680		0.679		0.677		0.677		0.678	
Number of observations	933		933		933		933		933		933	

[(i)] The estimated model is the same as in column 3 of Table 2.
Notes: Cf. Table 2.
Sources and coverage: Banque de France, UFP 2019 and FiBEn; companies in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees, that were in operation in 2018 and 2019 and for which we can measure productivity and the presence of any recruitment difficulties.

estimated in column 1, although this depends on the productivity measurement used (see Online Appendix, figure S1-II). All reasons for recruitment difficulties seem to be associated with a productivity level that is greater than or similar to that of companies without difficulties, except for the reason of company or business activity image problems, which is linked to considerably lower productivity, which may be due to lower employee motivation in these companies, although the coefficient is not estimated very precisely.

4.3. Recruitment Difficulties and Salary

The findings above suggest that the productivity differences associated with recruitment difficulties are at least partly the consequence of insufficiently attractive salary conditions. To attempt to explain these results, we recalculated model (1) by replacing the dependent variable with the logarithm of the average salary in the company.

The results in Table 5 confirm that companies with recruitment difficulties for salary reasons have, all other things being equal, an average salary that is on average 1.8% lower than other companies. Conversely, companies with recruitment difficulties associated with a lack of labour force have a 1.6% higher average salary. There may be multiple explanations for this outcome. Firstly, the fact that companies faced with a

Table 5 – **Average salary and recruitment difficulties**[(i)]

	(1)		(2)		(3)		(4)		(5)		(6)	
Salary in 2018 (log)	0.890***	(0.029)	0.893***	(0.030)	0.888***	(0.030)	0.889***	(0.030)	0.894***	(0.030)	0.892***	(0.030)
Employment in 2018 (log)	0.004	(0.003)	0.005	(0.003)	0.005*	(0.003)	0.005	(0.003)	0.005*	(0.003)	0.005	(0.003)
Average hours (log)	−0.002	(0.040)	0.002	(0.043)	−0.007	(0.041)	0.002	(0.043)	0.002	(0.042)	0.001	(0.042)
PCU	0.024	(0.021)	0.024	(0.022)	0.028	(0.021)	0.025	(0.022)	0.017	(0.022)	0.023	(0.022)
RatOut	−0.010	(0.023)	−0.008	(0.025)	−0.011	(0.025)	−0.012	(0.026)	−0.012	(0.025)	−0.010	(0.025)
Reasons for difficulties												
Lack of labour force	0.030***	(0.009)	0.016*	(0.008)								
Wages	−0.018*	(0.009)			−0.018**	(0.008)						
Difficult conditions	−0.007	(0.009)					−0.011	(0.009)				
Competition	−0.014	(0.009)							−0.013	(0.008)		
Image	0.004	(0.010)									−0.002	(0.010)
Adjusted R^2	0.912		0.910		0.911		0.910		0.910		0.910	
Number of observations	1,004		1,004		1,004		1,004		1,004		1,004	

[(i)] The estimated model is the same as in column 3 of Table 2.
Notes: Cf. Table 2.
Sources and coverage: Banque de France, UFP 2019 and FiBEn; companies in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees, that were in operation in 2018 and 2019 and for which we can measure productivity and the presence of any recruitment difficulties.

lack of labour force are seeking to retain their employees via higher salaries to a greater extent than other companies. Secondly, this may also be explained by the fact that these companies are more productive and their employees are, on average, more qualified, and therefore better paid than those in other companies.

These results highlight the fact that companies facing recruitment difficulties are different from those that are not and could be grouped into two categories. Firstly, companies paying too little for their labour force, and in particular less than other companies. As a result, these companies could suffer from problems attracting potential employees to their positions. Secondly, companies facing a lack of labour force, who may be looking to increase their attractivity by paying higher salaries than those paid by other companies, on average.

4.4. Recruitment Difficulties and Profitability in Companies

The estimation results reported in Table 3 reveal that companies experiencing recruitment difficulties explained by salary level (among other obstacles) have a lower average salary than other companies. In this section, we illustrate this correlation by breaking it down by the reasons given by the company. One possibility is that these companies are subject to a higher level of competition preventing them from increasing their salaries. Another possibility is that these companies are not as productive and profitable. Finally, a third possibility is that these companies are limited in their capacity to increase starting salaries due to internal rigidities.

In terms of the first hypothesis, Table 6 presents the results of regressions similar to those presented in Table 5 (column 3), i.e. on the salary-linked recruitment difficulty indicator, but using different company profitability measurements as the dependent variable: the markup rate, the profit rate (*MR*), the economic (*ERR*) and financial (*FRR*) profitability rates given in Section 3, as well as a final general profitability rate that combines financial and economic profitability and defined as the ratio between the gross operating surplus and financial revenue, and the sum of debt and equity (*GRR*).

The coefficient associated with recruitment difficulties linked to low salary attractivity is negative, although it is not precisely estimated for the profit margin or markup rate. This suggests that companies facing recruitment difficulties that they attribute to low starting salaries are experiencing a less favourable financial situation than other companies also facing recruitment difficulties. These companies are therefore financially more restricted than other companies in strengthening their attractivity. This restriction is the result of a more competitive environment. Table S1-3 in the Online Appendix also shows that these different profitability indicators are negatively associated with the level of competition.

* *
*

The analysis carried out here on a sample of around 1,000 French industrial companies enables us to characterise some of the specific features of companies facing recruitment difficulties compared with other companies.

Firstly, their productivity is significantly higher, with the gap being, on average and with

Table 6 – **Profitability and recruitment difficulties linked to salaries**[(i)]

Dependent variable	*Markups* (1)		*MR* (2)		*ERR* (3)		*FRR* (4)		*GRR* (5)	
Dependent variable taken in 2018	0.829***	(0.048)	0.830***	(0.040)	0.800***	(0.038)	0.671***	(0.059)	0.787***	(0.060)
Employment in 2018 (log)	0.012	(0.010)	0.001	(0.005)	−0.001	(0.003)	0.000	(0.003)	0.002	(0.002)
Average salary in 2018 (log)	0.107	(0.066)	0.060*	(0.034)	0.032	(0.022)	0.025	(0.016)	0.018	(0.013)
Average hours (log)	0.246	(0.173)	0.079	(0.066)	0.076	(0.063)	0.090*	(0.051)	0.053	(0.044)
PCU	0.027	(0.075)	0.013	(0.036)	0.025	(0.024)	0.007	(0.023)	0.006	(0.019)
RatOut	0.289***	(0.104)	0.125***	(0.040)	0.116***	(0.039)	0.093***	(0.030)	0.079***	(0.027)
Recruitment difficulties linked to salaries	−0.044	(0.033)	−0.014	(0.014)	−0.021*	(0.011)	−0.015*	(0.009)	−0.015**	(0.008)
Adjusted R^2	0.751		0.742		0.696		0.588		0.668	
Number of observations	927		927		927		927		927	

[(i)] The estimated model is the same as in column 3 of Table 2.
Notes: Cf. Table 2.
Sources and coverage: Banque de France, UFP 2019 and FiBEn; companies in the manufacturing industry (excluding oil industry and extraction) with at least 20 employees, that were in operation in 2018 and 2019 and for which we can measure productivity and the presence of any recruitment difficulties.

all other things being equal, around 7%. This finding suggests that recruitment difficulties are likely to lead to a misallocation of production factors, at a global level, in companies that are efficient in terms of productivity and that may be hindered in their growth by these recruitment difficulties. Based on very simplified assumptions, an exercise carried out shows that the recruitment difficulties could lead to an average productivity loss in the manufacturing industry of around 0.10% to 0.15%. Secondly, an insufficient starting salary seems to be the reason for recruitment difficulties in some companies. In these companies, the average salary is, on average, around 2% lower than that seen in other companies. Conversely, in companies identifying competition from other companies as the reason for their recruitment difficulties, the average salary is around 1.5% higher than in other companies. Furthermore, among the companies experiencing recruitment difficulties, those that attribute their difficulties to insufficient starting salaries have a considerably lower profitability than other companies. They are therefore in a sort of trap: they have difficulties in hiring due to their low salaries and at the same time are prevented from increasing their salaries due to their insufficient profitability.

As productivity is higher in companies experiencing recruitment difficulties, other things equal, than in other companies, these difficulties may lead to a misallocation of the factors, which are not seen as a priority by the most efficient companies. One response to these difficulties is certainly better training of the labour supply. However, the salary reason also appears frequently, and the companies giving this response pay their employees less but suffer from lower profitability than other companies experiencing recruitment difficulties. Therefore, one response to this difficulty may be to increase the labour income without increasing company costs. The increase in the *prime d'activité* (an employment bonus to increase purchasing power), such as that decided at the start of 2019, is in line with this logic. Furthermore, these findings reinforce the need to look at the distance between transfer revenue (unemployment, income support) and business activity revenue, as this distance sometimes seems too small to motivate the labour supply. □

Link to the Online Appendix:
www.insee.fr/en/statistiques/fichier/6530562/ES534-35_Bergeaud-Cette_Online-Appendix.pdf

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Candidate Selection Criteria: A Summary of the Recruitment Process

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Abstract – This article examines the extent to which the employer selection criteria and the research and selection methods implemented vary by occupation, based on the 2016 DARES OFER survey. Classifying occupations according to selection criteria results in four classes. The personal attributes needed for "public-facing occupations" are assessed through telephone interviews, the work capacity expected in "manual work" through testing, the skills and potential to perform "technical occupations" through interviews and tests, and qualification and listening skills required in the "personal assistance occupations" through a detailed application form. The hiring assessment drawn up by the employer (satisfaction, duration, difficulty, etc.) varies greatly depending on the classification of occupation.

JEL Classification: J23, J63, M51
Keywords: selection criteria, hiring efforts, occupations

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In France, as in other countries, employers often attribute their hiring difficulties to a mismatch between the candidates' profiles and the skills they seek (Lhommeau & Rémy, 2019; Chamkhi *et al.*, 2018a; Brunello & Wruuck, 2019). However, the criteria for evaluating applications could be more or less stringent depending on the job requirements, labour market tightness, expected duration and so on. The ability of employers to select the appropriate application is also a factor and depends on their efforts in this area. Several recent economic research studies (Davis *et al.,* 2013; Carrillo-Tudela *et al.,* 2020; Lochner *et al.*, 2021) emphasise the need to consider employers' efforts at the various stages of hiring (when determining their needs, research or even the selection of candidates), which influence the number and quality of matches achieved. Our study aims to analyse the extent to which the selection criteria chosen by employers differ based on the occupation for which they are seeking to recruit and to contextualise these criteria with their candidate search and selection methods and their assessment of the recruitment.

The selection criteria chosen by employers vary substantially: qualifications, education, experience, technical skills, availability, motivation, dynamism or other soft skills, etc. Soft skills are increasingly sought after, as evidenced by the multitude of terms used to identify them: occupational and personal qualities, non-academic, non-cognitive, socio-emotional or behavioural skills, personality traits, etc. Initially associated with service sector jobs whose skills are not always recognised by degrees or qualifications, such as the cleaning occupations (Desjonquères, 2019) and executive jobs – the "personality" sought for this type of position (Dubernet, 1996) – they have been gradually associated with all jobs (Bailly & Léné, 2015). While they are decisive for some hires,[1] they sometimes represent only one criterion among others: their role is dominant in accommodation and food services, retail and the agri-food industry, while academic degrees remain crucial for financial, insurance, computer science, science and technology as well as health, social action, education and public administration activities (Lainé, 2018).

The channels used to search for candidates (networks, advertisements, intermediaries, etc.) vary depending on the recruiters' criteria and the market segment for which they are hiring. By classifying the selection criteria according to job qualification, Larquier & Marchal (2020) find that recruiters valuing the candidates' ability to invest in the work (serious, availability, engagement, etc.) are mobilising their network more to recruit because of its ability to screen candidates. Recruiters who promote the ability to grow within the company favour advertisements, a channel that can be used to highlight their expectations in terms of skills (education, training, technical skills, etc.). The various channels also value candidates' strengths differently: hand-delivering an application is seen as a signal of motivation and availability (Larquier & Rieucau, 2015). Public employment services agents help jobseekers to showcase their skills in a written and standardised format shared with certain employers (Larquier & Rieucau, 2014; 2015). Preferred channels also differ depending on the job market segment targeted by recruiters: unsolicited applications and network in the accommodation and food services sector, characterised by urgent hiring (Forté & Monchatre, 2013), unsolicited applications and advertisements on their premises for the positions of employees in retail (Rieucau & Salognon, 2013), online advertisements for the positions of computer engineers (Fondeur, 2013).

Application selection methods also differ depending on the criteria applied by employers. Although a candidate's qualifications or degree is easily identifiable in a CV, soft skills are not. For example, the mediation or communication skills expected for client-facing occupations can only be gauged in real life (Collard *et al.*, 2015). Personal qualities can also be corroborated based on recommendations or during interviews or testing. These are more common when adherence to rules and guidelines is one of the most sought-after behavioural skills for a position (Chamkhi *et al.*, 2018b). Larquier & Marchal (2020) find that the methods for assessing a candidate's abilities to grow and invest themselves are rather formal (CV, interviews, etc.) while those for their ability to interact are mixed (CV, cover letter as well as role playing, etc.).

Qualitative studies analysing the specificity of hiring in specific sectors and occupations (Forté & Monchatre, 2013; Rieucau & Salognon, 2013; Fondeur, 2013) are interesting, but they do not provide an exhaustive approach to candidate search and selection, nor allow assessing the satisfaction of recruiters with the hiring. Some quantitative studies have examined the criteria favoured by employers but they are limited to specific positions – executives (Apec, 2020; 2021) – or to specific population segments

1. According to Lainé (2018), 60% of employers place behavioural skills ahead of technical skills in hiring; more than 80% consider them essential.

(Di Stasio, 2014; Humburg & van der Velden, 2015; Albandea, 2020). Only a few quantitative studies address the diversity of criteria in France based on occupation (Lainé, 2018; Chamkhi & Lainé, 2021) or the job qualification for the vacancies to be filled (Dubernet, 1996;[2] Larquier & Marchal, 2020). Although Larquier & Marchal (2020) contrast their criteria classification with the recruitment process, they are not interested in the hiring results of employers. Lainé (2018) studies the qualities expected by employers at the occupation level but does not relate those qualities to their candidate search and selection methods. Moreover, the information used is less rich than that of the Dares survey of 2016 on job offer and hiring (*Offre d'emploi et recrutement*, OFER), which we use here as Larquier & Marchal (2020): recruiters must choose from a closed list of approximately 15 criteria, unlike OFER 2016, where they respond spontaneously. Finally, Lainé (2018) analyses the expected qualities of the candidates and not the criteria ultimately selected, which OFER 2016 allows as it relates only to the latter. Chamkhi & Lainé (2021) simultaneously study expected qualities and final criteria but in a relatively small list. Moreover, their occupation classification includes only a limited number of requirements – education and experience – and it cannot be linked to the entire hiring process given the information available.[3]

The OFER 2016 survey, conducted among establishments that concluded fixed-term employment contracts with durations of more than one month or open-ended employment contracts between September and November 2015, identifies the three main criteria selected by employers during the final selection and details all the resources allocated to hiring (channels used, selection methods, etc.). It answers the following questions: do the criteria differ based on the occupation, level of qualification, specific occupational skills? How do recruiters search for and select candidates that meet these criteria? The survey can also be used to characterise those hired and assess the recruiter's satisfaction with the hiring. To identify the various types of labour markets and how selection takes place in each of them, we develop a typology of occupations based on recruiters' selection criteria. The occupation constitutes a relevant level of study of the adequacy between supply and demand for work and allows for a comparison between the tasks associated with the vacancy to be filled and the candidates' skills (training, experience, etc.). This is the preferred level of DARES and Pôle Emploi (the French employment agency) for analysing labour market tightness indicators (Niang *et al.*, 2021).

The rest of the article is organised as follows: the first section presents the construction of the occupation classification and the second section describes the resulting four occupation classes. In the third section, the hiring process (activated candidate search channels, selection methods used, characteristics of the person ultimately hired and assessment) is analysed through the prism of the classification of occupations.

1. Construction of the Classification

The analysis is performed based on the 2016 OFER survey of new hires with fixed-term employment contracts with durations of more than one month or open-ended employment contracts between September and November 2015 in establishments with at least one employee in the non-agricultural competitive sector in France. In this study, the establishments recruiting for positions belonging to occupational areas A (agriculture, marine, fisheries) and X (politics, religion) are excluded as well as those for which the selection criteria could not be processed and grouped.

1.1. Semantic Grouping of the Three Main Hiring Criteria

In the OFER survey (Box), after describing the various stages of hiring, the recruiter is asked about the main criteria used to select the successful candidate(s) and can spontaneously cite up to three.[4] The specific question is as follows: "Finally, to select the candidate(s), what were your main criteria?". Recruiter criteria are identified based on an analysis of the answers to this question. Of the 18,756 statements collected, 32 recruiters surveyed indicated no criteria and 3,837 indicated three. The free text has been cleaned up: automated spelling correction, systematic use of lowercase letters, deletion of punctuation (except for the dash), masculine singularity of the most frequent nouns and deletion of stop words (articles, prepositions, etc.).

2. The author analyses the main criteria defining the candidate's desired profile for a given level of qualification. Employers in the Nantes urban area surveyed had to select up to 3 of 13 criteria by category of position considered (worker, employee, technician or first-line supervisor, sales representative or executive).

3. They know the recruitment channels, possible use of tests and final selection criteria (the employer must select two criteria from a closed list of seven criteria).

4. The OFER 2016 survey differs from the 2005 survey in which the employer chose from a closed list of criteria (Garner & Lutinier, 2006; Larquier & Marchal, 2012). In 2005, most often cited "motivation", "personality", "presentation, appearance and general care" and "experience".

Several methods can be used to reduce the number of statements that are too few to conduct statistical analysis. For short statements, such as those of OFER 2016, automated methods, such as subject or sentiment analysis models, are poorly adapted (Andrey *et al.*, 2017) because of statements that are too limited in size (often a single word) for the former, or a body comprising essentially keywords and not adjectives or adverbs, the main vectors of feelings (positive/negative), for the latter. We have therefore performed manual groupings of words or statements by semantic proximity. We adopted an iterative approach by first analysing the counts of the most frequent word associations (up to three contiguous words = trigrams) and then grouping them together. To constitute a "criterion", each grouping must have at least 30 observations.

The word "experience" is the most often cited (2,432 occurrences) and is most often cited alone. When the surveyed recruiter has completed their description of experience, several criteria can be distinguished: the "specific experience" criterion corresponds to cases in which the experience is qualified by a particular field, sector or occupation (for example, "financial engineering experience"). The "similar experience" criterion includes cases in which experience is associated with the "same sector", "similar domain" or "comparable position", without specifying the exact area of experience. When citations of a word (or statement) are too rare for it to be a selection criterion, the proximity of meaning rather than the form has been favoured during grouping: the "base" criterion groups words associated with basic skills ("read", "count", "speak French"). Similarly, the "human" criterion includes words that are quite varied but homogeneous at the semantic level. It includes variations around the word human – "human contact", "human qualities", "human side", etc. – and words like "kindness", "empathy" and "sensitivity." Arbitration is sometimes difficult. For example, the "civil status" criterion includes words that are directly related to it, such as "age" and "sex", as well as rare words like "criminal record", "nationality" and "insecurity", for which it seemed most appropriate even if some words do not fall directly under it. To confirm the relevance of our choices, we then compared our groupings with those of Larquier & Marchal (2020), which are more detailed. The latter discerned 451 groupings of texts by morphological proximity (favouring the form of

Box – **OFER Survey 2016**

The OFER survey was conducted in 2016 by the DARES (*Direction de l'animation de la recherche, des études et des statistiques*, the French Ministry of Labor Directorate for statistics and studies) among establishments with at least one employee in the competitive non-agricultural sector recently hired[(a)] on a fixed-term contract of more than one month or an open-ended contract between September and November 2015 in metropolitan France or a French overseas department and region (DROM) and who had at least one day of activity in 2015. It is the only national survey that accurately describes the various stages of hiring, from determining the human resources needs to the employer's satisfaction with the hire. The response rate is 64%, with 8,510 respondents, mainly by telephone.

Unlike the previous survey in 2005, it only covers successful hires. The survey focuses on a single randomly selected recruitment with a contract of at least one month, relatively shortly after the hiring (4 to 10 months) to limit recall bias. Since employers are only asked about one hire, we equally speak of classifications of occupations, positions and employers, although in practice, a given employer can hire in different classifications of occupations if they have more than one vacancy to fill.

Recruiters are asked detailed questions about the search channels used (advertisements, relationships, labour market intermediaries, etc.), about the one that ultimately identified the successful candidate and the resources used to select candidates (documents requested, such as CVs, cover letters and references, interviews, trials, various tests, etc.). Employers are also asked about their assessment of the recruitment procedure (duration, cost, number of applications examined, etc.) and the characteristics of the person hired (experience, level of education according to the employer, etc.). Finally, they are asked for the main criteria used to sort the applications for the final selection.

Many characteristics of the vacancy to be filled (observed once recruitment is completed and not at the beginning of the process), establishment (size, sector, etc.) and recruitment procedure (existence of a human resources department, single or multiple recruitment, etc.) are also available.

The scope of this study is restricted to establishments recruiting for positions not belonging to occupational areas A (agriculture, marine, fisheries) and X (politics, religion) – less well covered by the survey than the others – and for which the selection criteria could be processed and grouped. The sample thus included 8,296 respondent establishments and represents approximately 1,165,000 hires.

(a) *The employee's last hire in the establishment must be more than two years earlier and their departure must be at least six months earlier.*

the word) and semantics when necessary. After this comparison, we selected 93 selection criteria (Table A-1 in the Appendix). A total of 125 statements could not be coded, either because the rare statement could not be aggregated with one of the 93 criteria identified or because it was meaningless, for example, the term "quality" often cited without further clarification.

