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THEMATIC SECTION: EFFECTS OF THE HEALTH CRISIS AND SUPPORT MEASURES ON COMPANIES' ACTIVITY AND FINANCIAL SITUATION

ARTICLES

One Year of COVID: What Impact did the Pandemic have on the Economic Activity of French Companies? Construction of Individual Counterfactuals and Diagnoses for 2020

Benjamin Bureau*, Anne Duquerroy*, Julien Giorgi, Mathias Lé*, Suzanne Scott** and Frédéric Vinas***

Abstract – We study the impact of the health crisis on the activity of more than 645,000 French companies using individual data to estimate their monthly turnover. Our microsimulation model is innovative in three ways. First, we quantify the loss of activity with respect to a non-crisis counterfactual situation to take into into account companies' growth trajectories before the pandemic when discussing the consequences of the crisis. Second, we estimate this shock at the individual level to study the heterogeneity of loss of business. We highlight the disparities of the shock both between and within sectors. The sector explains up to 48% of the variance of the monthly activity shocks observed in 2020, a much larger proportion than in a normal year. Finally, we identify four profiles of activity trajectories in 2020. The industry is the primary determinant of belonging to these profiles. Conditionally to the sector, these profiles are also correlated with the organisational adaptation of companies.

JEL Classification: D22, G38, H32
Keywords: COVID-19, economic activity, non-financial corporations, microsimulation

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In early 2020, the COVID-19 pandemic and the restrictive health measures caused an economic shock of a magnitude not seen since the Great Recession (Bartik *et al.*, 2020; Forsythe *et al*., 2020), affecting the supply and demand of goods and services (Baldwin & Di Mauro, 2020). In France, these measures, consisting of several periods of lockdowns and reopening and of a range of evolving measures such as curfews and travel restrictions, caused a sharp downturn in economic activity. Between 2019 and 2020, French gross domestic product (GDP) fell by 7.9% and national income by 6.3% (Amoureux *et al.*, 2021). In April 2020, the decline in added value exceeded 30%, placing France among the worst affected countries in the eurozone (Heyer & Timbeau, 2020). For all of 2020, the added value of French companies decreased by 8.1% and by 8.3% for non-financial corporations (NFCs).

Beyond these trends at the macroeconomic level, our aim in this paper is to evaluate the impact of the health crises on companies' activity more precisely. This means estimating the difference between the levels of activity observed during the crisis and the levels that would have been observed had the crisis not occurred. This "counterfactual" approach is the basis of traditional microeconometrics for assessing public policy.[1] With the COVID-19 pandemic, estimating these counterfactual levels raises new methodological problems. The pandemic affected all companies, making estimations based on the use of control groups obsolete. Moreover, even if the pandemic affected all French companies, its consequences may have been extremely uneven and depended on a multitude of complex factors, which may have different effects or be unobservable. As a result, modelling the companies' activity during this period proved to be either challenging or overly simplistic. Many studies therefore estimated the impact of the crisis by using the observed rates of change in their activity between 2019 and 2020 (Hadjibeyli *et al.*, 2021; Bourlès & Nicolas, 2021), skewing the estimation of the magnitude of the activity shocks. Other more structural approaches forecast different scenarios of the evolution of the pandemic and the health restrictions to estimate the magnitude of the economic shock (Schivardi & Guido, 2020; Gourinchas *et al.*, 2021; OECD, 2020).[2] These studies rely on significant theoretical assumptions whose relevance suffer from a lack of *ex post* verification, in an unprecedented context where such assumptions may not apply. In addition, studies using U.S. data show that self-isolation behaviour did not always follow the same schedule as health restrictions (Glaeser *et al.*, 2021; Gupta *et al.*, 2021; Sears *et al.*, 2020) and that the decisions to reopen businesses did not always coincide with the lifting of restrictions (Balla-Elliott *et al.*, 2020), limiting the relevance of using the restriction timetable when modelling activity. Another avenue explored was the use of survey data (Bloom *et al.*, 2021; Bignon & Garnier, 2020), which may however, be subject to low coverage rates or risks of reporting bias.