The criteria "experience", "motivation", "skill" and "availability" are the most frequently cited (at least 1,200 occurrences each). They represent 7% to 12% of the criteria cited by recruiters.[5] In contrast, 16 criteria are mentioned less than 50 times by recruiters. Beyond this apparent concentration, the selection involves various criteria. On the one hand, the topics covered are broad: technical skills, education, knowledge of the candidate and possession of a driving licence, as well as soft skills (personality, interpersonal skills, seriousness or courage). On the other hand, the hierarchy of criteria changes significantly depending on the occupation, for example, technical skill is on par with experience in hiring a maintenance technician, whereas it is motivation that is most appreciated for an unskilled worker in building finishing work.

1.2. Construction of the Classification of Occupations Based on the Selection Criteria

To analyse the selection criteria based on the occupation of the position offered, we classified the occupations based on the main criteria used by employers. The analytical unit chosen for the occupation is the detailed occupational family (FAP) defined by the Dares. We use its aggregation in 87 categories, grouped here into 59,[6] to have at least 30 hires per FAP. The contingency table in input of the factorial correspondence analysis (FCA) cross-references these 59 FAPs in rows and the 93 criteria in columns. Each recruitment is weighted by the inverse of the number of criteria cited, ranging from 1 to 3. A single criterion thus counts three times more than a criterion associated with two others. Each hire therefore has the same weight regardless of the number of criteria to which it is associated. The analysis is thus representative in the recruitment stage, the other unit of analysis chosen in this study. Conversely, the order in which the criteria are cited does not affect the weighting.

Using the elbow method for eigenvalues, we use the first three axes of the FCA, which represent one third of the initial inertia (for a detailed presentation of the axes, see Lhommeau & Rémy, 2021). The coordinates of the 59 FAPs on these three axes then feed into the ascending hierarchical classification (AHC) maximising the interclass distance and minimising the intraclass distance (according to Ward's criterion) in relation to the selection criteria. As the loss of inertia is marked between the third and fourth classes, we use a classification with four classes of occupations.

2. Classification of Occupations Based on the Candidate Selection Criteria

In this section, we outline the selection criteria and themes (grouping of criteria) that define the four occupation classes and the main occupations of each class. We then characterise the hiring establishments and the vacancies with respect to the various occupation classes and then examine the labour market situation, the working conditions and employers' expectations regarding the candidates in the various classes. All of this can be used to understand and contextualise the selection criteria used to hire for these occupations.

2.1. Skill, Potential and Remuneration for Technical Occupations

In the first class of occupations, comprising 29% of hires, recruiters highlight the themes[7] of 'skill', 'potential' and 'remuneration' (Table 1 and Table A-2 in the Appendix). These occupations will be called "technical" because they mostly require specific skills. This heterogeneous class includes the occupations of business management and administration, retail, computer science, skilled workers, construction and public works technicians and maintenance technicians and supervisors (Table 2). Recruitment is most often in the business services, information and communication, financial, insurance and real estate activities, as well as industry and construction (Table 3). Most often part of a group, the establishments concerned are most frequently large and located in the Paris urban area. They usually have a human resources department and a single vacancy of this type, recruit most often

5. By weighting by the inverse of the number (between one and three) of criteria cited per hire. In the rest of the document, the citation frequency of the criterion (at least once) is measured per hire: if the "experience" is cited by an employer having mentioned three criteria, it will be weighted in the same way as if they mentioned only one. This criterion thus represents 12% of the criteria cited by employers and is mentioned in 24% of hires.

6. For the FAPs, see https://dares.travail-emploi.gouv.fr/actualite/la-nomenclature-des-familles-professionnelles-fap. The groupings made are outlined in Lhommeau & Rémy (2021).

7. Selection themes are established by semantic proximity based on criteria most often cited in hiring in a given class than in all hiring. They are marked in single quotes to distinguish them from the criteria used to establish them.

Table 1 – **Most discriminating criteria by occupation class**

Technical occupations		Manual occupations		Personal assistance occupations		Public-facing occupations	
Skill		Working capacity		Qualifications		Presentation	
Length of experience	1.7	Courage	2.3	Professional licence	4.0	Smile	3.4
Technical skill	1.7	Physical capacity	1.9	Education	3.1	Home	3.3
Training	1.5	Commitment	1.9	Qualification	2.8	Friendliness	2.2
Appropriate profile	1.5	Worker	1.8	Knowledge	1.6	Contact	2.1
Skill	1.5	Quality of work		Mobility		Presentation	1.7
Potential		Respect	1.9	Mobility	1.9	Communication	1.6
Potential	2.3	Cleanliness	1.8	Listening		Values	
Personality	1.9	Ability	1.7	Listening	1.7	Honesty	2.3
Integration	1.6	Punctuality	1.6	A public	1.6	Values	2.0
Remuneration		Responsibility	1.6			Operational capability	
Remuneration	2.0	Discretion	1.6			Dynamism	2.1
		Attendance	1.5			Operational capability	2.0
		Know-how				Hourly availability	
		Know-how	1.8			Hourly availability	1.6
		Driving	1.6			Punctuality	1.5
		No criteria					
		None	1.5				

Reading Note: The “length of experience” criterion is cited 1.7 times more often for hiring for the technical occupations class than for all hiring.
Sources and Coverage: DARES, 2016 OFER survey; all new hires with fixed-term employment contracts with durations of more than one month or open-ended employment contracts between September and November 2015 in establishments with at least one employee in the competitive sector, except in occupational areas A (agriculture, marine, fisheries) and X (politics, religion), in the whole of France, hereinafter “scope of study”.

Table 2 – **Composition of occupation classes by occupational family**

Technical occupations	%	Manual occupations	%	Personal assistance occupations	%	Public-facing occupations	%
R2Z Commercial attachés/ representatives	10	T4Z Maintenance workers	15	V5Z Cultural and sports professionals	26	R1Z Salespeople	37
L4Z Technicians and supervisors in administrative, accounting and financial services	8	J3Z Vehicle drivers	15	T2A Home helpers/ housekeepers	11	S23 Hotels/ cafés/ restaurants	24
L56 Administrative, accounting and financial services managers/ corporate executives	8	S1Z Cooks	13	WZZ Education/training	11	L2Z Corporate administrative staff	15
G1Z Maintenance technicians and supervisors	7	B3Z Unskilled worker in building finishing work	11	V0Z Caregivers	10	R0Z Cashiers, self-service employees	12
R4Z Sales and technical-sales managers	6	J0Z Unskilled handling workers	8	T36 Security and other services	10	L0Z Secretaries	7
H0Z Industrial engineers/ technical managers	5	G0Z Skilled automotive repair and maintenance workers	7	T2B Childcare workers	7	J0Z Skilled handling workers	5
L1Z Accounting employees	5	B0Z Unskilled heavy construction workers	7	V4Z Social workers	6		
M2Z IT engineers	5	S0Z Butchers, pork butchers, bakers	6	V1Z Nurses, midwives	6		
R3Z Store management/sales agents	5	D03 Unskilled metal or mechanical workers	5	V2Z Health professionals	5		
B67 Construction technicians and supervisors + managers	4	T0Z Hairdressers, beauticians	4	V3Z Allied health professions	5		
B4Z Skilled worker in building finishing work	4	B2Z Skilled heavy construction workers	3	P14 Public service, intermediate occupations, and army, police, firefighters	2		
U1Z Arts and entertainment professionals	4	E0Z Unskilled workers in process industries	2	CZZ Electricity, electronics	2		

Sources and Coverage: DARES, 2016 OFER survey, scope of study.

Table 3 – **Characteristics of establishments and vacancies by occupation class**

	Technical occupations	Manual occupations	Personal assistance occupations	Public-facing occupations	Total
Business sector of establishment (%)					
Industry	16*	15*	1*	8*	11
Construction	10	17*	1*	2*	9
Trade and transportation	18*	23	4*	42*	23
Accommodation and food services sector	1*	15*	1*	25*	11
Information and communication, financial, insurance and real estate activities	20*	1*	1*	5*	7
Business services(1)	23*	12	12*	12	15
Public administration, education, human health and social work	9*	12*	64*	4*	17
Other service activities(2)	4*	6	17*	2*	6
Establishment size (%)					
Less than 10 employees	27*	40*	23*	36	33
10 to 49 employees	29	31	36	34	32
50 to 199 employees	21	15	20	17	18
200 or more employees	23*	13*	21	13	17
Group membership	49*	30*	27*	48*	39
Establishment in the Paris urban area	40*	24*	28	32	31
Presence of a human resources department	58*	36*	50	44	46
Multiple vacancies of the same type to be filled	25*	30	42*	34	32
New position	60*	50	43*	43*	50
Contract type (%)					
1-3-month fixed-term employment contract	9*	18*	17	17	15
3+ months fixed-term employment contract	36	40	44*	33*	38
Permanent	55*	42*	39*	50	47
Part-time contract	12*	31	59*	39*	32
Contract with financial support	14*	26*	11*	15	17
Socio-professional category					
Manager	33*	0*	7	0*	11
Middle-management	45*	1*	54*	3*	23
Unskilled white-collar employee	0*	14*	27	66*	25
Skilled white-collar employee	12	5*	11	26*	13
Unskilled manual worker	1*	44*	0*	0*	14
Skilled manual worker	9*	35*	0*	4*	14
Labour market tightness(3)	2*	1.1*	1.4	1.1*	1.4

(1) The detailed sectors are "Specialist scientific and technical activities" and "administrative and support service activities".
(2) "Arts, entertainment and recreational activities" and "other service activities".
(3) Ratio of the total number of vacancies (i.e. the number of job offers collected by Pôle Emploi (the French employment agency) to the share of Pôle Emploi in hires, itself calculated from the 2016 OFER survey) and the number of job applicants registered with Pôle Emploi for categories A, B and C in the same period.
* Significant differences compared with the overall at the 5% threshold.
Sources and Coverage: DARES, 2016 OFER survey, scope of study.

for new positions, full time and open-ended. In fact, the non-sustainability of employment is lower in this class than in the others (Table 4).

Employers refer most often to the theme of 'skill' for final selection in these highly skilled occupations (33% of executive positions, Table 3). Thus, the criteria "length of experience", "technical skill",[8] "training", "appropriate profile" and "skill" are each cited at least 1.5 times more often than in all hiring. Although the training-employment relationship and the expectations for education are strong (Table 4), the "degree" criterion is not decisive in the selection process. Ultimately, the required technical know-how refers more to experience and skill than to education. Lainé (2018) made the same observation for over-represented sectors in this class: in construction and industry, technical skill is not assessed by a degree, and in the banking-insurance sector, computer science and scientific and technical activities, only the

8. Apec (2021) also highlights the importance of career paths and technical skills when recruiting executives. Dubernet (1996) highlights the major role of technical skills in recruiting technicians and supervisors, which are also over-represented in this class.

Table 4 – **Labour market context, educational expectations and working conditions by occupation class**

	Technical occupations	Manual work	Personal assistance occupations	Public-facing occupations	Total
Labour market context indicators in 2015[1]					
Hiring intensity	2.5	2.5	2.2	3.3*	2.6
Non-sustainability of employment	1.8*	4.2*	3.7*	4.3*	3.1
Training-employment link	3.3*	2.0*	3.2	1.3*	2.6
Educational expectations (%)					
No expectations of the recruiter regarding education	21*	50*	17*	44*	35
Could have hired someone less qualified but more experienced	71	76	56*	82*	73
Hiring expected to be difficult in 2015 (%)	38*	33	38	26*	35
Working conditions in 2016 (%)					
Weekend work	39*	52	56	62	49
Physical constraints[2]	19*	58*	33	36	36
Rhythm constraints[3]	35	46*	26*	38	37
Repetitive tasks	28*	65*	35	61*	45

(1) Labour market context indicators are centred and reduced at the business level over the period 2014-2018; they vary from one to five depending on the quintiles of their distributions over the period (for more details, see Niang & Vroylandt, 2020); the indicators used here are prior to the 2021 update. Employment intensity is the ratio of the number of online job offers and recruitment projects to average employment. The training-employment link helps to identify whether the occupation is difficult to access for people who do not have the required training.
(2) At least three of the five constraints: carrying or moving heavy loads, standing for a long time, staying in another difficult or tiring posture for a long time, long or frequent walking trips, experiencing shaking or vibration.
(3) Three constraints among seven: automatic movement of a room, automatic machine speed, other technical constraints, immediate dependence on the work of one or more colleagues, production standards or deadlines to be met in at most one hour, external requests (customers, patients, public) requiring an immediate response, permanent checks or monitoring exercised by management.
* Significant differences at the 5% threshold compared with other classes.
Note: To calculate all indicators, except for education expectations, occupations are weighted by salaried employees.
Reading Note: In 2015, the average hiring intensity reached 2.5 for technical occupations.
Sources and Coverage: Labour market indicators, Pôle Emploi-DARES, tight occupations (occupational families "Craft and related trades workers", "Corporate executives", "Health professionals" and "Teachers" are excluded). Educational expectations, DARES, 2016 OFER survey, scope of study. Hiring expected to be difficult, Pôle Emploi, 2015 survey of labour needs. Working conditions, DARES, 2016 survey of working conditions.

degree level is important for recruiters who are rather indifferent to its type.

Executive and middle management positions, the vast majority in this class, are in principle more strategic for the companies and involve longer lasting employment relationships and internal career planning (Fondeur, 2013). As a result, more recruiters refer to the candidate's 'potential':[9] "personality", "integration", and "potential" criteria[10] are often seen. However, the "potential" criterion can also reflect the difficulty of the recruiter in identifying their need since they summarise the versatility, adaptability and the experience of the candidates (Ben Mezian, 2017). This problem can be explained by the large share of new positions, with profiles less well defined than those of existing jobs. Finally, the "remuneration" criterion, twice as often cited, may reflect the substantial tightness associated with these occupations, as well as hiring difficulties anticipated by recruiters (Tables 3 and 4).

2.2. Work Capacity, Quality of Work and Know-How for Manual Occupations

In the second class of occupations (31% of hires), employers favour 'capacity' and 'quality of work', as well as 'know-how' (Table 1). Transport and logistics occupations (vehicle drivers, unskilled handling workers) and the food service industry (cooks, butchers, pork butchers, bakers), unskilled construction workers and maintenance workers are the most common in this class of hires, later qualified as "manual" (Table 2). Not surprisingly, recruiting establishments are more often positioned in the industry, construction, transport and accommodation and food services sectors (Table 3). Smaller in size and located outside the Paris urban area, they are less often part of a group and less often have a human resources department. Most of them recruit for blue-collar jobs and employment contracts are more often subsidised.[11]

Recruiters emphasise the candidates' 'capacity to work', with the criteria of "courage", "physical capacity", "commitment" and "hard working". Candidates must be able to cope with

9. Larquier & Marchal (2020) find that the recruitment of executive and middle management positions appraises the candidates' ability to grow in the company more.
10. The importance of the "personality", "capacity for integration" and "potential" criteria for over-represented executive hiring in this class has already been observed by Dubernet (1996) and Apec (2020).
11. Sandwich contracts account for just over half of these contracts, the remaining share corresponding to assisted contracts.

the difficult working conditions associated with these occupations: more frequent exposure to physical and rhythm constraints and repetitive tasks (Table 4). Recruiters more often cite 'quality of work' – "compliance" (with standards), "cleanliness", "punctuality", "attendance" and "responsibility", which refers to the proper execution of manual work. "Discretion", also discussed, is more a matter of contact with customers (hairdressers and beauticians, maintenance workers). Personal qualities here replace academic skills for occupations whose qualifications are not always recognised (Demazière & Marchal, 2018; Desjonquères, 2019).

Indeed, the training-employment link here is rather weak overall. More than a degree (half of recruiters have no expectations in this regard), it is know-how that is expected. Nevertheless, this link varies within the occupations of this class (Niang & Vroylandt, 2020). Access to some occupations, such as food service industry, car maintenance and repair, hairdressing and beauty care requires very specific know-how and adequate training. Similarly, for vehicle drivers, the "driving" criterion explains both know-how and certification (licence(s)). Recruiters in this class actually cite the candidates' 'know-how' more often. In this class, the tightness is rather low and the non-sustainability of jobs is more widespread. Turnover is high, especially for the occupations of cooks, hairdressers and beauticians, which are also characterised by a high hiring intensity: they can "circulate" within a defined professional market and move from one employer to another (Forté & Montchatre, 2013). In this context, recruiters, concerned about the need to fill a vacancy quickly, may be less demanding. More people meet 'no criteria'[12] and select candidates from a reduced number of criteria: one for 28% of their hires versus 20% for other classes.

2.3. Qualification, Mobility and Listening for Personal Assistance Occupations

In the third class (16% of hires), recruiters favour 'qualifications', 'mobility' and 'listening' of candidates (Table 1). This class brings together occupations with a strong assistance component. The health (doctors, nurses, midwives, caregivers, allied health professions) and cultural and sports professions are the majority in hiring. The personal assistance occupations (home help, housekeepers and childcare workers) and security guards and other services constitute the second component and the occupations of education and training the third (Table 2). Here, middle management positions, making up the majority, and unskilled workers are combined. Hiring is mainly carried out by public administration, education, human health and social action establishments, as well as by other service establishments (Table 3). They are recruiting more for multiple positions in the same category, both long and part-time fixed-term employment contracts to replace employees who have left their establishments. These jobs are less often subject to rhythm constraints.

To a large extent, these occupations are regulated – competitive examinations, *numerus clausus*, etc. – which is why recruiters prefer 'qualifications' with the criteria "degree", "qualification", "professional licence"[13] and "knowledge". They are placed in professional markets whose access is subject to a specific degree or certification (Fondeur, 2013; Lainé, 2018). Recruiters more often have education expectations and are less inclined to compensate for an insufficient educational level through greater experience (Table 4). The "assistance" component of these occupations is best described as 'listening', which is more difficult to objectify with a degree: criteria such as "listening" and knowledge of or experience with a specific "public" (children, people with disabilities, the elderly, etc.) are then crucial. Finally, 'mobility', for example, on a site for security guards or at a home for housekeepers, is also a part of recruiters' expectations.

2.4. Presentation, Values, Operational Capability and Hourly Availability for Public-Facing Occupations

In the fourth class (25% of hires), recruiters cited more often 'presentation', 'values', 'operational capability' and 'hourly availability' of candidates (Table 1). This class is a group of occupations that are most often public-facing. Salespeople, cashiers and self-service employees account for almost half of the hires (Table 2); hospitality staff account for one quarter, and corporate clerical staff account for more than two out of ten. Hires are thus concentrated in trade and accommodation and food services establishments that are also more often part of a group (Table 3). Two thirds of the positions are at the unskilled worker level. The link between training and employment is the weakest (Table 4) confirming Collard *et al.* (2015): the skills expected in the service occupations are more a matter of an ability to

12. The 'no criteria' theme contains a single "none" criterion that is used when the recruiter has indicated "none", "no choice", "lack of candidates".
13. The "professional licence" criterion refers to approvals, authorisations and certificates necessary to practice regulated occupations.

cope with a situation than of having a certain qualification. As a result, recruiters have fewer educational expectations and are more willing to come to a trade-off between education and experience. The personal qualities of the candidates take precedence for these public-facing occupations. 'Presentation' is particularly valued: "smile", "welcome", "friendliness", "contact", "presentation" and "communication" are cited at least 1.5 times more often than in all hires.

In connection with the commercial transactions often associated with these positions, 'values' are also highlighted even if they are difficult to objectify during hiring. The "operational capability" and "dynamism" of candidates are also frequently mentioned, all of which identify an ability to invest in the work (Larquier & Marchal, 2020) and to meet the expectations of these public-facing occupations. Moreover, if these occupations are less tight (recruiters, at the time they were surveyed, anticipated fewer hiring difficulties), they are distinguished by high hiring intensity and lower sustainability of jobs (Table 4), and these are replacements rather than job creation; the 'operational capability' of candidates, limiting the training required to take the job, addresses this risk of turnover and short employment relationships. In addition to a primary market for full-time, open-ended employment contracts with limited career prospects, the retail sector is characterised by a secondary market for part-time, high-turnover jobs more aimed at young workers and students, offering flexibility to employers (Rieucau & Salognon, 2013). Similarly, in the hospitality sector, service jobs offer important temporary job opportunities for people entering the labour market (Forté & Montchatre, 2013). Recruiters also mention the importance of having somewhat of a flexible schedule: "hourly availability" and "punctuality" are qualities desired for these retail and hospitality jobs, which more often require weekend work (Table 4). Schedule constraints, often repetitive tasks and frequency of part-time can explain the turnover of these positions.

3. Hiring Process By Class of Occupation

To find out whether the search channels, selection methods, characteristics of candidates ultimately hired and the hiring assessment differ based on the selection criteria preferred by employers, we analyse their effect[14] on the probability of belonging to a given class of the classification using several multinomial probit models controlling for the characteristics of the establishments, their vacancies to be filled and the prevailing tightness for the occupation in question (see detailed variables in Table 3).

3.1. Do the Channels Used by Recruiters Differ Based on Their Hiring Criteria?

To search for candidates in a technical occupation, employers have more often used their relationships and other labour market intermediaries – schools, universities, training centres, recruitment agencies, professional bodies, etc. (Table 5). Relationships can reduce uncertainty about the candidate's skills, as the employer can infer the candidate's unobserved characteristics from those of the people who recommend the candidate, especially if they are their employees (Montgomery, 1991). Some of the predominant selection criteria in this class – linked to the candidates' 'potential', the suitability of their profile or their technical skills – are difficult to identify from the CV or cover letter and relationships are an effective alternative. The other intermediaries, given their specialisation in certain market segments (Bessy & Larquier, 2010; Sabatier, 2010), allow access to candidates who are difficult to reach and preselected based on the desired criteria. Employers hiring for a manual occupation used fewer channels (Table 5-A), relied less on ads job fair participation to search for and hire candidates (Table 5-B). Advertisements are more suitable for transmitting standardised information (Larquier & Rieucau, 2014), which cannot be used to assess the 'work capacity' and/or 'quality of work' of the candidates preferred in this class. They also used their network and other intermediaries less often to collect applications.

In the personal assistance occupation class, recruiters have increased the number of channels to find candidates who meet their expectations. They prefer their network, contact with former employees and examination of unsolicited applications (in more than 80% of their hires). Moreover, they have more often recruited through the latter channel, which is a more passive approach to finding candidates at no cost, except for the selection of applications collected through it. However, the quality of the applications is more uncertain: on the one hand, they are not filtered by an intermediary and, on the other hand, there is less self-selection of candidates than for an advertisement specifying the expectations of the position.

14. With the exception of assessment variables for which we analyse the effect of belonging to a given class of the classification on the outputs (satisfaction with hiring, early termination, recruitment duration, etc.).

Table 5 – **Search and recruitment channels by occupation class**

	Technical occupations	Manual occupations	Personal assistance occupations	Public-facing occupations
Average number of channels used	0.00	−0.01**	0.01***	0.00
A – Channels used for search of candidates				
Relationships	0.02**	−0.01*	0.02**	−0.02**
Unsolicited applications	−0.02***	0.00	0.03***	0.00
Recalls of former employees[1]	−0.03***	−0.01	0.03***	0.01
CV databases[2]	−0.01	0.00	0.00	0.00
Participation in job fairs and other channels	0.02	−0.03***	0.01	0.01
Public employment service intermediaries[3]	0.00	0.00	0.01	−0.01
Other intermediaries[4]	0.03***	−0.02**	−0.01	−0.01
Advertisements	−0.01	−0.02*	0.01	0.01*
B – Channels leading to hire (*Ref.:* Relationships)				
Unsolicited applications	−0.03***	0.01	0.02*	0.00
Recalls of former employees	−0.02	−0.03	0.01	0.04**
CV databases	0.01	0.03	−0.06***	0.02
Public employment service intermediaries	0.00	0.00	0.00	0.00
Other intermediaries	0.03**	−0.01	−0.03**	0.01
Advertisements, participation in job fairs and other channels	−0.01	−0.03**	0.01	0.03**

(1) The establishment has contacted persons who have already worked for them as an employee, intern, temporary worker or service provider.
(2) Applications received for a previous position, external CV databases or those of the establishment.
(3) Pôle Emploi, *missions locales* (French youth agency) and other public employment service intermediaries.
(4) Apec (Association for the employment of executives), occupational bodies or employer associations, schools, universities and training centres, recruitment agencies, temporary employment agencies, private placement firms and other organisations.
Notes: Only the results concerning the marginal effects of the variables in the table on belonging to a given class of classification are presented. The estimated model is a multinomial probit including the variables in Table 3 as control variables. The marginal effect is calculated for each channel taken separately (except in Table B). Statistical significance thresholds at 10, 5 and 1% represented by *, ** and *** respectively.
Reading Note: The examination of unsolicited applications decreases by 2 percentage points the likelihood that the recruiter belongs to the technical occupation class. Hiring through other intermediaries rather than relationships increases the likelihood that the recruiter will be in the technical occupations class by 3 percentage points.
Sources and Coverage: DARES, 2016 OFER survey, scope of study (only establishments that know their recruitment channel are considered in part B).

Nevertheless, some of the qualities sought in this class of occupation, such as "education", the "professional licence" and 'qualification' in general, can be easily verified through the CV or requests for additional documents. Finally, to constitute the pool of candidates and hire for a public-facing occupation, advertisements are preferred. Allowing for the collection of a higher number of applications[15] for the price of limited information on each candidate, they require a tailored selection process. Conversely, relationships are less often used to search for candidates while recalls are favoured during hiring. This latter channel makes it possible to find candidates whose behavioural qualities valued for these public-facing occupations ("presentation", "contact", "friendliness", "communication", etc.) have already been tested.

3.2. How do Recruiters Select Applications that Meet their Expectations?

To hire for a technical occupation, recruiters more often informed themselves of the candidates' wage expectations, perhaps to adjust the wage offered (Table 6), "remuneration" being one of their preferred selection themes. At the time of selection, they favoured telephone interviews, a faster way to sort out the many applications received and reviewed (13.5 vs 12 on average). Cover letters and foreign language and personality tests were also used to assess the candidates' 'skills' and 'potential', among others, their "integration ability" or "personality", particularly sought by these recruiters (Table 7). Despite the higher expectations regarding education, fewer recruiters are asking for a copy of degrees, mentioning it on the CV likely being sufficient. The increased number of actors, often three or more, and interviews with the person ultimately hired,[16] as well as not recruiting in a hurry (recruitments are often planned over more than one week) can be explained by the desire to best identify candidates' 'potential' while refining the measure of their 'skills'.

To recruit for manual work, the process is a little leaner; the number of applications examined proved to be lower (9 vs 12), with recruiters having most often less than a week to devote to hiring. More frequently, candidates had to provide their name and address, photo ID,

15. Moreover, recruiters in this class reviewed more applications: 15 compared to 12 on average.
16. Two or more in 60% of cases compared with 34% in other classes.

Table 6 – **Items requested by occupation class**

	Technical occupations	Manual occupations	Personal assistance occupations	Public-facing occupations
Average number of items requested[1]	−0.01***	0.00	0.02***	−0.01***
CV	0.01	−0.03***	0.00	0.02
Name and address	−0.02*	0.02*	0.03***	−0.03***
Cover letter	0.02**	−0.01	0.00	−0.01
Certificates or other administrative documents[2]	−0.03***	0.02***	0.05***	−0.04***
Wage expectations or wage level	0.03***	−0.02**	−0.02**	0.00
Copy of degree or training certificate	−0.03***	0.01	0.08***	−0.06***
Completed application form	−0.02**	0.00	0.04***	−0.01
References or recommendations	−0.01	0.00	0.03***	−0.02**
Driving licence	−0.02**	0.02***	0.06***	−0.06***
Photo ID	−0.02**	0.02*	0.05***	−0.05***

(1) The various items could be requested from some or all applicants. Other documents or information requested in 10% of recruitments are also included in the calculation of the average number of items.
(2) ID, IBAN, residence permit, health card certificate (*carte vitale*), medical certificate, etc.
Notes: Cf. Table 5.
Sources and Coverage: DARES, 2016 OFER survey, scope of study.

Table 7 – **Selection methods by occupation class**

	Technical occupations	Manual occupations	Personal assistance occupations	Public-facing occupations
Average number of selection methods used[1]	0.00	0.00	0.01***	−0.01*
Telephone interviews	0.02**	−0.03***	0.00	0.02**
Testing of candidate(s)	−0.02***	0.03***	0.01	−0.01
Tests that imitate work situations	−0.01	0.00	0.04***	−0.03***
Basic skills tests (reading, writing, counting)	0.00	0.00	0.03***	−0.03***
Tests of knowledge and abilities[2]	0.00	−0.01	0.04***	−0.03**
Personality tests	0.03**	−0.01	0.02	−0.04**
Foreign language tests	0.04***	−0.05**	−0.03	0.04**

(1) Selection methods could be used for some or all the candidates. Individual interviews, group tests and handwriting analyses are included in the calculation of the average number of methods but are not isolated: the former do not differentiate the occupation classes, while the latter are too marginal.
(2) So-called "intelligence" tests in the survey, which deal with mental agility, reasoning, logic, etc.
Notes: Cf. Table 5.
Sources and Coverage: DARES, 2016 OFER survey, scope of study.

certificates and other administrative documents, and driving licences, with recruiters adding more value to "driving" skills for this type of occupation. By contrast, they less often selected candidates based on CV, telephone interviews and foreign language tests; demands regarding wage levels or expectations were also rarer. They made more use of testing, this method allowing for a better assessment of the 'work capacity', 'quality of work' achieved and 'know-how' that recruiters seek to test.

Recruiters for personal assistance occupations more often examined unsolicited applications to find candidates (Table 5-A), a channel that does not filter applications. They made a drastic selection by using more methods and asked for a greater number of items to perform the initial application screening, particularly copies of degrees and training certificates (Table 6). Indeed, 'qualification' is more often mentioned for occupations in this class, some of which are regulated and require specific skills that must be certified. As recruiters placed greater emphasis on the candidates' 'mobility', they more often demanded addresses or driving licences. Once their 'qualifications' have been formally verified, they more often tested the basic skills, knowledge, intelligence or attitude of candidates in different work situations (Table 7). The latter tests may also aim to assess the listening and knowledge qualities of a "public" valued by these recruiters and less objectifiable than a qualification.

For public-facing occupations, requests for driving licences, photo ID, copies of degrees, certificates and administrative documents, among others, were less frequent. As recruiters in this class have few educational expectations, their selection criteria focus more on personal or communication skills than on academic skills. To detect these qualities among candidates, telephone interviews are preferred over tests,

which are less often used, with the exception of foreign language tests.

3.3. Which profiles are ultimately successful based on recruiter selection criteria?

The preferred selection criteria and the channels and methods of selection used lead recruiters to hire people with a wide variety of profiles. In line with the place given to the candidates' 'skills' and educational expectations, the candidates hired for a technical occupation are more highly educated: 64% have two years or more of study after earning a secondary school degree (*Bac*+2) compared with 22% in other classes. As the required technical know-how also depends on experience, successful candidates are more experienced, less often under 26 years old and/or inactive before hiring (Table 8). People hired for manual occupations are most often men, aged 50 years or older and/or with low-level qualifications (more than half have qualifications lower than the secondary school diploma (*Baccalauréat*)). The preferred selection criteria for these occupations relate to 'know-how' and 'work capacity' and not to academic knowledge. The importance of previous experience in the same type of position seems limited – it is more frequently unknown to recruiters; skills for this type of occupation may be preferentially assessed directly when testing.

Candidates hired for personal assistance occupations are more qualified than those selected for manual or public-facing occupations: 45% of them have a level greater than or equal to Bac+2 compared with 15% in the other two classes. This is due to recruiters' expectations of candidates' 'qualifications' during selection – occupations that are largely regulated and require a specific degree – and of knowledge or experience of a specific public. Candidates hired for public-facing occupations are more likely to be women, young, less experienced[17] and slightly more often inactive before they are hired; the personal qualities of the candidates – their 'presentation' and their 'dynamism' – are the most important during selection in this class. But these soft skills are more difficult to objectify with experience; they need to be assessed during their selection or even after starting the position.

3.4. Duration and Difficulty of Recruitment, Satisfaction of Recruiters Based On their Selection Criteria

Recruiters' satisfaction with hiring differs little with regard to the class of occupations considered (Table 9). Only recruiters hiring for technical occupations appear more satisfied with their hiring than those hiring for personal assistance occupations. They also have a lower risk of early termination and a greater likelihood of offering open-ended employment contracts to those with fixed-term employment contracts still in the establishment at the time of the survey. These elements of the hiring assessment can be reconciled with the selection themes favoured by these recruiters and the greater resources they have devoted to hiring. They placed more emphasis on the candidates' 'skills', which were more easily identified on a CV or through tests. With regard to the latters' 'potential', the multiple interviews attended by the person hired and the many stakeholders seem to have enabled recruiters to find a candidate that meets their expectations. Finally, these recruiters used relationships and other intermediaries more often, two channels that screen applications. Several studies have already highlighted such links between resources devoted to hiring, measured by the number of selection methods or the choice of a suitable hiring method and satisfaction with hiring (Larquier, 2009; Pellizzari, 2011).

17. According to Lainé (2018), recruiters place less importance on the candidates' experience for this type of occupation.

Table 8 – **Characteristics of successful candidates by occupation class**

	Technical occupations	Manual occupations	Personal assistance occupations	Public-facing occupations
Female (*Ref.:* Male)	0.00	−0.02**	−0.01	0.04***
Age of successful candidate (*Ref.:* 26 to 49 years)				
Under 26 years	−0.02*	−0.01	0.01	0.01*
50 years or over	0.00	0.03**	0.00	−0.03*
Experience in the same type of position (*Ref.*: Less than 5 years)				
5 years or over	0.04***	0.00	−0.01	−0.03***
Unknown	−0.04***	0.03***	0.02	−0.01
Inactive before hire	−0.03***	0.01	0.01	0.02*

Notes: Cf. Table 5.
Sources and Coverage: DARES, 2016 OFER survey, scope of study.

Table 9 – **Hiring assessment by occupation class**

	Satisfied[1]	Early termination	Switch from fixed-term to open-ended employment contract[2]	Difficult recruitment	Recruitment period
Occupation class (*Ref.:* Personal assistance occupations)					
Technical occupations	0.04*	−0.11***	0.07*	0.00	0.47***
Manual occupations	0.03	−0.04	−0.09**	−0.07***	0.19***
Public-facing occupations	0.01	−0.08**	−0.03	−0.07**	0.25***

[1] The recruiter responded positively to the question: "Given the opportunity, would you hire the same person again for this position?".
[2] Anticipated or already completed among persons hired with fixed-term employment contracts in the establishment at the time of the survey.
Notes: only the results concerning the effect of belonging to a given class of the classification for the assessment variables are presented. The estimated models are simple probits with calculation of marginal effects except for the recruitment period where it is an ordered probit (<4 days, 4 to 7 days, 8 to 15 days, 16 to 30 days, 31 to 60 days, >60 days). These models include the variables in Table 3 as control variables. Statistical significance thresholds at 10, 5 and 1% represented by *, ** and ***.
Reading Note: Hiring for a technical occupation rather than a personal assistance occupation increases the likelihood that the recruiter would hire the same person by 4 percentage points if given the opportunity.
Sources and Coverage: DARES, 2016 OFER survey, scope of study.

Recruiters for technical occupations or personal assistance occupations also found hiring more difficult. Their particular requirements with regard to the candidates' 'skills' or 'qualification', as in terms of 'potential' or 'listening skills', play a role. Nevertheless, with comparable job and establishment characteristics, hiring was faster for personal assistance occupations than for the other classes of occupations, despite the substantial resources allocated to hiring (use of a greater number of channels, request for documents and use of more selection methods).[18] Finally, early terminations are less common for public-facing occupations than for those for personal assistance. Several soft skills preferred by the former – including some 'presentation' and 'values' criteria – are more difficult to assess and objectify than the 'qualification' or 'mobility' avoured by the latter – but not necessarily more than the 'listening skills' also sought. Nevertheless, 'qualification' may be more rare. Lower expectations of recruiters for degrees and experience for public-facing occupations have also reduced the risk of early termination.

* *
*

This article examined the extent to which employers' selection criteria vary based on the occupation for which they are hiring. We constructed a classification of occupations in four classes based on the selection criteria declared spontaneously by employers in the 2016 OFER survey. 'Skills', 'potential' and 'remuneration' are the three main selection themes chosen by employers hiring for technical occupations, while 'work capacity', 'quality of work' and 'know-how' are the main qualities required for manual occupations. In the personal assistance occupations, employers are rather seeking 'qualification', 'mobility' and 'listening' while they are attached to 'presentation', 'values', 'operational capability' or 'hourly availability' for the public-facing occupations.

To have candidates with the desired qualifications, employers conduct more or less extensive research and use selection methods differentiated based on the occupation. The 'work ability' and 'know-how' for manual occupations are evaluated through testing; candidates are less frequently sought through advertisements and job fairs, as these channels are less likely to provide information about their skills in the field. Interviews make it possible to assess the personal suitability necessary for public-facing occupations held or not by applicants applying via advertisements or recalled by the establishment. The 'skills' and 'potential' in technical occupations are certified by numerous interviews and tests after a screening of applications by intermediaries other than the public employment service or the employer's network. Finally, the 'qualification' and 'listening' in personal assistance occupations are assessed thanks to a well-documented application file collected most often after the examination of unsolicited applications. Recruiters' satisfaction with hiring differs little based on their criteria: only those hiring for technical and public-facing occupations are less likely to have seen their employment relationships end early. Difficulties in hiring for technical occupations or personal assistance occupations are more likely, as the skills sought are specific and potentially rare, and recruiters' expectations are higher.

This study allowed us to highlight the diversity of selection criteria beyond the most frequently cited: "experience", "motivation", "skill" and "availability". This diversity is reflected in the

18. For these occupations and manual occupations, recruiters more often planned to spend less than one week on hiring.

variety of channels and methods that recruiters use to search for and select candidates that meet these criteria. Nevertheless, the data, despite their wealth, do not provide information on the criteria initially selected or disseminated for a possible job offer, which sometimes differ significantly from the final criteria used:[19] occupational experience, degree and location are likely to be preferred during the first screening of applications (Chamkhi *et al.,* 2018b; Chamkhi & Lainé, 2021). □

19. The initial criteria may be prerequisites and/or adjusted during the hiring process. This limit must, however, be put in perspective. According to Chamkhi et al. *(2018b), the information reviewed as a priority in a CV is generally the same as the criteria ultimately preferred for hiring: experience and behavioural skills.*

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APPENDIX

Table A-1 – **Selection criteria: number of citations and often associated statements**

Criteria	Number of citations	Other statements often associated with the criterion	Criteria	Number of citations	Other statements often associated with the criterion
Experience	2013		Basic knowledge	90	Counting, reading, proficiency in French
Motivation	1161		Mobility	89	
Skill	1507	Occupational qualities	None	84	No criteria, no choice, only one application
Availability	1233		Interest	83	
Presentation	530	Physique, attire, appearance,	Ability	81	Thoroughness, dexterity
Technical skill	527	Technical proficiency, technical know-how, business sense, technical level...	Career path	81	Stability
Personality	530	Temperament, character	Contract type	81	Student status, sandwich contract, part-time, contract with financial support, recognition of disability
Education	503	CAP, BAC, Master's, etc.	Soft skill	81	Curiosity, combativeness, creativity, spontaneity, optimism, culture
Know-how	426		Attendance	75	
Geographical proximity	367	Location, geographic area, geographical region, distance, etc.	Commitment	66	Involvement, investment, engagement, passion
Seriousness	338	Conscientious, discipline, application	CV	66	
Relationship	265	Sociability, conviviality, ease	Human	66	Empathy, kindness
Punctuality	253		Physical capacity	65	Physical fitness, athletic, endurance, health
Similar knowledge	235	Knowledge of the occupation, knowledge of the position, knowledge of the business, knowledge of the field, etc.	Charisma	65	Confidence, poise, self-confidence
Appropriate profile	232	Relevance, correspondence, expectations, consistency	A public	56	Knowledge of children, the elderly, experience with young people, like children
Known candidate	229	Internship, already employed, former employee	Studying	56	University curriculum
Selection mode	220	Interview, unsolicited application, test, trial, role playing, file	Intelligence	63	Analysis, common sense, summary, consideration
Dynamism	216		Education	61	School curriculum, school level, grades, school
Expression	211	Diction, language, conversation, line of argument	Efficiency	59	
Training	206	Education	Contact	63	
Recommendation	198	Reference, reputation, word of mouth	Immediate availability	58	Urgency, fast availability
Adaptability	181	Flexibility	Responsiveness	60	
Thoroughness	173	Patience, concentration, attention, high standards	Values	52	Service mindedness
Driving (licence)	161	Vehicle, know how to drive, transport	Project	54	
Specific knowledge	156	Computer knowledge, theoretical knowledge, technical knowledge, etc.	Home	57	

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Table A-1 – (*contd.*)

Criteria	Number of citations	Other statements often associated with the criterion	Criteria	Number of citations	Other statements often associated with the criterion
Team	156		Politeness	54	"Savoir-vivre"
Remuneration	140	Wage, wage expectations, wage acceptance	Speed	55	
Language	137	Foreign language proficiency	Honesty	54	Sincerity
Feeling	134	Feeling, impression	Professional licence	48	Certificate, accreditation, authorisation, BAFA (certificate of proficiency as a facilitator)
Envy	134	Enthusiasm	Communication	49	
Knowledge	129		Respect	50	
Civil status	123	Age, work permit, criminal record, nationality, family situation, financial insecurity	Organisation	47	
Behaviour	120		Understanding	48	Vision
Autonomy	118	Initiative, independence	Potential	48	Development, prospects
Attitude	113	State of mind	Versatility	45	
Know-how	111		Cleanliness	44	
Professionalism	110	Professional awareness, professional	Length of experience	37	Seniority
Specific experience	105	Experience in industry, experience abroad, experience in cleaning, etc.	Hard working	40	
Hourly availability	105	Flexible schedule	Integration	36	
Qualification	104		Learn	31	
Aptitude	101	Capacity, attitude	Acceptance	31	
Will	101	Determination	Discretion	32	
Smile	100		Listening	30	
Similar experience	98	Experience in the field, in the occupation, in the same type of position	Courage	28	
Trust	98	Reliability, loyalty	Operational capability	21	
Similar skill	94	Skill for this position, experience in the occupation, expertise	Responsibility	21	
Friendliness	91	Kindness, friendliness, pleasant			

Table A-2 – **Distribution of selection criteria and themes that distinguish the most each of the classes based on occupation class (%)**

	Technical occupations	Manual occupations	Personal assistance occupations	Public-facing occupations	Total
Skill	45.6	21.0	35.4	19.7	30.0
Length of experience	0.3	0.2	0.1	0.1	0.2
Technical skill	5.4	2.0	3.6	2.1	3.3
Training	1.8	1.0	1.4	0.5	1.1
Appropriate profile	2.4	1.1	2.0	0.9	1.5
Skill	14.5	7.3	10.2	6.3	9.5
Potential	13.0	3.4	4.2	5.4	6.8
Potential	0.5	0.1	0.1	0.1	0.2
Personality	4.7	1.1	1.7	2.1	2.5
Integration	0.3	0.2	0.2	0.0	0.2
Remuneration	3.2	1.1	0.9	0.7	1.6
Remuneration	1.3	0.5	0.4	0.3	0.7
Qualification	7.8	5.4	24.7	3.9	8.8
Professional licence	0.1	0.1	1.1	0.1	0.3
Education	2.4	1.6	8.5	1.0	2.8
Qualification	0.2	0.5	1.2	0.1	0.4
Knowledge	0.9	0.5	1.2	0.7	0.8
Mobility	1.0	1.0	2.2	0.5	1.1
Mobility	0.4	0.4	0.9	0.2	0.4
Listening	1.1	1.1	2.2	1.1	1.3
Listening	0.1	0.2	0.3	0.2	0.2
A public	0.4	0.4	0.6	0.3	0.4
Working capacity	1.3	4.2	1.3	1.9	2.4
Courage	0.0	0.2	0.0	0.1	0.1
Physical capacity	0.2	0.6	0.1	0.1	0.3
Commitment	0.3	1.0	0.3	0.4	0.5
Hard working	0.1	0.3	0.1	0.1	0.2
Quality of work	3.4	10.4	4.2	6.5	6.4
Respect	0.1	0.5	0.2	0.2	0.3
Cleanliness	0.2	0.5	0.1	0.2	0.3
Ability	0.4	0.8	0.4	0.2	0.5
Punctuality	0.3	2.1	0.6	1.9	1.3
Responsibility	0.1	0.2	0.0	0.1	0.1
Discretion	0.1	0.2	0.1	0.0	0.1
Attendance	0.4	0.6	0.2	0.2	0.4
Know-how	2.4	5.9	1.9	2.3	3.4
Know-how	0.4	1.0	0.4	0.3	0.6
Driving	0.9	1.7	0.5	0.7	1.1
No criteria	1.0	1.7	0.9	0.6	1.1
None	1.0	1.7	1.0	0.6	1.1
Presentation	5.2	8.4	5.5	21.0	10.1
Smile	0.1	0.2	0.0	1.7	0.5
Home	0.0	0.1	0.1	1.1	0.3
Friendliness	0.3	0.4	0.1	1.0	0.4
Contact	0.2	0.1	0.3	0.6	0.3
Presentation	1.5	2.7	1.5	4.7	2.7
Communication	0.2	0.2	0.2	0.4	0.2
Values	0.7	1.2	0.6	2.9	1.4
Honesty	0.1	0.3	0.1	0.7	0.3
Values	0.2	0.2	0.1	0.5	0.3
Operational capability	1.4	2.4	1.5	6.1	2.9
Dynamism	0.5	0.9	0.5	2.2	1.0
Operational capability	0.1	0.1	0.1	0.2	0.1

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Table A-2 – (*contd.*)

	Technical occupations	Manual occupations	Personal assistance occupations	Public-facing occupations	Total
Hourly availability	1.5	6.5	2.4	6.6	4.5
Hourly availability	0.6	0.5	0.3	1.0	0.6
Punctuality	0.3	2.1	0.6	1.9	1.3

Notes: The detailed criteria are weighted by the number of criteria cited by the recruiter while the major selection themes are not. They are only weighted by their weight in the hires.
Reading Note: The "technical competence" criterion represents 5.4% of the criteria cited by employers who recruited for a "technical occupation", while it represents 3.3% of the criteria cited by all employers. The theme of 'skill' is mentioned in 45.6% of the hires for the "technical occupation" class and in 30% of all hires.
Sources and Coverage: DARES, 2016 OFER survey; scope of study.