This paper aims to overcome these limitations by proposing an innovative method for assessing the impact of the COVID-19 pandemic based on a limited set of assumptions. This analysis relies on an a-theoretical positioning in order to model the activity of all French companies if their activity dynamics had not been altered by the onset of the crisis. Individual monthly activity dynamics after February 2020 is predicted using autoregressive mechanisms before being compared to the observed *ex post* amounts, their difference providing an individual estimation of the impact of the pandemic on activity. The predictions are performed at the company level and are not based on a uniform application of sectoral impacts. In this respect, this work differs from those applying shocks estimated entirely or partially at the sectoral level to individual data, artificially limiting their heterogeneity (Anayi *et al.*, 2020; Blanco *et al.*, 2020; Hadjibeyli *et al.*, 2021).

The sectoral dimension was indeed important in the crisis, as not all sectors were affected at the same intensity (Danieli & Olmstead-Rumsey, 2020; Brinca *et al.*, 2020). In France, differences were observed according to the sectoral intensity of restriction measures (Baleyte *et al.*, 2021; Dauvin & Sampognaro, 2021),[3][4] the dependence of certain sectors on tourism (Škare *et al.*, 2021) and on international value chains (Gerschel *et al.*, 2020; Baldwin & Tomiura, 2020). Similarly, the unprecedented deterioration in expectations as a result of the crisis (INSEE, 2020) may have contributed to an increase in households' precautionary savings and a refocusing of their consumption on basic necessities

1. See, for example, Angrist & Pischke (2008).

2. Most of these studies used their activity loss estimations in financial models to assess companies' liquidity or default risk.

3. At the international level, the direct impact of restriction intensity on activity is illustrated by the strong correlation between the Oxford University restriction index, synthesising the real time degree of restriction associated with national health measures (Hale et al. *2020), and the rate of growth or decline in GDP in the first quarter of 2020.*

4. Industrial sectors, construction, transportation, accommodation and "other services" – primarily arts, entertainment and recreational activities, hair and body care services, computer repair, and other personal goods – were particularly affected by these measures.

(Bonnet *et al.,* 2021). However, the sector does not seem to fully explain the diversity of situations experienced by companies, since even within a given sector, the degree of dependence on foreign markets (Brancati & Brancati, 2020) and the effects of social distancing measures (Blanchard *et al.*, 2020) had differentiated effects, sometimes leading to a reallocation of activity and employment between "winning" and "losing" companies (Barrero *et al.*, 2020; 2021). The method developed here therefore aims to measure the heterogeneity of individual activity shocks, possibly within the same sector, and consequently to propose a quantification of the sector's contribution to the variability of individual situations observed in 2020.

The use of sub-annual data makes it possible to assess the impact of the crisis both annually and monthly. The use of monthly series of activity shocks allows the cross-sectional analysis of heterogeneity to be supplemented by a dynamic analysis of the diversity of activity trajectories over the course of the pandemic. The short term effect of the pandemic on employment (Barrero *et al.*, 2020), company closures (Gourinchas *et al.*, 2020) and activity (Fairlie, 2020; Bloom *et al.*, 2021) has been regularly highlighted, but some works also underscore the uneven persistence of initial shocks on both activity (Bloom *et al.*, 2021) and employment (Chetty *et al.*, 2020; Cajner *et al.*, 2020). The final objective of this paper is therefore to characterise the diversity of the activity trajectories of French companies in 2020 and provide a typology. The understanding of this typology and of the role played by the sector or companies' other demographic or organisational characteristics allows for a better the understanding of the heterogeneous impact of the health crisis on the activity of French companies.

The remainder of the paper presents the data used (section 1), the methods used to assess the impact (section 2) and the main results (section 3). These results are then discussed in the conclusion.

1. Data and Sample Construction

1.1. Database Construction

The activity is measured by companies' turnover, which provides a gross measure of economic activity whose estimation is relatively unaffected by reconstruction assumptions. It makes it possible to approach the impact of the crisis on activity independently of the subsequent adjustments in the financial and operational management of companies and of public support measures. The data used are derived from companies monthly value added tax (VAT) declarations to the French tax administration (DGFiP). The turnover of each company can be reconstituted from these declarations by summing up all its operations, whether or not taxable, on the French territory or abroad (Appendix A1). The financial sector, public administrations, as well as the self-employed and sole proprietorships are excluded from the sample.

The series of turnover built from the tax returns require some corrections.[5] Deferred returns, resulting in a null return in one month followed by a return to two months' activity in the next month, were corrected by splitting the activity of the second month between the null month and the catch-up month. Outliers, in terms of level or growth rate, were corrected by returning them to the trend of the series. Finally, companies reporting their turnover too irregularly, for which robust simulations could not be performed, were excluded from the sample. This restriction mainly concerns micro-enterprises with low annual turnover and therefore only marginally affects the coverage rate of the study in terms of turnover (0.2 percentage points).

The VAT returns are enriched with information on the characteristics of companies from FARE 2018-ÉSANE (compilation of companies' annual statistics) aggregate results file – the latest year available. The sample is therefore restricted to companies present in FARE 2018 and reporting their VAT monthly since January 2018. This matching makes it possible to check the consistency of the turnover figures reconstructed from the VAT data. To ensure this consistency, companies whose turnover from FARE differs by more than 35% from the annual turnover reconstructed from VAT returns in 2018 are excluded from the data. Consistency was checked for both the legal units and the profiled groups. Where it was not verified for the legal unit but was for the profiled group, the latter was used in the sample by aggregating the turnover of the legal units comprising it.[6] This condition excludes from the sample some large French companies for which the gaps between balance sheet data and the VAT returns are large.

5. They are detailed in Bureau et al. *(2021a, Appendix B, p. 40).*

6. In business accounting, the turnover of a company's legal units do not exactly sum up. Comparing the turnover from the FARE profiled accounts with the proxy obtained by summing up the turnover from the VAT data makes it possible to keep legal units whose turnover are not consistent but whose approximation at the profiled level is consistent with the balance sheet data. This increases the sample size and coverage rate.