The National Rural Development Programme in France: How Does It Contribute to the Attractiveness of Regions?

Marielle Berriet-Solliec*, Abdoul Diallo*, Cédric Gendre, Vincent Larmet*, Denis Lépicier* and Lionel Védrine***

Abstract – Since the 2000s, the Common Agricultural Policy (CAP) has become one of the key components of rural development policy, which takes the form of a national programme in France; however, few studies have been dedicated to assessing its impact on the attractiveness of rural areas. This article presents the results of an evaluation of the specific impacts, during the period from 2007 to 2013, of the European rural development measures and measures relating to quality of life and diversification of the rural economy applied in France on the economic and residential attractiveness of the municipalities benefiting from the measures. The impacts of the projects are estimated using a difference-in-differences method with propensity score matching. The evaluation reveals little impact on residential attractiveness. However, it also allows for the identification of positive impacts on face-to-face jobs linked to local services, with around 80,000 jobs having been created during this period at a cost of EUR 18,000 per job, which is lower than has been seen with comparable policies.

JEL Classification: J11, J68, H11, H42, R12, R53, R58
Keywords: second pillar of the CAP, rural development, impact assessment, difference-in-differences, propensity score matching

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Established by the European Union during the 2000s as an intervention instrument in the face of expansion (Dwyer *et al.*, 2007), the rural development policy is primarily covered by the Common Agricultural Policy (CAP), and more specifically by its second pillar, since the first is dedicated to market and income support. This second pillar offers a broad range of agricultural, agri-environmental and tourism measures, etc., as defined in the Rural Development Regulation (RDR). It focuses on offering incentive schemes to farmers and other stakeholders (companies, municipalities, natural parks, associations, etc.). Aimed at reconciling socio-structural issues of agriculture, regional development, environmental protection and preservation and integrated rural development, it has steadily increased in both political and budgetary importance, using a quarter of the CAP budget between 2007 and 2013 (Camaioni *et al.*, 2016).

The evaluation of this policy therefore constitutes an important issue, both in terms of democracy, to estimate how effectively public resources are being used, and to identify ways of improving the relevance, consistency and effectiveness of the measures implemented. However, there are very few studies measuring the impact of the RDR itself. One of the reasons for this deficiency is the intertwining of its objectives, which makes it difficult to explain theories of action. Characterised by the extent of its coverage, the ambiguities of its aims and the complexity of its intervention instruments, the policy of the second pillar of the CAP therefore appears to be difficult to understand and assess (Berriet-Solliec, 2013). The vast majority of studies therefore focus on targeted measures, such as investment aid for agricultural holdings (Michalek *et al.*, 2016) and agri-environmental measures (Chabé-Ferret & Subervie, 2013), or question the impacts of the first pillar of the CAP on non-agricultural jobs in the regions (Blomquist & Nordin, 2017). However, few studies explore the impacts of the measures that aim to improve living conditions and diversify economic activities (Lépicier & Védrine, 2016).

This contribution therefore aims to enrich the studies assessing the territorial policies that enhance local resources (place-based policies, see Irwin *et al.*, 2010). The most studied policies concern the Enterprise zones (exemption from tax on labour and land costs in return for setting up in a targeted area), such as the Empowerment Zone Program in the United States (Busso *et al.*, 2013), the *Zones Franches Urbaines* (ZFU – urban tax-free zones) (Malgouyres & Py, 2016) or, in France, *zones de revitalisation rurale* (ZRR – rural revitalisation zones) (Behaghel *et al.*, 2015). Enterprise zones aim to create a labour demand shock by waiving a part of the labour cost of new companies. However, the effectiveness of such schemes remains controversial. In the United States, for example, studies generally show poor effectiveness of state-implemented programmes (Neumark & Kolko, 2010), unlike the federal programme (Busso *et al.*, 2013). As regards the policies implemented in France, and more specifically those introduced in rural areas, Behaghel *et al.* (2015) highlight the lack of impact of the ZRR, particularly when compared with the estimated impacts of the ZFU (Givord *et al.*, 2013; 2018). The majority of these studies explain these limited and contrasting economic findings as the result, on the one hand, of the effects of activity moving from non-beneficiary areas to beneficiary areas (Mayer *et al.*, 2017; Einiö & Overman, 2020), and, on the other hand, of the significant heterogeneity of the findings with local characteristics (Briant *et al.*, 2015).

A second instrument developed by these territorial policies relies on investments in major infrastructure, such as the Apalachian Regional Commission (Stephens & Partridge, 2011) and the Tennessee Valley Authority (Kline & Moretti, 2014) in the United States, and even the cohesion policy in Europe (Bouayad-Agha *et al.*, 2013). Finally, discretionary private investment subsidy policies are also implemented, such as the 'L488' programme in Italy. The findings of the literature assessing programmes of this type suggest that they have a positive impact on employment (Cerqua & Pellegrini, 2014), including over the long term (Kline & Moretti, 2014), yet they do not bring about any significant displacement effects (Cerqua & Pellegrini, 2022).

By assessing the specific impacts of measures relating to quality of life and the diversification of the rural economy (Axes 3 and 4) of the *programme de développement rural hexagonal* 2007-2013 (PDRH, the French rural development programme) on the economic and residential attractiveness of beneficiary municipalities, this study differs from the above-mentioned literature in the nature of the processes activated. Indeed, whereas the programmes studied previously aim to create a labour demand shock, the PDRH supports the local development process by stimulating both residential attractiveness (financing local facilities and services, as well as cultural and natural amenities) and labour demand (subsidies for the creation of companies and for the diversification of non-agricultural activities). As local development models suggest

interdependence between these two processes (Henry *et al.*, 2001), it is highly probable that these two levers have a simultaneous influence over residential and economic dynamics through multiplier effects (Abildtrup *et al.*, 2018).

By basing this study on a detailed analysis of the objectives, the levers activated and the anticipated outcomes of this policy, we evaluate its impacts on variations in the total population and the migratory balance (residential attractiveness) and variations in total, face-to-face and productive jobs (economic attractiveness). Face-to-face jobs are understood to refer to the jobs generated by the face-to-face economy, which groups together tertiary activities that are largely dependent on income spent locally by local residents and therefore spent by the inhabitants who frequent those areas (Dissart *et al.*, 2011). The impacts of funded projects are estimated using the difference-in-differences method with propensity score matching, which makes it possible to isolate the specific effect of selection bias. The evaluation concludes that the measures of Axes 3 and 4 make a positive contribution to overall employment and more specifically to employment in the public and private services sectors. This contribution, which is estimated at around 80,000 jobs at a cost of EUR 18,000 per job, is less costly than other policies of the same type, such as the ZRR, for example. The impacts on attracting population are much less clear-cut and are mainly observed in the municipalities that have conducted tourism and rural development projects.

The article is set out as follows. Having put the measures of Axes 3 and 4 of the PDRH into context (section 1), this article describes the evaluation method and data used (section 2), before presenting the main findings (section 3). A final section concludes with some lessons to improve the conditions under which public policies are implemented and their effectiveness and suggests ways for extending this study.

1. The Rural Development Programme 2007-2013

The PDRH 2007-2013 is the main programme[1] in France that transcribes the second generation of the EU Rural Development Regulation (Regulation No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development, EAFRD). Three broad categories of objectives are highlighted (PDRH, volume 1, p. 37):

- Improving the competitiveness of the agriculture, forestry and agri-food sectors (Axis 1);

- Preserving a varied and high-quality rural agricultural and forestry area with a respectful balance between human activities and the preservation of natural resources (Axis 2);

- Maintaining and developing the economic attractiveness of rural areas by drawing upon the diversity of resources, activities and stakeholders (Axis 3), in particular through the use of the LEADER approach (*Liaison entre les Actions de Développement de l'Économie Rurale* – link between actions for the development of the rural economy – referred to as Axis 4).

1.1. The Funding of 4 Axes for Various Purposes

From a budgetary point of view, the PDRH measures are therefore co-funded by the EAFRD, the French government (credits from the Ministry of Agriculture), the regional councils and, on a more incidental basis, the water supply agencies and other entities with the aim of boosting the capacity to intervene in the objectives of the programme. With EUR 5.7 billion in EAFRD funding granted for the PDRH for the period 2007-2013, EUR 13.7 billion of public funds were injected into the regions to implement the entirety of the rural development strategy, i.e. a quarter of the European and national funding allocated to the CAP as a whole in France. The distribution of financial resources across the four Axes reflects the order of priorities (Figure I).

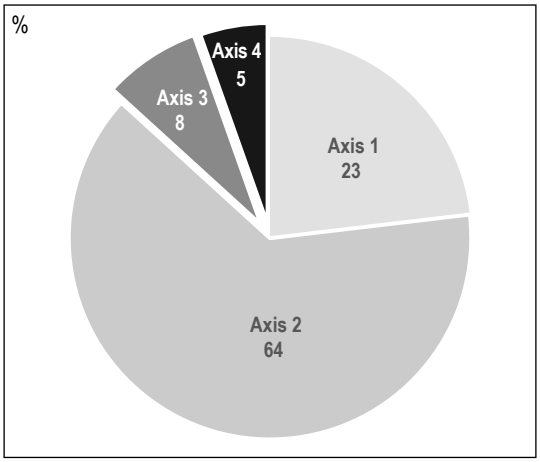
Close to two-thirds of the financial resources are assigned to Axis 2, which relates to the protection of the environment and countryside. Almost a quarter of the resources are earmarked for the competitiveness of agriculture and forestry, while Axes 3 and 4, which are more explicitly targeted at the rural development objectives covered by the evaluation presented in this article, receive almost 15% of the public funding under the PDRH, which equates to a little under EUR 1.7 billion during the period 2007-2013.[2]

Our evaluation, which focuses on the impacts of the PDRH on the economic and residential attractiveness of rural areas, therefore relates to Axes 3 and 4. The budgetary cost of the assessed measures (almost EUR 300 million per year) is therefore low when compared with sectoral policies such as the CAP (EUR 9.1 billion per year) or the *Contrat de plan État-Régions* (State-Region Planning Contract,

1. The five other French programmes focus on Corsica and each of the overseas departments (Guadeloupe, Martinique, La Réunion and French Guiana).

2. As certain measures are not taken into account, we are ultimately looking at an allocation of EUR 1.5 billion.

Figure I – **Budgetary distribution of EAFRD amounts paid (2007-2015) for the PDRH**



Sources: *Agence de services et de paiement* data made available by the *Observatoire du Développement Rural* (Observatory for Rural Development), hereinafter referred to as ASP-ODR; calculations by the authors.

CPER)[3] 2007-2013 (EUR 4.9 billion per year). However, its comparison with policies that are more specifically focused on attractiveness levers, such as the ZRR policy, estimated at EUR 400 million per year (Behaghel *et al.,* 2015) in 2009, or the territorial component of the CPER (EUR 480 million per year) indicates that this is a significant public policy for rural areas.

1.2. Three Main Levers Activated by Axes 3 and 4

In France, Axis 3 activates seven RDR measures[4] (Table 1).

Axis 4 (or LEADER) differs from the others in that it is not broken down into thematic measures, but instead aims to support the establishment of local development strategies broadly involving regional stakeholders and the implementation of an action plan that meets the expectations and needs of inhabitants and local stakeholders at the scale of organised regions ('*Pays*', regional natural parks).

LEADER is accompanied by governance that brings together private and public stakeholders in a local action group. Three levers are activated for its implementation. The first is territorial engineering (measure 431) through the financing of development facilitators for construction, followed by the implementation of the local strategy and action plan. The second lever is the financing of the action plan based on the measures associated with the other Axes (measures 411, 412, 413). Finally, the third is aimed at developing partnerships between LEADER regions (measure 421).

All of the rural development measures implemented in France between 2007 and 2013 have made use of variable funds (Figure II): more than half of the resources were dedicated to developing services for the population (321), the conservation and enhancement of heritage (323) and the creation of micro-enterprises (312).

Assessing the impacts of these measures presupposes an understanding of the objectives that the legislator has assigned to rural development policy, leading them to adopt the relevant measures proposed by the RDR and to adapt them to the local context. However, assessing the impact of the measures adopted also requires an understanding of the underlying mechanisms and how the intended effects are produced. Such an analysis implies two perspectives: on the one hand, the use of contributions from place-based policy theorists (Irwin *et al.*, 2000) and endogenous rural development theorists (Van der Ploeg *et al.*, 2000) to qualify the action levers of Axes 3 and 4; on the other hand, a detailed understanding of the empirical translations of these measures, starting with their specific achievements and then identifying the impacts that they produce, or that they are at least expected to produce, for the direct beneficiaries, with a view to gaining an understanding of the more global impacts on the attractiveness of the beneficiary regions.

It was therefore possible to identify three main levers. The first relates to the territorial economy and is based on the promotion and activation of local resources based on proximity

3. The CPER is the main financial tool coordinated between the State and the regions for the development of structural projects for regional development, equipment and cohesion. It covers the fields of transport, higher education and research, employment and vocational training and agriculture and the environment.

4. Some measures provided for in the RDR were not included in the PDRH, such as measure 322 concerning the renovation and development of villages, which was used heavily in the previous programme.

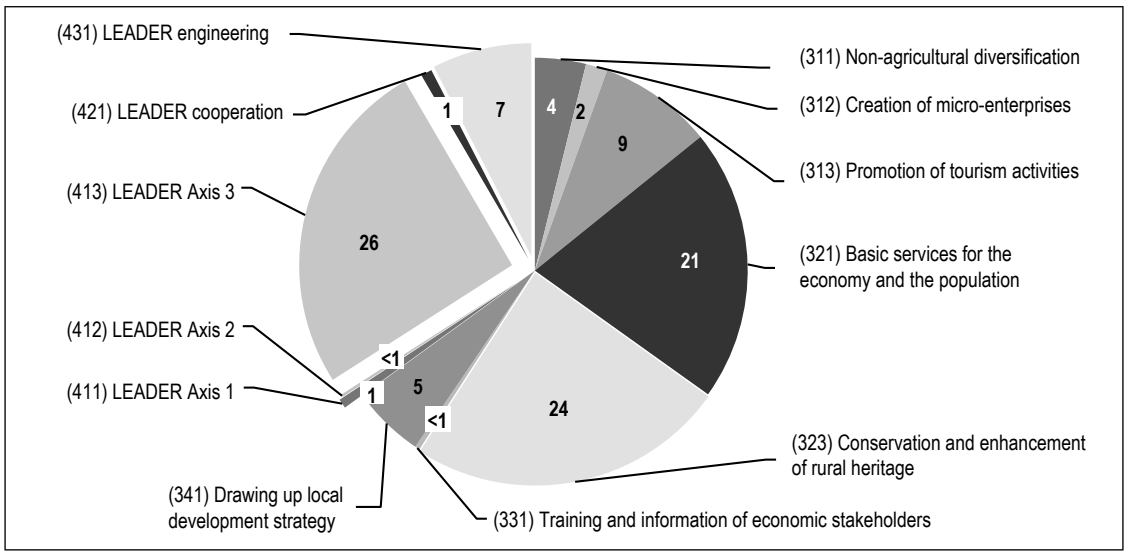
Table 1 – **Measures of Axis 3 of PDRH 2007-2013**

Code for the measure	Wording of the measure	Beneficiaries	Details of the implementation of the measure (sources: Ex post assessment of PDRH 2007-2013)
311	Diversification towards non-agricultural activities (excluding agricultural production and processing, which is included under Axis 1)	Members of agricultural households	2,350 beneficiaries (including around 450 via LEADER measure 413), spread throughout the territory, largely involves: *i*) creation or development of marketing activity (40% of beneficiaries), *ii*) hospitality (17%), *iii*) equestrian centre (9%), agrotourism and leisure (8%)
312	Support for the creation and development of micro-enterprises	Private project leaders ≤ 10 jobs, turnover or annual balance sheet < EUR 2 million	2,067 beneficiaries, including around 700 via LEADER (measure 413). Is more involved in business development than creation in terms of: *i*) the acquisition of new equipment (42% of beneficiaries), *ii*) modernisation (25%), *iii*) studies, consulting, diagnostics (11%)
313	Promotion of tourism activities	Territorial municipalities and their groupings, associations, project regions or providers of tourist facilities (accommodation)	3,924 beneficiaries, including around 2,160 via LEADER (measure 413). This measure mainly supports: *i*) hospitality (small rural hotels, cottages) (36% of beneficiaries), *ii*) communication/promotion (14%), *iii*) leisure and nature facilities (12%), the creation of tourist routes (8%)
321	Basic services for the economy and rural populations	Public or private project leaders (involved in a public-interest project)	4,335 beneficiaries, including around 3,000 via LEADER (measure 413). The main achievements are: *i*) facilities for young people (17% of beneficiaries), *ii)* sporting and cultural facilities (12%), *iii*) convenience stores (5%), *iv*) medical and health centres (4%), *v*) others (broadband, energy, mobility, welcoming new residents)
323	Conservation and enhancement of rural heritage (natural and cultural)	Local authorities and their groupings, trade unions, public institutions, '*Pays*' and Regional natural parks, associations, etc.	Around 9,000 beneficiaries working on: *i*) developing and running Natura 2000 projects, management contracts for non-agricultural and non-forest Natura 2000 sites, *ii*) supporting pastoral activities, *iii*) the enhancement of natural and cultural heritage (most often conducted within the scope of LEADER projects, measure 413)
331	Training and providing information to economic stakeholders	Local authorities and their groupings, organised regions ('*Pays*', parks, etc.), public institutions, associations, training funds, training organisations.	411 beneficiaries of actions aimed at developing skills in support of innovative approaches, largely carried out within the scope of LEADER (measure 413)
341	Acquisition of skills and facilitation for the development and implementation of local development strategies, including for forestry	Local authorities and their groupings, organised regions ('*Pays*', parks, etc.), public institutions, associations, forestry unions	Two types of action financed: *i*) establishment of forestry charters and a plan for the development of massifs (537 beneficiaries), *ii*) financing of public engineering and diagnostics, land studies (812 beneficiaries, half of which via LEADER, measure 413)

Sources: ODR based on the EAFRD Regulation No 1698/2005.

logic (Colletis & Pecqueur, 1993). It is based on the promotion of quality local products or the enhancement, in particular through tourism, of expertise and cultural and natural heritage. Its impacts in terms of economic attractiveness can be estimated on the basis of outcome variables relating to jobs. The second concerns the face-to-face economy and relates to the support for infrastructure and public and commercial facilities/services meeting the expectations of the resident population. Such a lever aims at both retaining the rural population and improving residential attractiveness, starting with the observation of a 'counter-urbanism' movement, which entails new needs of populations coming from urban environments (Murdoch & Marsden, 1995; Dissart *et al.*, 2011). These impacts can be estimated using demographic outcome variables. Finally, the third lever, which is more transversal in nature and acts as a catalyst for the effectiveness of the first two levers, involves the organisation and cooperation of stakeholders

Figure II – **Budgetary distribution (in %) of the amounts paid for the PDRH for each measure of Axes 3 and 4 during the period 2007-2013**



Sources: ASP-ODR; calculations by the authors.

(Shucksmith, 2000). The anticipated impacts of the LEADER projects are heavily reliant on this type of lever, which relies on supporting initiatives by local stakeholders that incorporate the specifics of expectations and territorial particularities, as well as on strengthening cohesion between stakeholders within the regions.

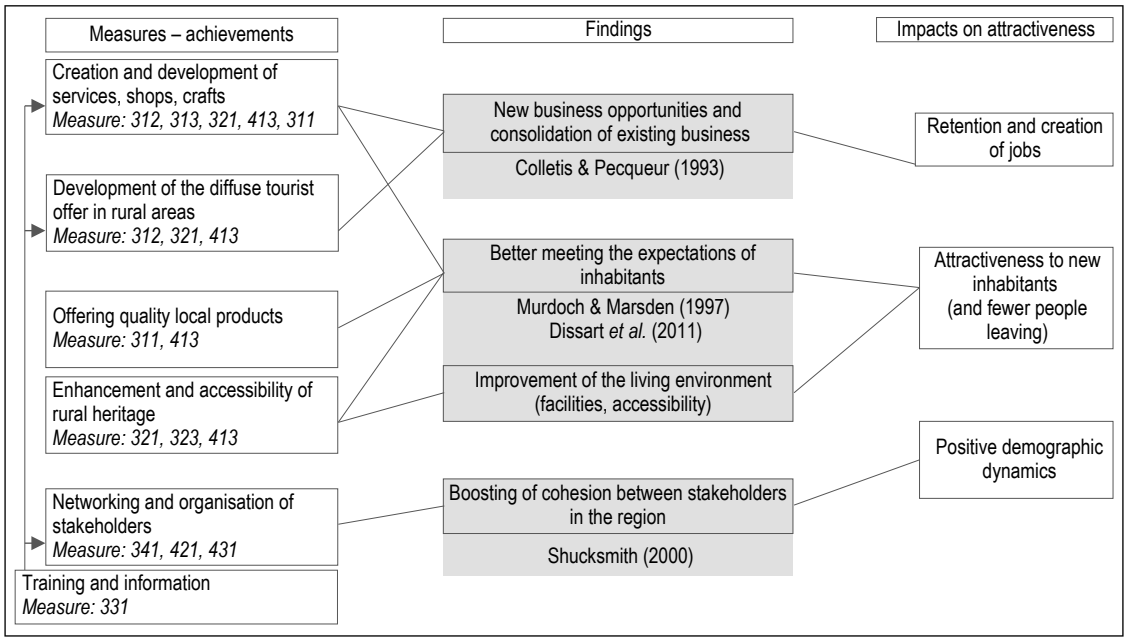
Figure III provides a schematic representation of these levers and a synthetic representation of the causal links between achievements financed by the measures of Axes 3 and 4 of the PDRH and their impacts on the attractiveness of the beneficiary regions. It adds a comprehensive dimension to the analysis of the findings by exploring the different ways in which the measures contribute to the measured impacts.

2. Data and Method

2.1. Data

The study uses municipal data. The data characterising the policy (amounts, public expenditure, involvement in the various measures) are primarily provided by the *Observatoire du développement rural* (ODR, Observatory for rural development) on the basis of the data made available by the body, the *Agence de services et de paiement* (ASP) responsible for paying CAP

Figure III – **Logic diagram of the impact of the measures of Axes 3 and 4 of the PDRH**



aid. The data used to construct the outcome variables are taken from INSEE (population census 2007 and 2015). Finally, the initial characteristics of the municipalities are, for the most part, provided by INSEE (Census 2006, *Base Permanente des Équipements*), but also from the Corine Land Cover database and from the Directorate-General for Public Finance.

Three types of variable are used: outcome variables, variables concerning participation in the measures of Axes 3 and 4 and control variables. Resulting from a preliminary analysis of the levers of Axes 3 and 4 (cf. Figure III), the outcome variables cover two main dimensions of the PDRH objectives. First, the impact on residential attractiveness is captured by the change in total population between 2007 and 2015 and the migration rate between 2010 and 2015. Next, we use the variation, between 2007 and 2015, in the logarithm of the number of jobs (total; productive, including agriculture and industry; population-based, including shops and services, administration, education and health) with a view to describing the impact of the programme on economic attractiveness.

In order to describe the characteristics of the municipalities before the launch of the programme with a view to controlling the bias that they may induce when estimating the impacts of the measures being assessed, 43 control variables were introduced (see Table A-1 in the Appendix). These variables, covering the period from 1990 to 2006, incorporate all of the municipal characteristics highlighted in the literature as being likely to influence attractiveness (Carlino & Mills, 1987; Abildtrup *et al.*, 2018; Bijker & Haartsenn, 2012; Schirmer *et al.*, 2014). They can be grouped into six categories:

- Accessibility (time to access, by road, the urban centre, the motorway junction, the nearest facilities);

- Land use (proportion of built-up, agricultural and forested areas);

- Demography (population variation and past migration balance, population distribution by socio-professional category, population density);

- Economy (sectoral structure of jobs, unemployment rate, distribution of the population by degree level);

- Average local taxable income per household;

- Local governance (regional national park, '*Pays*'; variable identifying whether the mayor is also a senator or deputy).

2.2. Estimation Method

In order to determine the extent to which the schemes under evaluation have improved the attractiveness of the municipalities benefiting from them, we want to compare the economic activity of the municipalities in question after the implementation of the measure (observed outcome) with the situation that they would have been in had these schemes not been implemented (i.e. the counterfactual, and by definition unobservable, situation). It is therefore a question of assessing the impact of a policy against a situation in which it does not exist[5] (Rubin, 2005).

This analysis can be complex, because it must be determined whether any improvements are actually attributable to the implementation of this measure. Indeed, individuals benefiting from the measure are generally not chosen randomly from the population. Most often, this assignment targets individuals according to their characteristics: the simple observation of growth rates of outcome variables that differ from the rest of the municipalities therefore does not allow us to draw any conclusions with regard to the impact of this programme.

In order to measure the contribution of Axes 3 and 4 of the PDRH, we use the difference-in-differences method with propensity score matching. The impacts of participation in Axes 3 and 4 are estimated at the municipal level (excluding all of the urban municipalities, according to the typology of French rural areas, Hilal *et al.*, 2011). The group of beneficiaries of measure *i* consists of municipalities in which a project associated with this measure is located (see a mapping in the Online Appendix – link at the end of the article). The control group is made up of the municipalities that are not covered by any projects of Axes 3 and 4, regardless of the measure being assessed.

This method consists of pairing each beneficiary municipality with one or more municipalities with similar observable characteristics that have not benefited from the measure in question. It is therefore a case of establishing something akin to a controlled experiment by ensuring that the control group is as similar as possible to the beneficiary group in terms of the distribution of variables that affect the probability of benefiting from the policy. The identification of the impact of the policy on the beneficiary municipalities is based on the assumption that

5. The outcomes with and without the policy being defined as the potential outcomes for an individual.

beneficiary municipalities are selected independently of the potential outcomes, subject to control variables (conditional independence assumption). Our construction of a counterfactual for each beneficiary municipality is based on the propensity score (Rosenbaum & Rubin, 1983). This is a two-step method in which the probability of benefiting from the policy is first estimated for the sample as a whole, before the municipalities are matched on the basis of this probability (propensity score). Matching is therefore reduced to the most relevant dimension to address selection bias, i.e. the dimension relating to participation in the measure that we are assessing. If the assumption of conditional independence is verified for the control variables, the potential outcomes are also independent of participation in the policy, subject to the propensity score (Rosenbaum & Rubin, 1983). In order to be credible, the estimated propensity score must capture observable differences in characteristics between beneficiary and non-beneficiary municipalities (balancing properties of the propensity score). In addition, matching will be considered to be of good quality if the majority of beneficiary municipalities share similar characteristics to those municipalities in the control group (common support assumption). In order to restrict our sample to common support, we use the min/max method, which involves excluding from the analysis beneficiary municipalities for which the propensity score is greater than the maximum score observed among non-beneficiary municipalities (Dehejia & Whaba, 1999).

We present these results estimated by kernel matching (Smith & Todd, 2005). This algorithm is a non-parametric estimator that uses a weighted average of all non-beneficiary municipalities. The main advantage of this matching technique is improved accuracy in estimating the average impact on the beneficiary municipalities (Caliendo & Kopeinig, 2008).

In order to characterise a finite number of potential outcomes, we assume the absence of any external impacts of the scheme (Stable Unit Value Assumption, SUTVA). The participation of municipality *c* only has an impact on its own dynamics and not on those of any other municipalities (regardless of whether they are benefiting from the policy or not). The literature on the effectiveness of Enterprise zones regularly highlights the spillover effects of schemes of this type (Mayer *et al.*, 2017; Hanson & Rohlin, 2013). Conversely, studies assessing investment subsidy policies do not appear to demonstrate this type of externality (Cerqua & Pellegrini, 2022; Turpin *et al.*, 2017). Although the policy that we are studying is closer to the latter, we nevertheless perform a robustness analysis to identify these impacts on the municipalities neighbouring the beneficiary municipalities (see below). This test consists of comparing a treatment group made up of all of the municipalities adjacent to the beneficiary municipalities with a control group made up of all of the other municipalities that have not benefited from the programme by means of a difference-in-differences method with matching.

2.3. Quality of Propensity Score Matching

The ability of a propensity score to balance out the distribution of the various characteristics used in its estimate is assessed by calculating a standardised bias (Stuart, 2010), which corresponds to the mean difference between the two groups under consideration, expressed as the square root of the total variance for the two groups (Rosenbaum & Rubin, 1983). Figure IV shows the distribution of standardised biases before and after matching for the estimates of the conditional probability of participating in an Axis 3 and Axis 4 measure. For both estimates, it can be observed that the distribution of standardised biases after matching is much more grouped around zero values than was estimated prior to matching. This finding confirms that our matching allows beneficiary and non-beneficiary municipalities, for which the observable differences in characteristics are most often negligible, to be compared. In almost all cases, the normalised differences after matching fall below the empirical rule of 0.25 standard error (Imbens & Wooldridge, 2009). The matching process implemented during this evaluation allows for a high degree of balancing of observable characteristics between matched beneficiary and non-beneficiary groups.

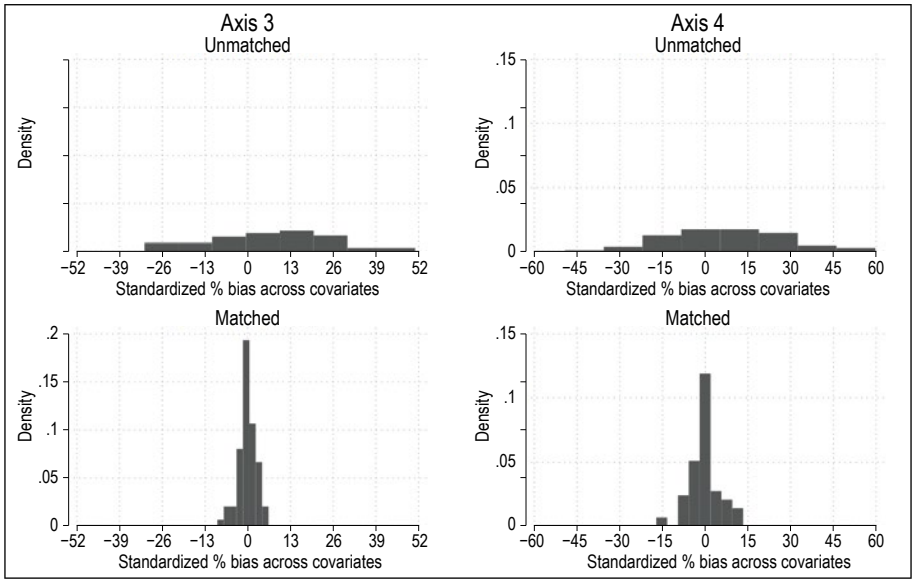
Moreover, the common support area is satisfactory for all of the schemes under evaluation. Figure V, which shows the distributions for each of the groups before and after matching, confirms that it allows the propensity score distribution of the beneficiary municipalities to be approximated with those of the matched non-beneficiary municipalities.

3. Results

3.1. Economic Attractiveness

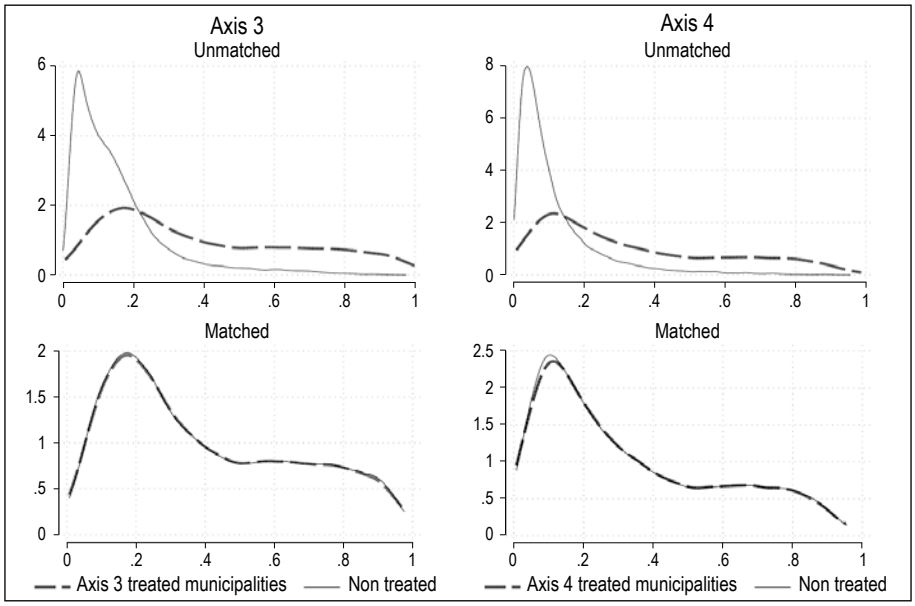
Although the measures of Axes 3 and 4 do not reflect the explicit objective of job creation (cf. Figure III), the territorial economic enhancement lever, which underlies certain

Figure IV – **Distribution of standardised biases (as a %) in the matching variables for the measures of Axes 3 and 4, before and after propensity score matching.**



Sources: ASP-ODR, INSEE; calculations by the authors.

Figure V – **Analysis of the common support for measures of Axes 3 and 4.**



Sources: ASP-ODR, INSEE; calculations by the authors.

measures, aims to contribute to creating jobs. This is particularly true of the measure offering support to micro-enterprises. The contribution to employment is more broadly sought via the consolidation of jobs through the modernisation, development and diversification (measure 311) of existing activities (tourism – measure 313, or basic services – measure 321), which will improve the competitiveness of activities in rural areas. Finally, by networking the stakeholders around a shared territory strategy, LEADER aims to develop new local partnerships that will open up new opportunities for activities with the potential to create jobs. Table 2 shows the results of estimates of the impacts specific to the measures of Axes 3 and 4 that aim to improve quality of life in rural areas and non-agricultural diversification (measure 413).

The first finding of note is a positive impact on total employment (Table 2, col. (1)). This result is significant and not inconsiderable (2.7 percentage points – p.p. below) given the relative weakness of the resources allocated to these measures and the number of beneficiaries (around 21,000). The combination of direct support for the development and creation of VSEs, the modernisation of their production tool, the development of skills and the organisation of

stakeholders, allows positive action to be taken on employment in rural areas.

Estimates of the specific impacts on employment for each measure show that all of the estimated measures, with the exception of those that concern conservation and enhancement of rural heritage (323), have a positive impact on the total creation of jobs, with an especially marked impact being seen for the measure aimed at promoting tourism activities (+4.3 p.p. for total employment within the municipalities that benefited from this measure).

When looking at employment sectors, with the exception of non-agricultural diversification measures for agricultural holdings (measure 311) and the provision of support to micro-enterprises (measure 312), the Axis 3 measures primarily concern the services sector, and more specifically the personal services sector. Estimates show that the face-to-face economy sector sees the most positive impact (+5 p.p.) from the measures implemented under both Axis 3 and Axis 4. It follows that it is the projects supported by the measures focusing on the development of tourism (313) and the development of basic services (321) that contribute to these positive impacts, regardless of whether or not these projects are implemented within the scope of the LEADER project. These findings serve to support the relevance of developing services in rural areas, not just for the populations living in the area, but also for new inhabitants (Murdoch & Marsden, 1995).

A more detailed analysis of the estimates shows that, in the job categories making up the population-based economy, it is the trade and market services sectors for which the outcomes are the most significant for all measures of Axis 3; however, the origins of those outcomes cannot be linked to a specific measure in any significant way. The specific impact on jobs in the administration, teaching and health sectors is also positively associated, quite logically, with the measure of Axis 3 that relates to basic services; this can be attributed to actions such as the establishment of medical and health centres. The projects funded by LEADER also have a positive impact on these jobs. Since the projects for youth, cultural and sporting facilities, of which there are significantly more, do not fall within these sectors, it can be assumed that the impact of LEADER on public and para-public jobs can be linked at least in part to the project manager jobs created in each of the LEADER regions (1.5 FTE per region).

The estimated impacts on productive employment do not reflect either the significant impacts of the Axis 3 measures when looked at as a whole or those of LEADER. Measures 311 and 312, which focus on the productive sectors, therefore do not appear to contribute to improving the employment situation when looked at in isolation. With a little under 4,500 beneficiaries, it can be assumed that the scale of the implementation of these measures is not sufficient to generate observable positive impacts. Another explanation lies in the fact that the nature of the projects supported by these measures corresponds more to trade and service activities, particularly when it comes to the measure aiming to diversify non-agricultural activities (311).

Table 2 – **Mean impact on the economic attractiveness of the municipalities benefiting from the measures of Axes 3 and 4**

Logarithm difference in the number of jobs between 2007 and 2015	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Measures of Axis 3						Axis 4 LEADER
	Total	Diversification of non-agricultural activities (311)	Creation/ development of micro-enterprises (312)	Promotion of tourism activities (313)	Basic services for the economy and the population (321)	Conservation and enhancement of rural heritage (323)	Axis 3 measures implemented via LEADER (413)
Total employment	0.027*** (0.010)	0.030*** (0.013)	0.029*** (0.011)	0.043*** (0.018)	0.036*** (0.012)	−0.005 (0.025)	0.034*** (0.009)
Population-based employment	0.052*** (0.021)	0.0430* (0.022)	0.042 (0.024)	0.062*** (0.021)	0.062*** (0.013)	0.020 (0.042)	0.075*** (0.015)
Productive employment	0.022 (0.023)	0.050* (0.026)	0.012 (0.060)	0.041 (0.056)	0.057* (0.029)	0.005 (0.062)	0.002 (0.029)
Agricultural employment	0.060 (0.049)	0.116*** (0.043)	0.133*** (0.059)	0.088 (0.097)	0.073 (0.060)	−0.015 (0.073)	0.024 (0.055)
Administration, teaching, health care jobs	0.062*** (0.024)	0.113*** (0.043)	0.001 (0.059)	0.038 (0.061)	0.085*** (0.027)	0.060 (0.047)	0.093*** (0.025)
Jobs in sales and services	0.064*** (0.022)	0.059 (0.042)	0.026 (0.056)	0.083* (0.048)	0.021 (0.023)	0.030 (0.040)	0.044* (0.023)
Industrial jobs	0.052 (0.036)	0.032 (0.068)	0.037 (0.083)	0.079 (0.068)	0.089 (0.070)	0.061 (0.059)	0.035 (0.036)
Number of beneficiary municipalities	4,181	904	502	771	621	1,945	2,099

Sources: authors' processing of ASP-ODR data

Estimates of the impacts on the specific sectors of agriculture and industry do not reveal any significant findings across all of the measures of Axes 3 and 4, which is unsurprising given the non-sectoral orientation of the financial support provided under these Axes. Nevertheless, one notable exception is observed: agricultural employment appears to be positively impacted by the projects implemented in the case of measures concerning the non-agricultural diversification of agricultural holdings (measure 311) and micro-enterprises (measure 312). This finding appears to confirm the relevance of the activity diversification strategy in terms of boosting agricultural employment and/or generating new jobs linked to associated activities, such as agrotourism or equestrian or hospitality activities. This finding is consistent with the estimates of the value added generated and the jobs created within the scope of the PDRH monitoring indicators.[6]

These findings show that the LEADER approach appears to generate a positive impact on employment, an assumption that has been put forward in qualitative work since the 2000s (Shucksmith, 2000). This impact is at odds with the reservations expressed, most notably by the European Court of Auditors, with regard to the effectiveness of the programme and the administrative cost of its management. Furthermore, this finding runs counter to the frequent recommendations to concentrate resources on larger-scale projects, with LEADER projects being an average of up to 3 to 5 times smaller in terms of the amount of aid provided under measure 321, for example (Allaire *et al.*, 2018). It appears that the smaller size of the projects is offset by the coordination of stakeholders and the territorial coherence of several projects promoting the development of resources and synergies between activities.

By applying the total employment growth rate attributable to the programme (mean impact on beneficiaries) to the number of jobs in 2007 in the municipalities that benefited from Axes 3 (1,701,355 jobs) and 4 (989,911 jobs), we arrive at a measure of the number of jobs created (or retained). We therefore estimate that the measures of Axes 3 and 4 allowed for the creation (or retention) of 46,000 and 33,000 jobs respectively during the period being studied (2007-2015). This estimate is relatively inaccurate, as can be seen from the standard errors of the estimates: for Axis 3 (and Axis 4, respectively), a variation +/− the standard error provides a range of between 29,000 (or 25,000) and 63,000 (or 42,000) jobs. In total, all of the measures of Axes 3 and 4 allowed for the creation (retention) of more jobs (79,000) than the ZFU, for which the number of jobs created is estimated to be between 35,000 and 53,000 (Givord *et al.*, 2018). This is also well above the outcomes attributable to the ZRR, which created no more than 6,000 jobs (authors' calculations based on the findings of Behaghel *et al.*, 2015).