1.2. Sample Description

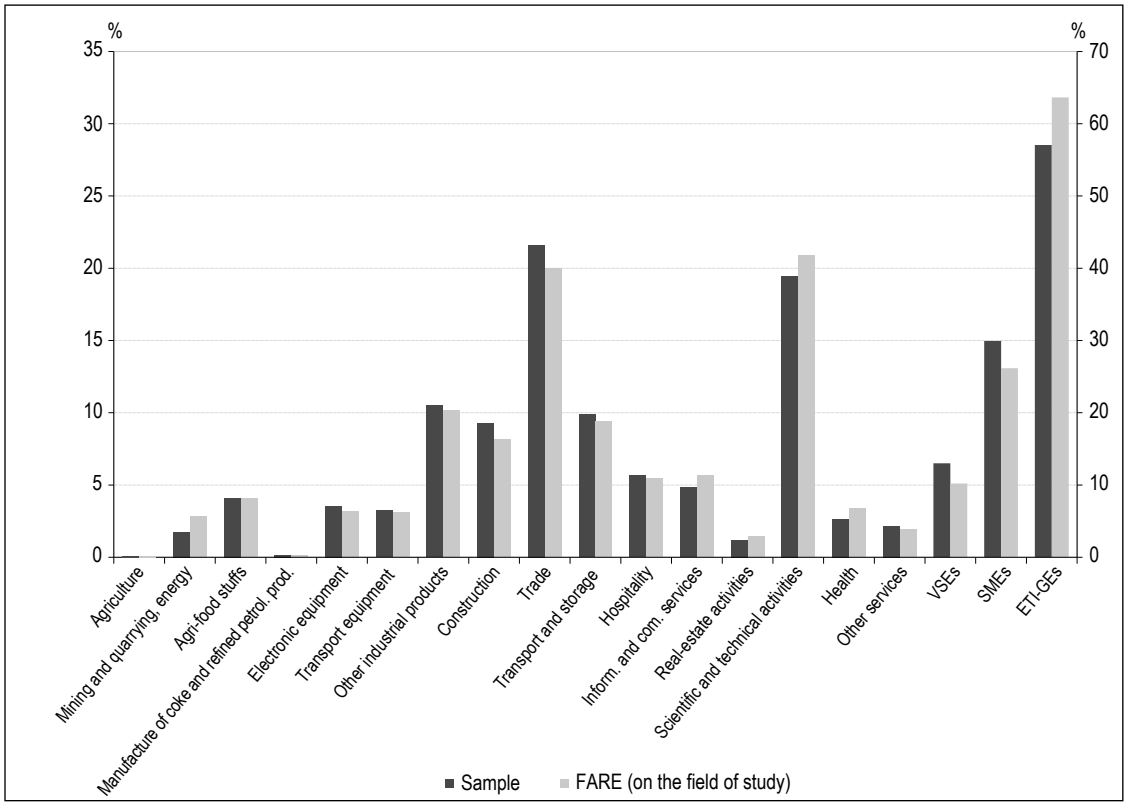
The final sample consists of more than 740,000 legal units, grouped into 645,000 observation units: 578,000 legal units analysed as such and 68,000 profiled groups. It represents 85% of the value added of non-financial corporations (NFCs) in the sectors used in the study, excluding self-employed workers. Out of all NFCs, the sample covers 71% of the value added, including 81% of the value added of intermediate-size and large enterprises (ETI-GEs), 72% of the value added of small and medium-sized enterprises (SMEs) and 38% of the value added of very small enterprises (VSEs), the majority of which are declare their VAT quarterly and annually.

The distribution of employees by sector in this sample is similar to that of all companies in the field of study. Compared with FARE data restricted to the scope of the study, the trade sector is slightly over-represented, and the energy and scientific and technical sectors under-represented. By company size, the workforce structure is comparable with the overall structure, but ETI-GEs are under-represented in the sample to the benefit of SMEs and VSEs (Figure I; for the figures, see Bureau *et al.*, 2021a, Appendix C, p. 41). The adjustments made to the returns thus only marginally distort the picture of the French NFCs population and of their activity.

1.3. Use of Survey Data

The study of the factors influencing the situation of companies during the crisis is enriched by the INSEE survey *Impact de la crise sanitaire sur l'organisation de l'activité des entreprises* (Duc & Souquet, 2020). This survey documents the behaviour of companies during the crisis, particularly their strategy for adapting their activity: proportion of employees working remotely, reorganisation of commercial logistics during the lockdowns (development of online sales systems, direct sales or new delivery systems), adaptation of the supply through the development of new products, activities or services, specific investments, especially in new technologies, and the reorganisation of activity via a change in suppliers and commercial partners or the pooling of resources with other companies. The matching with these data restricts the sample to 13,500 companies. To maintain the same representativeness of the sample, the observations are weighted by margin calibration. This matching is

Figure I – **Breakdown of employed staff by sector and company size**



Note: The data from FARE includes all French companies in the field of study. % sector on left axis, % size on right axis.
Sources: DGFiP, VAT returns; INSEE, FARE 2018. Calculations by the authors.

only used in the last stage of the analysis, within the parametric model.

2. Methodology

2.1. Estimation of the Activity Shocks Attributable to the Crisis

The method consists in estimating activity shocks attributable to the health crisis for each of company in the sample, while ensuring that the aggregation of these individual forecasts is consistent with robust sectoral forecasts.