However, it is difficult to compare schemes for which the budgetary amounts and territorial scopes are different solely on the basis of their outcomes with regard to the number of jobs created. In order to perform a more detailed comparison of the contribution of the measures of Axes 3 and 4 with those of other schemes, we will calculate a cost per job created. However, this cost should be taken with a pinch of salt due to the difficulty of tracing all of the public expenditure associated with the programme (e.g. the national financial monitoring system does not allow for tracing of 'top-up' financing). The total amounts spent within the municipalities included in our sample are EUR 890 million for Axis 3 and EUR 595 million for Axis 4, respectively (ASP-ODR data). According to our estimates, each job created by Axis 3 costs EUR 19,800, and each job created by Axis 4 costs EUR 18,000. Table A-5 in the Appendix details the estimated cost per job created for various schemes, regardless of whether or not they are geographically targeted. We observe that the estimated cost per job created for the measures of Axes 3 and 4 is generally lower than that of French policies based on tax exemptions: an example of this is the ZRR, for which the cost per job created is around EUR 70,000. It also appears to be lower than the cost per job created estimated by the majority of studies assessing the ZFU (~ EUR 30,000) or even the national reductions in social security contributions (~ EUR 35,000). In the specific case of the ZFU, the most recent studies suggest a relatively comparable cost (EUR 19,000 according to Charnoz, 2018; between EUR 18,000 and 26,000 according to Givord *et al.*, 2018). An international comparison confirms the low cost per job created, since the estimated value for the L488 in Italy (private investment aid) is around EUR 25,000 (~ EUR 45,000 according to Cerqua & Pellegrini, 2014) and this value is estimated at EUR 22,000 for the New Markets Tax Credits in the United States (Freedman, 2015).

6. The outcome indicator (R7) concerning the increase in gross value added within the companies receiving support provides an estimate of the increase in value added of EUR 18.3 million and EUR 13.4 million respectively for measures 311 and 312. The outcome indicator (R8) concerning the gross number of jobs created is estimated at 408 and 268 jobs created respectively for those same two measures (Allaire et al.*, 2018).*

3.2. Residential Attractiveness

Residential attractiveness is more complex to grasp since, unlike jobs, the PDRH measures do not directly affect the reception of new inhabitants. Residential attractiveness results from inbound and outbound mobility behaviours of inhabitants, which are dependent on a number of factors. Figure III highlights three types of contribution of the Axis 3 and 4 measures that may influence the migratory balance of the population and population change in general (which results from a combination of migratory and natural balances). The first is improved satisfaction among the inhabitants such that it reduces their desire to leave the region for a destination that better meets their expectations. The vast majority of the measures of Axis 3 and 4 (and in particular measure 321) contribute to this by broadening the range of services that inhabitants are able to access and improving the response to their expectations in terms of the quality and proximity of food, recreational, cultural and health facilities. The second concerns the living environment, which is a determining factor in attracting new inhabitants. Finally, several PDRH measures complement the thematic interventions by others promoting interknowledge, collective mobilisation and cooperation between local stakeholders. This third type of contribution aims to reinforce the internal social cohesion of the region and the ability to work together to improve the quality of life and well-being of the inhabitants. All of these factors can combine to create a positive contribution to demographic dynamics.

Table 3 shows the findings of the evaluation of the mean impacts of the measures of Axis 3 and 4 of the PDRH on the residential attractiveness of the beneficiary municipalities.

The first result is that all of the mechanisms underlying residential attractiveness that we have just mentioned appear to have little effect within the scope of the implementation of the measures being studied. Neither of the two attractiveness indicators selected is significantly impacted by the Axis 3 measures when looked at as a whole and only one of the two is impacted by the interventions carried out as part of a LEADER project (measure 413). The more detailed analysis of the findings per measure allows for the observation of certain impacts, but on a smaller scale overall than those observed for employment indicators (still below 2.8 p.p. for the very high estimates for the former compared with as much as 7.5 p.p. for one of the employment indicators).

A second finding is that the migration rate, which could be expected to be the first to demonstrate a positive impact as a result of the measures, was only positively impacted as a result of the promotion of tourism activities, while the more general indicator of the overall change in population responds positively to three measures: promotion of tourism activities (313), basic services (321) and LEADER actions (413). There could be a technical explanation for this, linked to the low average variation in this migration rate and the large standard errors observed at the municipal level, which reduces the accuracy of the estimate.

In addition, estimates of the mean impacts of rural development measures under the PDRH return some interesting findings. Firstly, with regard to the two most significant measures in terms of the financial resources committed, it is the measure focusing on the promotion of tourism activities (measure 313) that generates the most convincing impacts on residential attractiveness, demonstrating a positive impact

Table 3 – **Mean impact on the residential attractiveness of the municipalities benefiting from the measures of Axes 3 and 4**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Measures of Axis 3						Axis 4 LEADER
	Total	Diversification of non-agricultural activities (311)	Creation/ development of micro-enterprises (312)	Promotion of tourism activities (313)	Basic services for the economy and the population (321)	Conservation and enhancement of rural heritage (323)	Axis 3 measures implemented via LEADER (413)
Log difference in the total population 2007-2015	0.00516 (0.00347)	0.011** (0.006)	0.021** (0.010)	0.028*** (0.005)	0.016*** (0.006)	−0.002 (0.004)	0.009*** (0.003)
Migration rate between 2010 and 2015	0.000287 (0.00173)	0.005* (0.003)	0.008 (0.005)	0.019*** (0.003)	0.001 (0.002)	0.001 (0.003)	−0.003 (0.002)
Number of beneficiary municipalities	4,181	904	502	771	621	1,945	2,099

Sources: Authors' processing of ASP-ODR data.

on the migratory balance, averaging +1.9 p.p., and on overall population change, averaging +2.8 p.p.. It can be assumed here that the residential impact is a consequence of the job consolidation and/or creation identified in the previous section.

Secondly, and more modestly, the improvements made to basic services (measure 321) have a significant impact on population change (+1.6 p.p. on average); however, the impacts on attractiveness to new inhabitants or the reduction of outgoing migration cannot be established. This finding is consistent with the analyses of the *ex-post* evaluation of the PDRH, which estimate that around 1 million inhabitants are benefiting from improvements to the quality and accessibility of services thanks to projects financed by this measure (Allaire *et al.*, 2018).

Thirdly, the implementation of the actions of Axis 3 within the scope of LEADER, in spite of their small scale, has a positive influence on population change, even if that impact is of a small magnitude (+0.9 p.p. on average).

Fourthly, estimates conclude that actions aimed at developing rural heritage (measure 323) have no impact on residential attractiveness. They therefore do not appear to have any confirmed impact on living environment, or at least not to a sufficient extent to attract new inhabitants.

Finally, estimates show that the impacts of measures that are focused more on the productive sectors (measures 311 and 312) did not have any proven impact on population attractivity.

3.3. Analysis of Robustness and the Spatial Heterogeneity of Impacts

In order to analyse the robustness of our main findings, we will first check whether Axes 3 and 4 bring about any displacement effects. Secondly, we will test the sensitivity of our findings to the presence of pre-processing outcome variables in all of our matching variables. Finally, we propose to explore the heterogeneity of the impacts of the programme among beneficiary municipalities located in mountain areas (Act no. 85-30 of 9 January 1985) when compared with other beneficiary municipalities.

As was highlighted by Hanson & Rohlin (2013) and Behaghel *et al.* (2015), geographically targeted policies can generate effects in which activity shifts to the beneficiary areas from the surrounding areas.[7] As before, we estimate the presence of a diversion effect for all of the measures of Axes 3 and 4 using a difference-in-differences method with propensity score matching. Our estimates do not show any significant impacts of the scheme on the municipalities surrounding the beneficiary municipalities (see Table A-2 in the Appendix). Similarly to the cohesion policy (Giua, 2017; Turpin *et al.*, 2017) or L488 in Italy (Cerqua & Pellegrini, 2022), the measures of Axes 3 and 4 do not appear to generate any attractiveness-related displacement effects in the areas surrounding the beneficiary municipalities. These converging findings suggest that regionalised public and/or private investment aid policies do not generate any displacement effect, unlike tax exemption policies.

Although beneficiary and matched municipalities are commonly adjusted by pretreatment population dynamics within the scope of a propensity score approach, this practice may lead to bias (Chabé-Ferret, 2015). Table A-3 in the Appendix shows the estimated impact of the measures of Axes 3 and 4 on residential attractiveness without any adjustment by these pretreatment dynamics. The findings are very similar to those of our main estimates (cf. Table 3).

Finally, we estimate the impacts of Axes 3 and 4 separately for beneficiary municipalities in mountain areas and beneficiary municipalities in non-mountain areas (see Appendix, Table A-4). We observe that the measures of Axis 3 have a more marked impact on employment in non-mountain areas (e.g. 4.5 p.p. for overall employment) than in mountain areas (2.5 p.p. for overall employment). Conversely, the measures of Axis 4 appear to have a greater impact on employment in municipalities in mountain areas (5.9 p.p.) than in municipalities in non-mountain areas (3.6 p.p.). This finding can be interpreted by the relative scale of the LEADER projects offered by the mountain communities and promoting innovation and local solidarity for the retention of jobs in these disadvantaged areas (Dax & Oedl-Wieser, 2016).

As was the case with our main findings (cf. Table 2), the impact on employment is largely concentrated on face-to-face employment. Finally, we observe that the measures of Axes 3 and 4 have a significant influence, albeit on a small scale, on changes in the population of municipalities, but only in non-mountain areas (see Table A-4 in the Appendix).

7. We have defined the surrounding areas on the basis of geographical adjacency.

* *
*

Based on a Difference-in-Differences propensity score approach, this article highlights the positive impacts of the measures aimed at improving living conditions and diversifying the rural economy on employment as a whole and, more specifically, on employment in the face-to-face economy (shops, public health services, education, administration). The expected impacts of the measures aimed at improving living conditions (access to employment and quality local products and services), the living environment (natural and cultural heritage) and social and territorial cohesion on residential attractiveness are not as marked, but are significant for tourism-oriented municipalities.

These findings are important in several respects. First of all, these are the first impact studies applied to Axes 3 and 4 of the rural development policy in France. They back up the conclusions of the institutional evaluations that are based mainly on contributory methods derived from qualitative analyses. Secondly, they provide tools for assessing the impacts of a development policy with a low budget (EUR 1.7 billion over six years, which equates to less than 3% of the total support provided by the common agricultural policy and represents public support amounting to around EUR 25 per inhabitant), the effectiveness of which is often questioned.

Moreover, these findings tend to confirm the relevance of public support for the diversification of the local economy and the improvement of living conditions in rural areas. They demonstrate that rural areas have sufficient natural, material and organisational resources to generate their own development capacities. The LEADER programme, which is so often criticised for the high administrative cost of managing the weak means of intervention assigned to it, appears to make a positive contribution to employment and population dynamics. Although this study did not aim to demonstrate the value added of the bottom-up approach of LEADER when compared to the top-down approach of the implementation of measures of Axis 3, it does confirm certain impacts produced by this scheme.

These findings must also give rise to questions concerning financial trade-offs between the various public policy instruments that affect rural areas. While the impacts of the first pillar of the CAP on jobs and the environment are regularly scrutinised, the resources allocated to rural development measures remain poor. The resources allocated to the second pillar of the CAP for 2014-2020 have certainly increased slightly, but largely to the benefit of farms in mountain areas. The prospects for the future CAP 2023-2027 do not indicate any major changes and the rural development measures under the future second pillar could be adversely affected by the increased priority afforded to agricultural insurance measures.

The evaluation of the PDRH has highlighted the significant regional adaptation of the implementation arrangements. In the run up to the next programming period, the regional councils – which are now responsible for managing a large proportion of rural development measures – have an important role to play in encouraging eligible populations to set up projects, as well as boosting complementarity with other regional policies.

Subsequently, against a backdrop of the implementation of the 'Green Deal', the contribution of rural development measures to the global challenges of climate change and the preservation of biodiversity must continue. In spite of the above, it is important to deepen the analysis and evaluation of the impacts of rural development measures on key components, namely climate change mitigation and the preservation and even the restoration of biodiversity from a perspective of economic and social sustainability. □

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6530617/ES534-35_Berriet-Solliec_Online-Appendix.pdf

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APPENDIX

Table A-1 – **Presentation of matching variables**

Matching variables	Years	Sources
Population migration balance	1990-1999 1999-2006	INSEE RP-2006
Rate of change in population	1990-1999 2000-2006	INSEE RP-2006
Mean altitude		BD TOPO
Time to access mid-range facilities (and its square)	2006	Odomatrix, CESAER based on the *Base permanente des équipements* (permanent database of facilities)
Time to access local-range facilities (and its square)	2006	Odomatrix, CESAER based on the *Base permanente des équipements*
Time to access the nearest urban area with more than 100,000 inhabitants	2006	Odomatrix, CESAER
Time to access the nearest interchange	2000	Odomatrix, CESAER
Mid-range facilities score	2006	CESAER based on the *Base permanente des équipements*
Local-range facilities score	2006	CESAER based on the *Base permanente des équipements*
Location of the municipality within a regional national park	2012	*Observatoire des territoires*
Municipality eligible for the ZRR scheme	1995; 2006	*Observatoire des territoires*
Amount of public expenditure under Axis 1 of the PDRH	2007-2013	ASP-ODR
Population density	2006	INSEE RP-2006
Share of jobs by sector in total employment	2006	INSEE
Share of Population-based jobs in total employment	2006	INSEE
Fine particle concentration (pm10)	2006	PREV'AIR
Presence of a railway station	2003	SNCF
Share of the population with a higher education diploma	2006	INSEE RP-2006
Employment rate	2006	INSEE RP-2006
Share of the population by socio-professional category (8 categories)	2006	INSEE RP-2006
Taxable income per household	2006	DGF
Tax potential	2006	*Observatoire des territoires*
Location within a '*Pays*'	2003	*Observatoire des territoires*
Dummy variable=1 if the mayor of the municipality is also a parliamentarian (deputy or senator)	2007	CESAER
Classification according to Urban Area zoning	2011	INSEE
Share of built-up areas	2006	CLC
Share of agricultural areas	2006	CLC
Share of forested areas	2006	CLC

Sources: Authors.

Table A-2 – **Mean impact on the economic attractiveness of municipalities adjacent to the beneficiary municipalities of the measures of Axes 3 and 4**

Logarithm difference in the number of jobs between 2007 and 2015	Measures of Axis 3		Axis 4 LEADER	
Total employment	−0.004	(0.012)	0.003	(0.056)
Population-based employment	−0.004	(0.028)	0.004	(0.006)
Productive employment	−0.024	(0.032)	−0.045	(0.037)
Agricultural employment	−0.005	(0.039)	−0.007	(0.046)
Administration, teaching, health care jobs	0.001	(0.046)	0.181	(0.074)
Jobs in sales and services	0.004	(0.049)	−0.001	(0.001)
Industrial jobs	−0.0171	(0.045)	0.012	(0.039)
Log difference in the total population 2007-2015	0.001	(0.002)	−0.004	(0.008)
Migration rate between 2010 and 2015	−0.001	(0.002)	−0.001	(0.003)

Sources: Authors' processing of ASP-ODR data.

Table A-3 – **Mean impact on the residential attractiveness of municipalities benefiting from the measures of Axes 3 and 4 (excluding the pretreatment outcome variables of all of the matching variables)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Measures of Axis 3						Axis 4 LEADER
	All measures	Diversification of non-agricultural activities (311)	Creation/development of micro-enterprises (312)	Promotion of tourism activities (313)	Basic services for the economy and the population (321)	Conservation and enhancement of rural heritage (323)	Axis 3 measures implemented via LEADER (413)
Log difference in the total population 2007-2015	0.0054(0.0033)	0.012** (0.005)	0.027**(0.081)	0.013***(0.005)	0.023***(0.008)	−0.005(0.005)	0.003(0.003)
Migration rate between 2010 and 2015	0.0027(0.0018)	0.009***(0.003)	0.007* (0.004)	0.019 (0.003)	0.001 (0.003)	0.002(0.003)	−0.001(0.002)
Number of beneficiary municipalities	4,181	904	502	771	621	1,945	2,099

Sources: Authors' processing of ASP-ODR data.

Table A-4 – **Mean impact on the economic attractiveness of the municipalities benefiting from the measures of Axes 3 and 4**

Logarithm difference in the number of jobs between 2007 and 2015	(1)		(2)		(3)		(4)	
	Measures of Axis 3				Axis 4 LEADER			
	Mountain area		Non-mountain area		Mountain area		Non-mountain area	
Total employment	0.025*	(0.014)	0.045***	(0.001)	0.059**	(0.026)	0.036***	(0.012)
Population-based employment	0.054*	(0.029)	0.079***	(0.017)	0.011***	(0.048)	0.065***	(0.017)
Productive employment	0.066	(0.082)	0.041*	(0.021)	0.001	(0.089)	0.027	(0.025)
Agricultural employment	0.050	(0.12)	0.063**	(0.031)	0.030	(0.125)	0.092	(0.062)
Administration, teaching, health care jobs	0.097	(0.105)	0.089***	(0.034)	0.181***	(0.074)	0.081***	(0.032)
Jobs in sales and services	0.194	(0.140)	0.070**	(0.28)	0.114	(0.106)	0.050	(0.041)
Industrial jobs	0.118	(0.132)	0.066	(0.045)	0.203	(0.128)	0.056	(0.049)
Log difference in the total population 2007-2015	−0.004	(0.007)	0.008**	(0.004)	−0.002	(0.007)	0.010**	(0.005)
Migration rate between 2010 and 2015	0.003	(0.004)	0.002*	(0.001)	−0.005	(0.006)	−0.001	(0.001)

Sources: Authors' processing of ASP-ODR data.

Table A-5 – **Comparison of costs per job created by different iconic programs**

Study	Scheme under assessment	Geographical targeting	Cost per job created (EUR)
Freedman (2015)	New Markets Tax Credits (MNTC, USA)	yes	22,000
Givord *et al.* (2018)	ZFU	yes	Between 18,000 and 26,000
Gobillon *et al.* (2012)	ZFU (Paris region)	yes	95,000
Rathelot & Sillard (2008)	ZFU	yes	31,000 [11,000; 73,000]
Behaghel *et al.* (2015)	ZRR	yes	70,000
Charnoz (2018)	ZFU	yes	19,000
Bunel *et al.* (2012)	General exemptions for social security contributions	no	Between 34,000 and 42,000
Crépon & Desplatz (2001)	Exemptions for social security contributions for low earners	no	Between 11,000 and 29,000
Cerqua & Pellegrini (2022)	L488 (Italy)	yes	25,500
Cerqua & Pellegrini (2014)	L488 (Italy)	yes	Between 46,000 and 77,000
Blomquist & Nordin (2017)	CAP, decoupling of support (Sweden)	no	26,000

Sources: Summary created by the authors.

Impact of COVID-19 Activity Restrictions on Air Pollution: Methodological Considerations in the Economic Valuation of the Long-Term Effects on Mortality

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Abstract – This article offers an approach incorporating latency into the process for evaluating long-term mortality and into its economic valuation, following a temporary impact. It is applied to the effects of COVID-19 activity restrictions, in the spring of 2020, on ambient air pollution in France. These effects are evaluated in terms of Life Years Gained (LYG) and in monetary terms for two air pollution indicators. This approach is compared to a standard estimate on the basis of difference. It gives results that are lower by a factor of 3.7 to 5.5 for LYG and, on account of the additional effect of discounting, gives an economic valuation that is lower by a factor of 4.7 to 6.9. These results show that an adapted valuation of the long-term health benefits, then their translation into monetary terms, is essential in order to compare the long-term consequences of temporary exogenous impacts or policies.

JEL classification: C18, I1, Q51, Q53
Keywords: COVID-19, long-term mortality, activity restrictions, air pollution, economic valuation

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Beyond the direct impacts on morbidity and mortality, COVID-19 led to radical changes of lifestyle for the population as of March 2020. As in most countries (Liu *et al.,* 2021), France imposed activity restrictions in spring 2020. The many negative consequences of these – social, educational, professional and health – are likely to increase the socio-economic inequalities within the population and cannot yet be fully evaluated (Bambra *et al.*, 2020; Tisdell, 2020; Brodeur *et al.*, 2021b). From a health standpoint, the impacts include mental health damage, a decrease in physical activity, loss of opportunities in medical terms linked to the inability to monitor chronic illness and surgery cancellations, changes to eating habits, increased exposure to indoor air pollution or reduced well-being linked to lockdown (Brodeur *et al.,* 2021a; Hrynick *et al.*, 2021; Le & Nguyen, 2021; Molina-Montes *et al.*, 2021). Some consequences of lockdown were positive, however, as the activity restrictions were accompanied by a drop in the number of road traffic accidents (in France, about 720 fewer deaths and 14,900 fewer injuries in 2020 than in 2019, cf. ONISR – *Observatoire national interministériel à la sécurité routière*, 2021), and reductions in ambient concentrations of certain atmospheric pollutants and the associated health effects.

This article studies the consequences of this reduction on long-term mortality. Short-term mortality has been widely studied (Bherwani *et al.,* 2020; Chen *et al.,* 2020; Wang *et al.,* 2020; Liu *et al.*, 2021; Sannigrahi *et al.,* 2021; Venter *et al.,* 2021), but its long-term counterpart less so (however, see Giani *et al.,* 2020; Adélaïde *et al.,* 2021b; Hao *et al.*, 2021). When it was studied, the results obtained were not adapted to economic valuation. In fact, these studies evaluated the effects on mortality based on two situations – with and without lockdown – and calculated the consequences by considering the difference between these two situations over a given period, *ceteris paribus*. This standard approach based on difference – clear, simple and instructive – is perfectly suited to short-term effects. However, its value is limited for long-term effects as it does not take account of the cumulative nature of the exposure which dictates the distribution of health benefits over time. Therefore, disregarding this latency when evaluating health effects has repercussions on the economic valuation of future benefits, which are amplified by discounting.

As such, we offer an approach that incorporates latency when assessing the effects of a temporary impact on long-term mortality and its economic valuation. We apply this approach to the drops in concentration of two atmospheric pollutants observed in mainland France in 2020: fine particles $PM_{2.5}$ (aerodynamic diameter less than 2.5 μm) and nitrogen dioxide (NO_2). We find that the standard approach based on difference gives results in terms of Life Years Gained (LYG) that are considerably higher than those obtained using the approach that we offer, by a factor of 3.7 for $PM_{2.5}$ and 5.5 for NO_2. Under the effect of discounting when performing economic valuation, these factors rise to 4.7 and 6.9 respectively. Generally speaking, an adapted valuation of long-term health benefits, then its translation into monetary terms, is essential to allow the economist to compare the long-term consequences of temporary public policies or exogenous impacts such as COVID-19.

We set out the methodology used to evaluate the health and economic impacts, in particular the use of uncertainty (Section 1). We apply this to the impact on long-term mortality of drops in pollution levels resulting from the restrictions related to COVID-19 in spring 2020 (Section 2). The results are shown in Section 3.

1. Methodology for the Economic Valuation of Health Impacts

1.1. Standard Approach Based on Difference

The association between pollution indicators and health indicators is based on statistical models that estimate exposure-response functions. For most pollutants and long-term mortality, these functions are considered linear and non-threshold (WHO, 2021). Therefore, the relative risks (RR) used quantify the variations in mortality in a population when its exposure varies, regardless of the initial exposure level. They are used as a basis for calculating three indicators: the number of premature deaths, the total number of years of life and life expectancy at a given age. The latter two require the use of dynamic mortality tables for the population concerned: the RR of mortality associated with exposure to the pollutant affects the probability of death from any cause, and the synthetic cohort is monitored until its extinction.

Epidemiological studies generally apply a difference-based approach to determine the health effects of a variation in exposure. The RR is then applied to the exposure differential and to the average annual number of deaths, or used to evaluate a number of LYG based on the difference between the evolution of cohorts exposed or not to this exposure variation (for example,

Corso *et al.,* 2019, pp. 46–50 for the methodology). When the variation is permanent, these RR are used to determine the annual long-term impact; when it is temporary, as with lockdown, they determine the total long-term impact. In both cases, the health effects are considered to be immediate.

1.2. Impacts of Latency on the Distribution over Time of Health Gains Following a Temporary Shock

The standard approach based on difference is not, however, adapted to a long-term mortality RR, translating the impact on state of health of a cumulative process, which is not immediate in either its degeneration or its improvement (Leksell & Rabl, 2001; Miller & Hurley, 2003; Röösli *et al.,* 2005; Burnett *et al.,* 2018). We are, therefore, seeking a framework adapted to a drop in exposure which is temporary, and where the long-term health effects would not be immediate.

1.2.1. Literature Review

Epidemiological literature on the effects of air pollution rarely studies this process on account of a lack of data on the change over time of the long-term RR following an exposure modification. Walton (2010) produces a very comprehensive analysis based on three sources: time-based trends taken from epidemiological studies, the biological processes underlying the different types of associated mortality (cardiopulmonary, cardiovascular, respiratory and lung cancer), and certain similar risk factors which are better quantified, such as stopping smoking. Despite the existence of uncertainties, the first two sources confirm a non-immediate effect which stretches over several years on account of the mechanics of deterioration and recovery associated with the health effects, without being able to precisely determine the distribution over time.

This latter may, however, be inferred from data on smoking cessation, an area in which Walton (2010) compiles 22 studies published between 1976 and 2008, which indicate that the mortality of ex-smokers is similar to that of individuals who have never smoked, after a period of abstinence of 10 to 20 years. It is strongly demonstrated that cardiovascular mortality decreases rapidly over the first five years, while maintaining a component that diminishes more gradually up to 20 or 30 years after stopping, whereas lung cancer mortality decreases more gradually over 30 years.

On these bases, and given that the exposure route (inhalation) and target organs (pulmonary system) are common to tobacco and pollution exposure, several structures for latency distribution have been proposed. Some of these cover a relatively short timeframe: 85% the first year with the remaining 15% over the next six years (Laden *et al.*, 2006), or 25% per year over the first four years (Puett *et al.*, 2009). Other approaches consider a longer time period: uniform distribution over the first 15 years (Krewski *et al.*, 2009), 40% in the first five years, and the remaining 60% over the following 30 years (Walton, 2010); or a decreasing exponential structure with 50% in the first six years and the remainder over the next 40 years (Röösli *et al.*, 2005).

Empirically, analyses of the benefits carried out by the Environmental Protection Agency (US EPA, 2021) have, since 2006, applied a 20-year lag structure: 30% of premature deaths arising during the year following the reduction (the contribution of short-term exposure), 50% spread equally over years 2 to 5 following the reduction (deaths of cardiopulmonary origin) and 20% distributed equally over years 6 to 20 following the reduction (deaths due to pulmonary disease and lung cancer).

Ultimately, we conclude, along with Rabl (2006), that the data available support the impact of atmospheric pollution on mortality in proportion to the integration over time of past concentrations, weighted by a decreasing exponential profile.

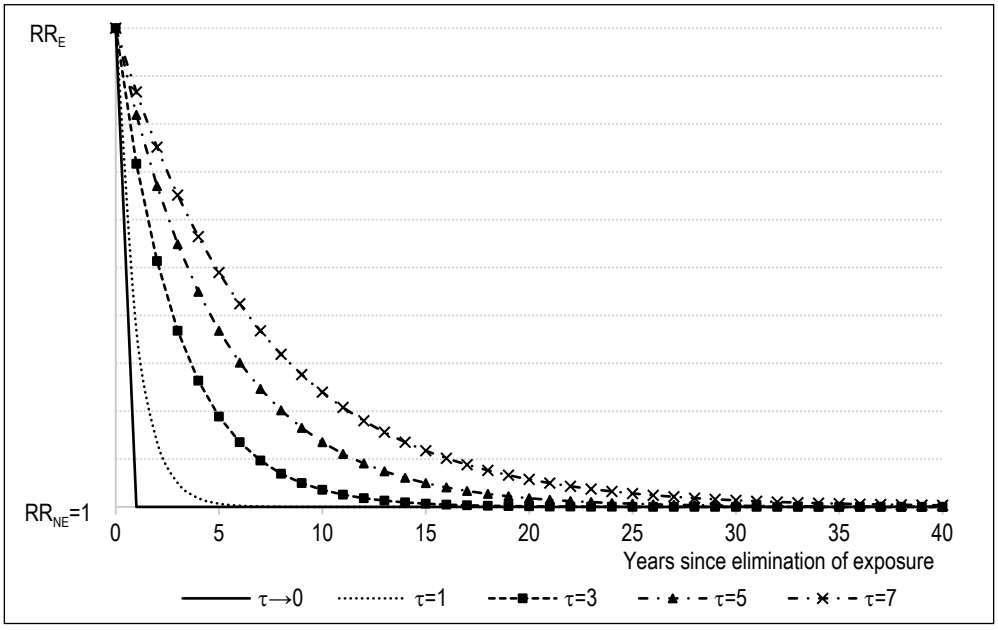
1.2.2. Consideration of Latency for a Permanent Elimination of Exposure

Lightwood & Glantz (1997) thus estimate a negative exponential mortality risk function (like Röösli *et al.*, 2005), based on the meta-analysis of seven studies on the impacts of smoking cessation, which represents an immediate and complete elimination of the risk:

$$RR(t) = RR_{NE} + (RR_E - RR_{NE})\, e^{\left(-\frac{t}{\tau}\right)} \qquad (1)$$

where RR_E is the RR linked to exposure to a risk factor (active smoking in smokers), RR_{NE} the RR associated with no exposure to this factor (absence of smoking in non-smokers), $e(.)$ the exponential function, t the time elapsed since elimination of the exposure (stopping smoking) and τ a parameter > 0. If $\tau \to 0$, the impact on the RR is obtained immediately, and concurs with the standard approach based on difference. When τ increases, the time necessary for $RR(t)$ to reach RR_{NE} increases. Figure I represents the change in $RR(t)$ for different values of τ: immediate decrease when τ is close to 0 (solid line); decrease over approximately six years for $\tau = 1$;

Figure I – **Change in the relative risk (RR) of mortality following a permanent elimination of exposure, function of τ**



over 20 years for $\tau = 3$; over 30 years for $\tau = 5$; and over 40 years for $\tau = 7$.

Some studies on the long-term effects of exposure to atmospheric pollution have adopted and applied this formula (Leksell & Rabl, 2001; Chanel *et al.,* 2006; Rabl, 2006) or its counterpart for air pollution (Röösli *et al.*, 2005; Tainio *et al.*, 2007), favouring epidemiological data specific to the diseases leading to death. They performed a sensitivity analysis on the value of τ, liable to represent the gradual decrease in mortality over the longer term, in order to take account of the associated uncertainties.

1.2.3. Consideration of a Temporary Elimination of Exposure

However, the reduction in exposure is deemed permanent in the case of smoking cessation, whereas we are looking at – to use the expression of Johannesson *et al.* (1997) – the impact of a *blip* on mortality, i.e. a low, immediate and temporary reduction, with a return to the previous exposure level. We are, therefore, adapting the mortality risk function from equation (1) to model this return to the level of RR_E when exposure to the factor is re-established at its initial level (as $t = t_0$). This then gives us, with the previous notations:

$$RR(t) = RR_E + \left(RR(t_0) - RR_E\right) e^{\left[-\frac{(t-t_0)}{\tau}\right]}$$

for $t \geq t_0$ (2)

Figure II shows the change in $RR(t)$ for a temporary elimination of exposure over five years ($t_0 = 5$) and for different values of τ. It shows that the higher the value of τ, the quicker $RR(t)$ drops, to achieve a value at the end of the period during which exposure is eliminated that is closer to RR_{NE}, but that more time is needed to return to the level of RR_E (five years for $\tau = 1$ but 35 years for $\tau = 7$).

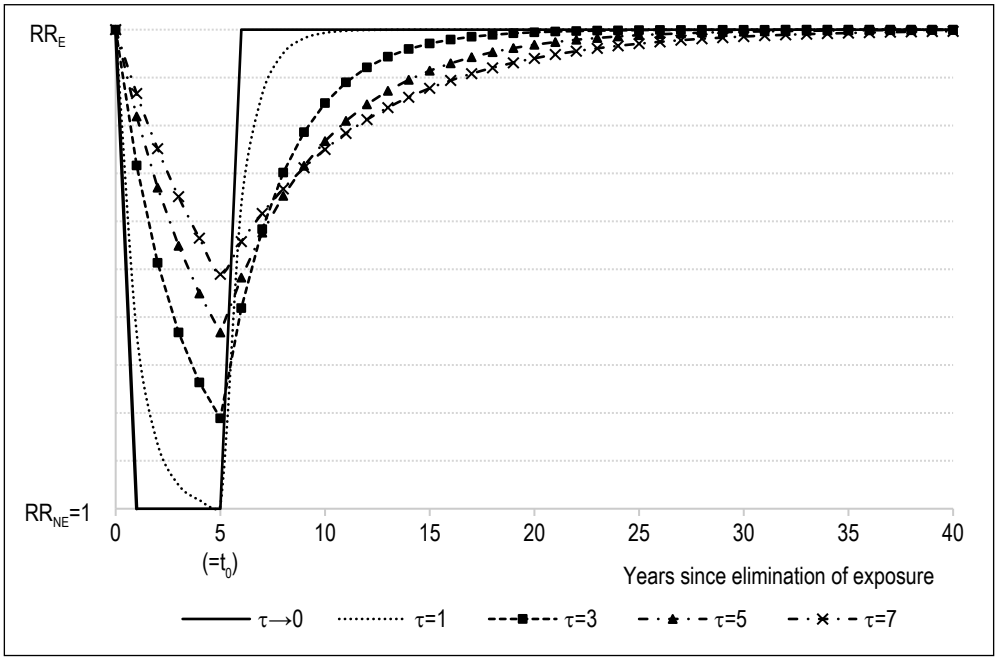
1.2.4. Choice of Value of the Parameter τ

Estimates of τ differ in literature depending on the disease causing the death. With regard to smoking cessation, Lightwood & Glantz (1997) suggest 1.4 for a stroke and 1.6 for an acute myocardial infarction, Leksell (2000) between 4.3 and 6.5 for lung cancer, and Doll *et al.* (1994) between 10 and 15 for a total excess risk of mortality. Leksell & Rabl (2001) find that a good approximation for mortality across all causes is a weighted average where $\tau = 1.5$ (weight of 0.3) and $\tau = 13$ (weight of 0.7).

With regard to exposure to air pollution, Röösli *et al*. (2005) estimate τ for two interventional studies and obtain 1.1 (for elimination of exposure to the emissions of a steel mill for 13 months) and 9 (for permanent elimination of exposure to coal, but a follow-up of only six years). For their own study, they choose a central value $\tau = 5$ with a sensitivity analysis ranging from $\tau \rightarrow 0$ to $\tau = 10$.

Ultimately, we have chosen a central value of $\tau = 3$, which corresponds approximately to the empiric distribution used by the US EPA (2021). Indeed, Figure I indicates that 30% of the risk variation (RR_E - RR_{NE}) is obtained in the first

Figure II – **Change in the relative risk (RR) of mortality following a temporary elimination of exposure, function of τ**



year, 50% for the period from 2 to 5 years and 20% for the period from 6 to 20 years. We have chosen the values $\tau = 1$ and $\tau = 5$ as the uncertainty interval.

1.3. Impacts of Latency on the Economic Valuation of Mortality

From an economic point of view, incorporating latency and distribution over time in LYG involves the use of discounting to express future monetary flows as current values, whether through years of life (Hammitt, 2007; Jones-Lee *et al.,* 2015) or the valuation of future monetary gains (US EPA, 2021). Thus, using the LYG distribution over time, we obtain the following total economic valuation:

$$Total\ economic\ valuation = \sum_{t=1}^{120} LYG_t VOLY\,(1+\delta)^{-t} \quad (3)$$

where LYG_t represents the number of LYG on date t, VOLY the value of a life year, and δ the discount rate, the latter two having to be chosen. The upper limit of the sum is set at 120 years, the maximum age that guarantees extinction of the cohort.

1.4. Accounting for Uncertainties

The economic valuation of the effects of exposure of the population to ambient air must take into account the accumulated uncertainties that mainly arise from three sources.

Firstly, the uncertainties in the characterisation of population exposure, mainly due to the measurement of concentrations and of the exposure (observed), and to the modelling of the counterfactual exposure (not observed). The quality of the modelling depends on the quality of the input data (emissions inventories, land use data, geographical distribution of the population, meteorological data, etc.), the topography of the area studied, the availability of measurement data, etc., making the uncertainty spatially heterogeneous.

Next, epidemiological uncertainties concern the quality of the health data, the choice of a risk-exposure function (functional form, thresholds) or an RR, and their transposability to the population studied, which depends on way of life, climate or the nature of the emission sources. Part of this uncertainty is provided by the confidence interval, generally 95% (95% CI) around the central RR value. This latter is derived from econometric regressions on data pairs representing the exposure levels and health effects observed, such that the associated uncertainty reflects the statistical variability specific to the relationship between exposure and health effect. We note that as the RR are more frequently calculated based on urban rather than rural populations, the uncertainty is likely to be higher for the latter. Although the value of τ that we select in equations (1) and (2) is based on our analysis of epidemiological knowledge and practice, and not on an objective statistical estimate, this choice does convey an underlying epidemiological uncertainty.

Finally, the quantification of economic uncertainties differs as the underlying knowledge is more subjective than scientific, leading to an approach that is more normative than positive. It is based on the unit monetary values used and technical parameters such as the discount rate. These uncertainties are generally accounted for through a triangular probability distribution (Chanel *et al.,* 2014; Rabl *et al.,* 2014), and/or the construction of a range from an empirical standard deviation under an assumption of normality. For example, CAFE (2005) proposes ± 33%, which corresponds to a variation of approximately one standard deviation around the mean for normal distribution.

These three types of uncertainty are generally considered either independently or jointly by integrating their respective sources in a Monte-Carlo simulation approach, preferable from a methodological standpoint. A more complex analysis can also be performed by breaking down each source and assigning it a specific distribution (Rabl *et al.,* 2014).

2. Application to the Activity Restrictions Related to COVID-19

A quantitative health impact assessment (HIA) conducted by *Santé publique France* has estimated the impact on long-term mortality of the reductions in levels of $PM_{2.5}$ and NO_2 observed in mainland France during lockdown (Adélaïde *et al.,* 2021b; Medina *et al.,* 2021). We present this methodology briefly, along with our own approach (2.1), before addressing the elements necessary for the economic valuation (2.2) and then for accounting for uncertainties (2.3).

2.1. Evaluation of Health Effects

2.1.1. Modelling of Population Exposure

The first step estimates the difference between the actual exposure of the population to the pollution indicators $PM_{2.5}$ and NO_2 during the periods of strict lockdown (from 16 March to 11 May 2020) and the gradual relaxation of measures (from 11 May to 22 June 2020), and that observed in the absence of these lockdown measures. The latter models the air quality using the CHIMERE chemistry-transport model (co-developed by Ineris and CNRS) on the basis of European scenarios adapted for France by CITEPA (*Centre interprofessionnel technique d'études de la pollution atmosphérique*). The air pollution data are taken from the French approved air quality measurement network. The methodology used is similar to that mobilised for the Ineris air quality map library.[1] Using population data from the 35,228 communes of mainland France (according to the 2018 communes list), exposure is calculated per grid measuring approximately 4 km by 4 km. The concentration values of the different model grids present within the territory of a commune are then weighted according to the population size defined for each grid. Ultimately, this allows us to calculate the average exposure observed during lockdown, weighted at communal level, and to model that which would have been observed in the absence of any lockdown measures. Calculated as an annual average over the period from 1 July 2019 to 30 June 2020, this represents a drop of 2.9% for $PM_{2.5}$ and 4.7% for NO_2.

2.1.2. Estimate of the health effects for a 10 $\mu g.m^{-3}$ increase

Medina *et al.* (2021) propose two long-term RR for all causes mortality applying to the population aged 30 years and over. For $PM_{2.5}$, the RR is 1.15 (95% CI: 1.05-1.25) based on 22 European cohorts from the ESCAPE project and one French cohort (Pascal *et al.,* 2016). It is slightly above the values found by Pope *et al.* (2020): 1.09 (1.07-1.11) taken from 75 international studies, and 1.12 (1.06-1.19) obtained from 10 European studies. The difference may emanate from the exposure method and/or the particular composition, and we favour the RR defined by Medina *et al.* (2021). For NO_2, the long-term mortality RR adopted is 1.023 (1.008-1.037), based on 11 Western studies (PHE, 2018), which is also the value selected by the WHO in its latest guidelines (WHO, 2021). It is comparable to the meta-analyses of Huangfu & Atkinson (2020), with 1.02 (1.01-1.04) over 24 studies, or of Stieb *et al.* (2021), with 1.025 (1.012-1.038) across 53 international studies.

2.1.3. Standard Approach Based on Difference and Approach Taking Latency into Consideration

The two approaches study the impact on mortality of a further reduction of the average exposure of the population to $PM_{2.5}$ and NO_2 over the period from 1 July 2019 to 30 June 2020, following the lockdown measures.

The standard approach based on difference, mobilised in Medina *et al.* (2021), applies the RR to the exposure differential calculated during this period. It thus calculates the number of LYG

1. *https://www.ineris.fr/fr/recherche-appui/risques-chroniques/mesure-prevision-qualite-air/20-ans-evolution-qualite-air*

based on the difference between the development of two fictitious cohorts, one exposed to this exposure variation from the age of 30 years, and the other not exposed.

The approach that we propose applies a reduced risk of mortality obtained from equation (1) for this period to the exposed cohort, followed by a return to the previous exposure level in accordance with equation (2). We are, therefore, modifying the conditional probability of death in the population aged 30 years and over, and following the cohorts to extinction, recording the LYG on each date. In practice, we are using the most recent mortality tables by gender (INSEE, 2018), expressed for two fictitious cohorts of 100,000 births. We then approximate LYG_t, the number of LYG in the French population on each date t, replacing the 100,000 initial births in these fictitious cohorts with the actual numbers of births by gender in France (349,105 female and 364,924 male in 2019, the last known year).

2.2. Evaluation of Economic Effects

The monetary valuation of mortality – always delicate – relies on a standard framework adopted in New-Ext (2004), CAFE (2005), Aphekom (2011) and by the European Environment Agency (Schucht *et al.*, 2021). It is based on the choice of a Value of Prevented Fatality (VPF[2]) and a Value of a Life Year (VOLY),[3] employing three main methods (box). As our analysis is based on variations in number of LYG, it therefore requires the adoption of a VOLY. The latter can be obtained by derivation from a VPF considered as a flow of VOLY discounted over the remaining life expectancy (Viscusi *et al.,* 1997; Leksell & Rabl, 2001) or by direct estimation in a contextual study of stated preferences. A discount rate δ must also be adopted to value the (future) flows of LYG.

2.2.1. Methodology

In France, values for the socio-economic valuation of public investments are chosen based on official documents. For mortality, the most recent version (Quinet, 2013) uses the results of a set of international works prepared under the aegis of the OECD (Lindhjem *et al.,* 2011; OCDE, 2012). These documents are based on a meta-analysis of 856 valuations of the VPF worldwide in reference to 76 stated preference studies, and the VPF that were proposed

2. The most standard terminology is Value of a Statistical Life (VSL). However, we prefer VPF, in accordance with Desaigues et al. *(2011) who explain in their first footnote that "the traditional term "value of statistical life" (VSL) is unfortunate, because it tends to evoke hostile reactions by non-economists, However, people tend to accept the concept if it is presented as the "willingness-to-pay for avoiding an anonymous premature death", i.e. the value of preventing a fatality (VPF)". Recently, "value of reduced mortality risk" has also been suggested (Simon* et al.*, 2019).*

3. The use of an indicator taking into account the quality of years of life (QALY, quality adjusted life years) is not considered here for two reasons. On the one hand, there is no knowledge regarding the quality of life at the time of death and this would require strong hypotheses in order to be established. On the other hand, we consider that these indicators are still not used very much for environmental valuation and are not subject to an international scientific consensus (Cerema, 2016).

Box – **Reminders of the Methods for Economic Valuation of Mortality**

The economic valuation of mortality is based on three main methods:

- The market price method – often inappropriately called the human capital method – assumes that the value associated with the life of an individual is equal to the future production losses occasioned by their death, with such losses being measured by the value of future revenue discounted based on life expectancy at the age of death. Although easy to implement, it is barely used any more as it does not take into account individual preferences; the value of an individual is represented solely by their production measured by revenue from labour and is very sensitive to the choice of discount rate.