2.1.1. Estimation of the Non-Crisis Dynamics at the Meso-Economic Level

A total counterfactual turnover is first estimated at the *size* × *sector* level. For this, 16 sectors of the A17 aggregate nomenclature[7] and three company sizes (VSE, SME and ETI-GE) are used, for a total of 44 series.[8] The combination of sector and size makes it possible to maintain a fine level of analysis, even at the most aggregated level of the simulations, to take into account the particular seasonality of VSEs in some sectors and to obtain more robust predictions of the amounts of activity generated by VSEs within each sector.

The total turnover of the *size* × *sector* groups is first reconstructed monthly between January 2015 and January 2020. This period is used to model the non-crisis dynamics of the 44 *size* × *sector* series *s*. Each series is stationarised[9] then modelled using a SARIMA model by selecting the pair (p_s, q_s) of autoregressive and moving average parameters wich minimises the Akaike information criterion (AIC) criterion[10] among 64 possible parameter combinations ranging from $(p_s = 1, q_s = 1)$ to $(p_s = 8, q_s = 8)$.[11] This procedure provides a robust model of the transformed *size* × *sector* and stationary series corresponding to equation (1). By noting $Y_{t,s}$ the turnover of the *size* × *sector* group *s* at date *t*, *B* the delay operator and $X_{t,s} = (1 - B^{12}) log(Y_{t,s})$,[12] each series can be written as:

$$X_{t,s} = \left(\varphi_{1,s} X_{t-1,s} + ... + \varphi_{p_s,s} X_{t-p_s,s}\right) + \varepsilon_{t,s} - \left(\psi_{1,s}\varepsilon_{t-1,s} + ... + \psi_{q_s,s}\varepsilon_{t-q_s,s}\right), \forall s \quad (1)$$

where $(\varepsilon_{t,s})_{t=1,...,T}$ designates a gaussian white noise of variance σ^2. These equations are then used to calculate the monthly optimal linear forecast of horizon *h* for each *size* × *sector* series. As part of the study, $h \in [1,11]$, the forecast being made between February and December 2020:

$$X_{\hat{T+h},s} = EL\left[X_{T+h,s} \mid X_{1,s},...,X_{T,s}\right], \forall h \in [1,11] \quad (2)$$

The forecasting model is trained over the January 2015-January 2020 period. The transformation of the series of forecasts obtained with equation (2) results in the series $\left(Y_{\hat{T+h},s}\right)_{h\in[1,11]}$, corresponding to the estimate of counterfactual turnover during each month of 2020 for each *size* × *sector* group[13][14].

2.1.2. Calculation of the Counterfactual Activity Figures and Individual Shocks

The second step is to allocate the estimated counterfactual turnover to all companies in each *size* × *sector* group. This breakdown is done iteratively, starting with February 2020 and ending with December 2020. The monthly market share of each company in its group incorporates its own seasonality and recent development dynamics. Formally, the individual share attributed to each company *i* in the group *size* × *sector* s in the first month *t* (here, February 2020) is:

$$S_{\hat{i,s,t}} = \frac{1}{2}\left(S_{i,s,t-12} + \frac{1}{3}\sum_{j=1}^{3} S_{i,s,t-j}\right) * \left(1 + \frac{1}{2}\frac{\left(\sum_{j=1}^{3} Y_{i,t-j} - \sum_{j=1}^{3} Y_{i,t-12-j}\right)}{\frac{1}{2}\left(\sum_{j=1}^{3} Y_{i,t-j} + \sum_{j=1}^{3} Y_{i,t-12-j}\right)}\right) \quad (3)$$

---

7. The 17-sector split was preferred because it allowed for better quality forecasts than those obtained with a finer division.

8. Of the 48 groups resulting from cross-referencing the sizes and sectors, those with few companies are merged by sector. In the agriculture and health sectors, companies with more than 10 employees are grouped together. The coke and refined petroleum product sector is a single group.

9. The stationarity of the transformed series is verified by Dickey-Fuller and augmented Dickey-Fuller tests (Dickey & Fuller, 1979).

10. The AIC criterion is $2k - 2\log(L)$ *where* L *is the likelihood of the estimated model and k the number of free parameters of the model. It is based on a compromise between the quality of the adjustment and the complexity of the model, penalizing models with a large number of parameters to limit the over-adjustment (Akaike, 1998).*

11. Once this pair of parameters has been selected, the residuals are tested for the absence of serial autocorrelation, their normality and their whiteness (Box & Pierce, 1970; Ljung & Box, 1978). The significativity of the coefficients associated with the pair of parameters is tested by a z-test. When more than one of these criteria is not verified, the pair of parameters giving the second lowest value for the AIC is selected and the procedure is repeated.

12. The difference to the same month of the previous year is a classic approach to the stationarity of time series. A monthly breakdown of the 44 size × sector *series also identified a seasonal trend, justifying the use of 12 months delays.*

13. The quality of these size × sector *forecasts is tested on 2019. In a crisis-free year, the counterfactual forecasts are expected to match the observed turnover amounts. Over the entire period, the absolute value of the difference between the observed amount and the simulated amount for all series is 2% on average, and the observed amount is within the 95% confidence interval for the predicted amount (details in Bureau* et al. *2021a, Appendix F, Figure F.1). For 2019, the model developed allows for better results than naive modeling, attributing as monthly turnover the turnover of the same month of the previous year, for 85% of the months of all 44* size × sector *series.*

14. These forecasts also coincide with the Banque de France's monthly economic survey (details in Bureau et al.*, 2021a, Appendix F, Figure F.4). The correlation coefficient between the monthly shocks estimated in the study and by the survey is around 0.8.*

with $S_{i,s,t}$ the market share of company i within the group *size* × *sector s* at date t. The market share attributed to each company in February corresponds to the average of its market share in the previous three months[15] and its market share in February 2019,[16] to which is added an individual weight to incorporate the companies' growth or decline trend over the past year. This coefficient is based on the structure of the Haltiwanger and Davis indicators and is bounded by construction between 0 and 2 and centred around 1 (Davis & Haltiwanger, 1992). Above 1, it allows for the incorporation of a growth trend, and below it, of a decline.

The counterfactual market shares for the months of March (t+1) to December 2020 (t+10) are calculated in the same way but by replacing the market shares for the months after February 2020 with those estimated in the previous iterations:

$$\begin{cases} S_{i,s,\hat{(t+1)}} = \frac{1}{2}\left(S_{i,s,(t+1)-12} + \frac{1}{3}\left(S_{i,\hat{s},t} + \sum_{j=2}^{3} S_{i,s,(t+1)-j} \right) \right) * \\ \left(1 + \frac{1}{2} \frac{\left(\left(Y_{i,\left(\hat{t+1}\right)-1} + \sum_{j=2}^{3} Y_{i,(t+1)-j} \right) - \sum_{j=1}^{3} Y_{i,(t+1)-12-j} \right)}{\frac{1}{2}\left(\left(Y_{i,\left(\hat{t+1}\right)-1} + \sum_{j=2}^{3} Y_{i,(t+1)-j} \right) + \sum_{j=1}^{3} Y_{i,(t+1)-12-j} \right)} \right) \\ S_{i,s,\hat{(t+10)}} = \frac{1}{2}\left(S_{i,s,(t+10)-12} + \frac{1}{3}\sum_{j=2}^{3} S_{i,s,\left(\hat{t+10}\right)-j} \right) * \\ \left(1 + \frac{1}{2} \frac{\left(\sum_{j=1}^{3} Y_{i,\left(\hat{t+10}\right)-j} - \sum_{j=1}^{3} Y_{i,(t+10)-12-j} \right)}{\frac{1}{2}\left(\sum_{j=1}^{3} Y_{i,\left(\hat{t+10}\right)-j} + \sum_{j=1}^{3} Y_{i,(t+10)-12-j} \right)} \right) \end{cases} \quad (4)$$

The monthly market shares are then adjusted so that they sum up to 1 within each group:

$$S_{\tilde{i,s,t}} = \frac{S_{i,\hat{s},t}}{\sum_{i=1}^{n} S_{i,s,t}} \quad (5)$$