- The revealed preference method is based on situations in which individuals reveal their preferences when choosing consumer goods, implying a trade-off between a market good and a death risk variation. It relies on markets where the death risk level represents one of the characteristics behind the decision: labour markets, housing markets or protection expenditure. The advantage of this method is its reliance on real, observed choices resulting from individual decisions. Disadvantages include the difficulty in isolating the drop in a particular risk when different risks are reduced simultaneously (injury, property loss, drawbacks of a specific job) and the assumption of complete and perfect knowledge of goods, associated risks, the effect of risk attributes on the probability of death etc. In addition, the sample used may not be representative of the general population, under- or over-representing certain groups (workers, owners, etc.). This method is still used to assess the Value of Prevented Fatality (VPF), in particular by the various US federal agencies.

- The stated preference method uses surveys conducted on a sample of the population, which elicit Willingness To Pay (WTP) in order to reduce the probability of death on the basis of hypothetical scenarios. A VPF or Value of a Life Year (VOLY) is then calculated directly. This method is easy to deploy, offers a very accurate description of the trade-off between WTP and the health risk involved, and requires a simpler theoretical framework than that needed for the revealed preference method. The main pitfalls are the various sources of bias and errors that may not always be controlled (see Mitchell & Carson (1989) for an exhaustive presentation and McFadden & Train (2017) for a more critical approach). This method is increasingly used in mortality valuation, particularly by the European agencies.

(taking into account the level of wealth in each country) were largely taken up by the national and supranational bodies in charge of health-environmental valuation. Abroad, the World Bank (World Bank, 2020), the European Union (European Commission, 2020), the WHO and the OECD (WHO-OECD, 2015) have used them in evaluating the health effects of atmospheric pollution.

Quinet (2013) therefore puts forward a single VPF of €3 million$_{2010}$ for France, considered as a reference, used in the French legislative and regulatory context of the normative framework for the economic valuation of major transport infrastructure projects. He also derives a single VOLY of €115,000$_{2010}$, on the basis of an average age of the French population of 40 years, and an annual discount rate of 2.5%. This value, like the VPF, depends neither on the scope of application nor on the cause of death.

However, an important finding in the studies based on stated or revealed preferences is that the VPF depends on the context in which death occurs – the nature and level of the underlying risk, age, quality of life and the state of health at death (Chestnut & De Civita, 2009; OECD, 2012; Rabl *et al.,* 2014; Narain & Sall, 2016) – and even the scenario used (Ami *et al.,* 2013). The context of the underlying mortality risk is thus a pertinent factor explaining the extent of the VPF (Hammitt, 2007). Ideally, valuations of the VPF and VOLY should be specific to the context of atmospheric pollution.

2.2.2. Choice of Economic Valuation Parameters

- Direct Estimate of a Contextual VOLY:

A review of the literature finds six European stated preference studies where the scenario explicitly mentions exposure to atmospheric pollution as being the origin of the risk of death. Chronologically, Soguel & van Griethuysen (2000) use a sample of Swiss respondents to estimate an implicit VOLY based on a scenario eliciting the WTP for a gain of one hour of life per year. Their estimate of 53,000 Swiss francs (€29,000$_{2008}$) is calculated as 24×365 times the value of an hour of life. In a scenario based on health risks associated with atmospheric pollution, Chilton *et al.* (2004) estimate the average VOLY for a normal state of health at €45,000 (£27,600) for a sample of UK residents. For a sample of Swiss citizens, Jeanrenaud & Marti (2007) obtain an average VOLY of between €31,000 and €58,000 depending on the scenarios. Desaigues *et al.* (2011) take an approach similar to that of Chilton *et al*. (2004), based directly on an increase in life expectancy for nine European countries within the framework of the NEEDS programme. Taking the average values for an increase of three months, they recommend a VOLY of €41,000$_{2006}$ for the EU15 countries plus Switzerland. In Greece, Vlachokostas *et al.* (2011) estimate a VOLY of €41,000 based on a contingent valuation survey eliciting the WTP for an increase in life expectancy of one year thanks to the deployment of air quality improvement measures. Finally, across a sample of French citizens, Chanel & Luchini (2014) express the reduction of mortality as a gain in life years. Considering the VPF as a flow of VOLY discounted at the annual rate of 6.8% (rate estimated in the model based on responses), they derive an average VOLY of €165,000. This value – which is relatively high – is explained by the high discount rate used.

- Choice of a VOLY:

Depending on how a VOLY is obtained (by direct estimate in a contextual stated preference study or by derivation based on a single VPF), the values vary by around a factor of two. As there is no scientific consensus favouring either approach, and as we do not want to favour either, we have chosen the arithmetic average (rounded) of the VOLY adopted by Desaigues *et al.* (2011) and of that recommended in Quinet (2013), i.e. €85,000$_{2020}$. We note that this value is consistent with that recommended by the British government (£60,000$_{2010}$ equating to €79,999$_{2020}$, cf. HM Treasury, 2020) or the EU (€70,000, cf. European Commission, 2020).

- Choice of Discount Rate:

We are taking as our central value the annual risk-free discount rate of $\delta = 2.5\%$ currently favoured in France (Quinet, 2013). It is comparable to the rate of 3% used by the US EPA (2021) to take account of death flows occurring in the future.[4]

2.3. Accounting for Uncertainties

We adopt two approaches. On the one hand, an independent valuation of the uncertainties in the results tables. We account for epidemiological uncertainties based on central estimates using the 95% confidence intervals proposed

4. We are also estimating the sensitivity of economic impacts to the choice of an annual rate of 7%. This choice is based on US EPA (2021, p. F-8) which advocates, in the absence of arbitrage at federal level, performing an economic valuation of health benefits on the basis of 3% (which it recommends) and 7% (as recommended by the Office of Management and Budget, OMB).

in Medina *et al.* (2021). The uncertainties concerning τ, δ and VOLY will be represented by an interval adjusted to their central values, 1 and 5 respectively for τ, 1.5% and 3.5% for δ, and €$85{,}000_{2020}$ ± 33% (namely €56,666 and €113,333) for the VOLY.

On the other hand, we represent a joint valuation of the uncertainties on a figure. It takes into account all of the sources in an integrated approach, using Monte-Carlo simulations (Burmaster & Anderson, 1994; CAFE, 2005; Ostro *et al.,* 2006). The epidemiological uncertainty with regard to the exposure-response ratio is accounted for thanks to random draws in a normal distribution whose mean is the central estimate of LYG and whose standard deviation is derived from the 95% CI. For the other uncertainties, we use a triangular distribution defined from the central values and the lower and upper values referenced above for each parameter (τ, δ and VOLY). We then generate 10,000 independent Monte-Carlo replications from these probability distributions, each constituting a monetary valuation. A probability distribution of the economic valuation of the impact of activity restrictions on mortality is then obtained for each of the two pollution indicators ($PM_{2.5}$ and NO_2).

3. Results

The results are set out below for both indicators and must not be added together in order to avoid double counting, as some underlying health effects are common.

3.1. Evaluation of Health Effects

Table 1 presents the results in terms of LYG for various values of τ, by gender and by pollution indicator. The value "close to 0" allows these results to be compared to those based on the HIA (Medina *et al.,* 2021), which reflect the difference between the health effects (considered immediate) due to ambient air pollution with and without lockdown measures.

For a τ which is close to 0 and for $PM_{2.5}$, the total numbers of LYG are comparable between the approach including latency (26,313) and the standard HIA approach (27,815). However, the difference is greater for NO_2: 7205 *vs.* 11,263 for the HIA. This is explained by the fact that the distribution of the population by level of exposure is much more finely measured in the HIA (it is carried out at commune level) than in our approach (based on a weighted national average). It thus allows better consideration of urban exposure, mainly linked to motor traffic (principal source of NO_2) and affecting a large proportion of the population (60% of the population live in an urban unit of more than 20,000 inhabitants, Medina *et al.,* 2021, Table 3).

When τ increases, the total number of LYG drops for both pollution indicators, for two reasons. The main reason stems from the decrease in impacts seen in the first year, linked to the lower RR attained as a result of lockdown (see Figure II), a phenomenon which develops as the cohort ages. This is illustrated in Figure III, which represents the distribution over time of LYG following lockdown, for the three values of τ used in our analysis (for $PM_{2.5}$). The second, more ancillary reason, is explained by the other reasons for death (independent of exposure to air pollution) which affect the ageing of the cohort. Their contribution to its extinction becomes more significant as the evolution of RR towards RR_{NE}, following lockdown, is slow (high τ), reducing the total number of LYG attributed to

Table 1 – **Total number of life years gained long-term following lockdown**

	$PM_{2.5}$			NO_2		
Values of τ	Men	Women	Total	Men	Women	Total
Close to 0	14,425 (5,266–22,118)	11,888 (4,340–18,228)	26,313 (9,606–40,346)	3,950 (1,394–6,269)	3,255 (1,149–5,166)	7,205 (2,543–11,435)
1	9,118 (3,329–13,982)	7,515 (2,743–11,523)	16,633 (6,072–25,505)	2,497 (881–3,963)	2,058 (726–3,266)	4,555 (1,607–7,229)
3	4,089 (1,493–6,270)	3,370 (1,230–5,167)	7,459 (2,723–11,437)	1,120 (395–1,777)	923 (326–1,464)	2,043 (721–3,241)
5	2,615 (955–4,009)	2,155 (787–3,304)	4,770 (1,742–7,313)	716 (253–1,136)	590 (208–936)	1,306 (461–2,072)
7	1,920 (701–2,944)	1,583 (578–2,427)	3,503 (1,279–5,371)	526 (186–835)	433 (153–688)	959 (339–1,523)
HIA (2021)			27,815 (9,709–44,414)			11,263 (3,946–17,995)

Notes: The figures in brackets are established based on the 95% CI of the health data.
Sources: Calculation by the author and Medina *et al.* (2021).

the drop in exposure. This contribution is only marginally offset by a slower return of RR to the level of RR_E when τ increases (cf. Figure II). These two reasons thus explain why the discrepancies between our results and those of the HIA widen as τ increases, irrespective of the pollution indicator (cf. Table 1). For the central value $\tau = 3$, they are thus lower by a factor of 3.7 (for $PM_{2.5}$) and 5.5 (for NO_2).

3.2. Economic Results

3.2.1. Independent Processing of Uncertainties

Table 2 presents the discounted monetary valuation of the flow of LYG for the three values of τ, δ and VOLY used to reflect uncertainty. For the central values of these parameters it is €504 million (184-773) for $PM_{2.5}$, and

Figure III – **Distribution over time of the number of life years gained (LYG) following lockdown, function of τ (For $PM_{2.5}$)**

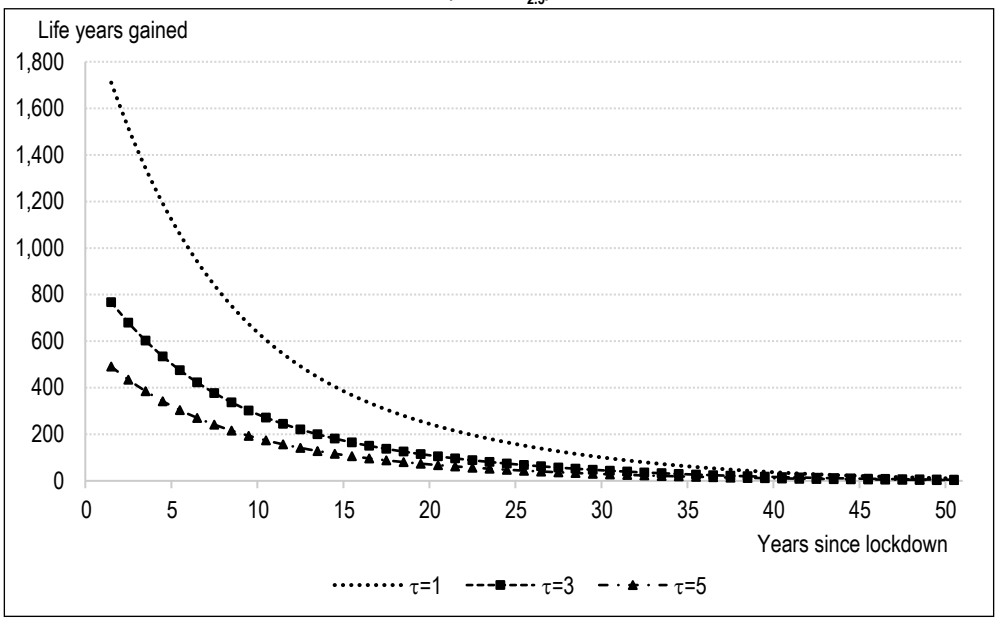


Table 2 – **Discounted monetary valuation of the total number of life years gained long-term following lockdown (in € Millions)**

		$PM_{2.5}$			NO_2		
		VOLY			VOLY		
τ	δ	€56,667	€85,000	€113,333	€56,667	€85,000	€113,333
1	1.5%	816 (298–1,251)	1,224 (447–1,877)	1,632 (596–2,503)	223 (79–355)	335 (118–532)	447 (157–709)
	2.5%	749 (273–1,149)	1,124 (410–1,723)	1,499 (547–2,297)	205 (73–325)	308 (109–488)	411 (145–651)
	3.5%	693 (253–1,062)	1,039 (379–1,593)	1,385 (505–2,124)	189 (67–301)	284 (100–451)	379 (133–601)
3	1.5%	366 (133–561)	549 (200–842)	732 (267–1,123)	100 (35–159)	150 (53–239)	200 (71–319)
	2.5%	336 (123–515)	504 (184–773)	672 (245–1,031)	92 (33–146)	138 (49–219)	184 (65–292)
	3.5%	311 (113–476)	466 (170–714)	621 (227–952)	85 (30–135)	128 (45–202)	171 (60–269)
5	1.5%	234 (85–359)	351 (128–538)	468 (171–717)	64 (32–102)	96 (34–153)	128 (45–204)
	2.5%	215 (79–329)	322 (118–494)	429 (157–659)	59 (21–93)	88 (31–140)	117 (41–187)
	3.5%	199 (73–305)	298 (109–457)	397 (145–609)	55 (19–86)	82 (29–129)	109 (39–172)
HIA (2021)		1,576 (550–2,517)	2,364 (825–3,775)	3,152 (1,100–5,033)	638 (223–1,020)	957 (335–1,530)	1,276 (447–2,040)

Notes: The figures in brackets are established based on the 95% CI of the health data.
Sources: Author's calculations.

€138 million (49-219) for NO_2. When we compare them to the monetary valuations calculated based on the results of Medina *et al.* (2021) and presented in the last line, they are 4.7 (for $PM_{2.5}$) and 6.9 (for NO_2) times lower, reflecting the combined effect of latency and discounting. For a given value of τ or VOLY, the results are not particularly sensitive to the value of the discount rate, which is explained by the fact that the flow of LYG, decreasing over time, limits the impact of discounting.[5] The results are proportional to the VOLY, *ceteris paribus*. On the other hand, the choice of τ is more determining: the move from a value of 1 to 5 divided the monetary valuation by 4 approximately, for both pollution indicators.

3.2.2. Joint Processing of Uncertainties

Figure IV represents the distribution of monetary valuations jointly considering the different sources of uncertainties, based on 10,000 Monte-Carlo replications. It gives rise to an average value and empiric 95% CI of €708 million (151-1,678) for $PM_{2.5}$ and 193 million (38-462) for NO_2, approximately 40% more than the central values of Table 2. This difference is mainly explained by the non-linear impact of τ on the valuation, favouring higher values due to the random draws from a triangular distribution. The difference actually sits at less than 8% when calculated based on the averages of the 27 central values ($3\delta \times 3\tau \times 3$VOLY) of Table 2, i.e. €653 million ($PM_{2.5}$) and €179 million (NO_2). It thus approaches those obtained in other studies comparing independent *vs.* joint processing of uncertainties (Adélaïde *et al.,* 2021a; Chanel *et al.,* 2014).

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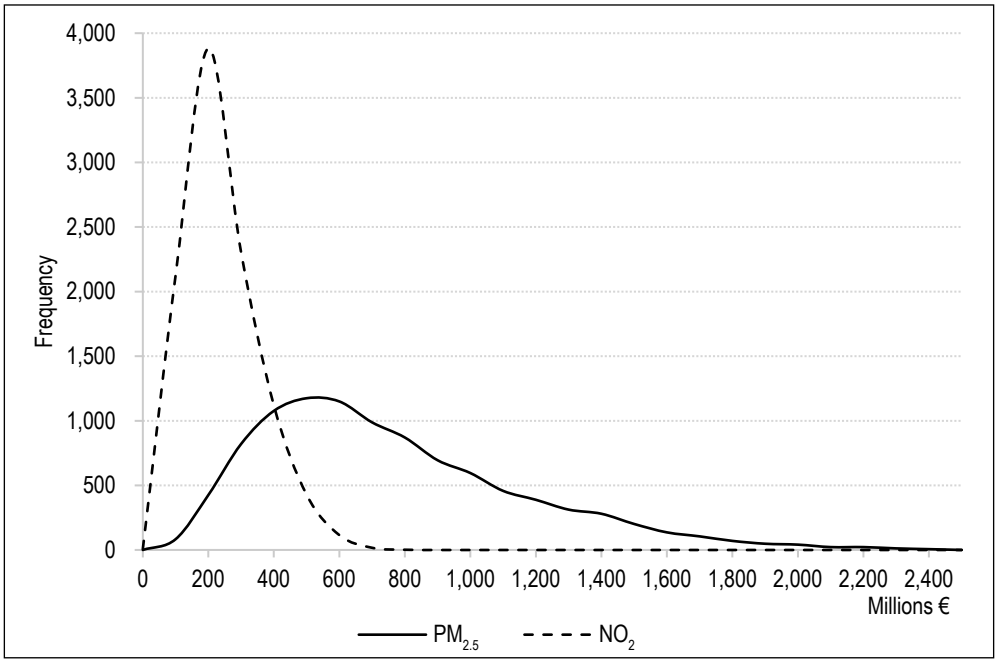
In terms of public health, our results confirm the importance of reducing – even temporarily and by a low amount – the exposure of the population to atmospheric pollution. The standard approach based on difference evaluates the effects associated with long-term mortality at €2.4 billion for $PM_{2.5}$ and €957 million for NO_2. Taking into account latency (and discounting future LYG flows), our recommended approach involves dividing these values by 5 approximately for $PM_{2.5}$ (i.e. €500 million) and 7 for NO_2 (i.e. €140 million). Thus it is crucial to be aware of the implicit epidemiological choices associated with these approaches when they are included in the economic analysis.

It is difficult to make a direct comparison between the monetary valuations that we have obtained and those from literature, for two reasons. Firstly, the works on activity restrictions caused by COVID-19 have only just begun to be circulated and published. Secondly, the

5. Thus the valuations performed using the annual discount rate of 7% (recommended by the US OMB) represent approximately 73% of the values obtained with the rate of 2.5%, ceteris paribus.

Figure IV – **Distribution of the total discounted monetary valuation jointly considering the different sources of uncertainty (in € Millions)**



valuations depend on the methodology used (modelling and comparison of levels, regression approaches or application of RR, period of restriction studied), exposure measured (choice of pollution indicators, calculation of exposure values), epidemiological choices (RR, reference scenario), measurement of mortality gains (premature deaths avoided or LYG), and the choice of monetary values.

However, some studies have evaluated the impact on long-term mortality of the drop in atmospheric pollution linked to activity restrictions, and offer comparative data.

Assuming an immediate resumption of activity for the whole of 2020 following lockdown, Giani *et al.* (2020) estimate that 76,400 (62,600-86,900) premature deaths would have been avoided in China and 13,600 (11,900-15,300) in Europe, including around 1,250 in France (see Figure S5 of their appendix). Assuming a lockdown throughout 2020, Hao *et al.* (2021) estimate the drop in average concentration of $PM_{2.5}$ to be 32.2% for China (compared with 2015-2019) with the number of deaths avoided being 140,200 (122,200-156,000). By way of perspective, we note that Medina *et al.* (2021) evaluate the drop in long-term mortality in France linked to the total elimination of the anthropic portion of atmospheric pollution at, respectively, 491,800 LYG (171,900-784,800) per year for $PM_{2.5}$ and 106,400 (37,300-169,900) for NO_2. In economic terms, this represents respectively €42 billion and €9 billion per year.

Some limits need to be specified. First of all, the transposition of a negative exponential function obtained from smoking cessation to a reduction in exposure to atmospheric pollution most likely depends – in addition to the similar exposure routes and target organs – on the nature of the chemicals involved, biokinetics, bioaccumulation, and the extent and temporality of the reduction. We note, however, that the negative exponential function of equation (1) is also adapted to reflect the phenomena of degradation in disciplines other than health (such as physics, biology, etc.), that it is compatible with the literature analysis carried out by Walton (2010), and that the broad interval used for τ reflects the uncertainty linked to this transposability.

The analysis could then be refined. On the one hand, we use a dynamic cohort based on an average variation in the exposure of the population over time. The use of exposure variations modelled at local level (grid measuring 4 km by 4 km) and their overlay with the communal population data should allow local specificities to be better taken into account, and mortality tables covering a more disaggregated level than national to be used. On the other hand, part of the population has moved out of urban areas into more rural environments (approximately 1.4 million, including 450,000 from Paris, according to Galiana *et al*., 2020). As the exposure levels in more urbanised areas are higher than those in rural environments, in particular for NO_2 (Medina *et al*., 2021), the effect of lockdown on mortality is undoubtedly underestimated in the population. Remote working has also contributed to reducing the exposure of the population concerned.

Lastly, mortality is evaluated monetarily on the basis of preferences stated by the population and not on an observation of market prices. These preferences represent the expression of a willingness to pay to reduce the probability of death, and include non-market components. The valuation of mortality also represents losses of collective well-being, therefore essentially a non-market component, for which a direct comparison with purely market components (such as the gross domestic product) is not recommended.

Finally, we note that, in addition to the drop in mortality following the impact of activity restrictions on the concentrations of $PM_{2.5}$ and NO_2, there are gains in morbidity linked to the respiratory or cardiovascular impacts (see Venter *et al.*, 2021, for paediatric asthma for example). However, potential negative health effects are also associated, since some studies demonstrate an increase in ozone levels and the associated mortality (Liu *et al.*, 2021; Venter *et al.,* 2021). □

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