The individual counterfactual turnover is the product of the estimated individual market share and the total counterfactual activity of the group to which the company belongs in month t:

$$CA_{\hat{i,s,t}} = S_{\tilde{i,s,t}} Y_{\hat{t},s} \quad (6)$$

The estimated monthly activity shock is the difference, in percentage, between the observed turnover and this counterfactual turnover.

$$Choc_{i,s,t} = \left(\frac{CA_{\hat{i,s,t}} - CA_{i,s,t}}{CA_{i,s,t}} \right) * 100 \quad (7)$$

By summing up – month by month or over the year – the counterfactual turnover of the entire sample or of a given sector and comparing it with the aggregate turnover observed in the same area, it is possible to construct aggregate activity shocks. Analyses of the distribution of individual activity shocks as calculated in (7) make it possible to refine these results by identifying winning and losing companies, even within the same sector.

2.1.3. Measurement of the Impact of the Crisis by Distributional Indicators of Activity Shocks

The estimated individual counterfactual turnover figures constitute robust scenarios of what could have been observed for each of the companies based on all the information available at the start of the crisis. However, despite the methodological precautions taken, it is possible that the forecasts at the company level differ from the figures that would have been observed. On the one hand, this is because the individual amounts of turnover declared by the companies are much more volatile than the aggregated amounts, and do not necessarily show the same seasonality. On the other hand, the attribution of the counterfactual market shares is based on the dynamics observed in the year preceding the forecasting exercise, which makes the exercise problematic for companies with a nonlinear growth trajectory. Therefore, even in the absence of a crisis, modelling individual shocks leads to the estimation of shocks that are not necessarily zero and may fluctuate around 0. In this sense, the analysis of the prevalence of winning or losing companies in 2020 and the magnitude of these gains or losses must focus on their distribution and its exceptional nature during the crisis.

The comparison of the distribution of activity shocks in 2020 with the one obtained by replicating the simulation over 2019 makes it possible to compare the deviations of the expected trajectories simulated by the model in the year of the crisis with those of a year without a crisis. The intensity of the distortion of this distribution in relation to 2019, when deviations close to zero are expected, illustrates the intensity of the impact of the health crisis. This distortion is measured with the Hellinger distance, which lies between 0 and 1 and measures the similarity between two statistical distributions. Noting f and g, the density functions of the compared distributions, the Hellinger distance is the square root of the following formula[17]:

$$H^2(f,g) = \frac{1}{2}\int\left(\sqrt{f(x)} - \sqrt{g(x)}\right)^2 = 1 - \int\sqrt{f(x)\,g(x)}dx$$

15. *This moving average smooths out potential one-off results and gives a more robust picture of the company's weight within the group.*
16. *The market share of the same month of the previous year allows to incorporation of the monthly seasonality of companies, an important element if it differs from the seasonality of the group.*
17. *The analysis was reproduced with other statistical distances (Kullback-Leibler, Bhattacharyya) for identical conclusions.*

The comparison of the distributions of activity shocks is made on annual and monthly shocks. The densities of individual shock distributions are estimated using kernel densities.

The use of individual data highlights the dispersion of the shocks. The contribution of the sector to this heterogeneity must be assessed and to do this, the monthly variance of the individual activity shocks is broken down into a part attributable to the activity sector and a residual part attributable to other factors. The sectoral breakdown used is the finest level of the French classification of activities, with 732 categories. The breakdown method used is standard (Gibbons *et al.*, 2014; Helpman, 2017) and follows the equation:

$$V = Var\left(Choc_{i,s}\right) = \underbrace{\sum_s \frac{n_s}{n} \cdot Var_s\left(Choc_{i,s}\right)}_{\text{Within class variance}} + \underbrace{\sum_s \frac{n_s}{n} \cdot \left(\overline{Choc_s} - \overline{Choc}\right)^2}_{\text{Between class variance}}$$

with $\overline{Choc} = \frac{1}{n}\sum_i Choc_{i,s}$ and $\overline{Choc_s} = \frac{1}{n_s}\sum_{i \in s} Choc_{i,s}$, $Choc_{i,s}$ the shock suffered by the firm i of sector s and n the number of companies in the sample.

2.2. Partition of Companies According to Their Shock Trajectory

The constitution of a series of monthly activity shocks for each company in the sample renders the trajectories of all the companies comparable, independently of their expected and observed figures, thus making it possible to identify homogeneous groups among the series of monthly shocks.

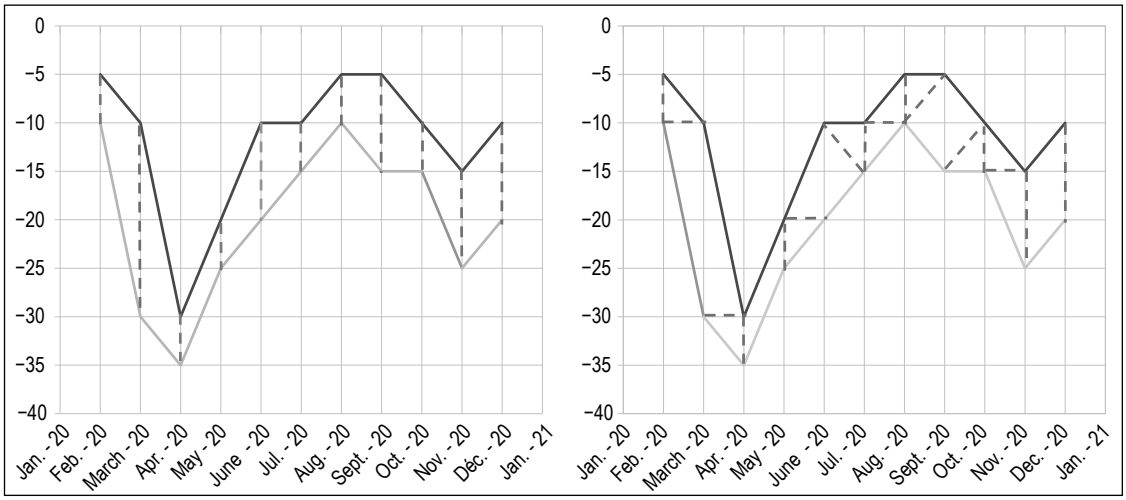
2.2.1. Construction of a Typology using Time Series Clustering

Business shock profiles for 2020 are identified using time series clustering. This method consists in partitioning a population of series into a given number of homogeneous classes according to the dynamic time warping[18] (DTW) distance (Berndt & Clifford, 1994; Ratanamahatana & Keogh, 2004). Figure II illustrates the difference between this distance and a Euclidean distance: the Euclidean approach simply compares the series point by point, whereas the DTW approach compares the series two by two and distorts the order of the points to align them as much as possible. This distortion only occurs within a window of width equal to 10% of the size of the series, i.e. one month (Aghabozorgi *et al.*, 2015).

The monthly shock trajectories are divided into k classes to minimise the DTW distance between elements of the same class (Sardá-Espinosa, 2019). To do this, k trajectories are drawn randomly in the sample to form the centre of each class. The other trajectories are then compared with the different centres and assigned to the class whose centre is closest. When all the series have been classified, the median series of each classe becomes the new centre and the process is repeated until the partition converges or until the maximum number of iterations is reached. The final partition depends on both the number of classes chosen and the initial centres. A 4 class partition was chosen here to optimise the quality of the partition while maintaining a large number of classes.[19] The clustering was

18. *Details in Bureau* et al. *(2021a, p. 15).*
19. *Details in Bureau* et al. *(2021a, Appendix H, p. 86).*

Figure II – **Comparison of Euclidean (left) and DTW (right) distances**



Reading Note: The Euclidean distance in March 2020 is the difference between the two series in that month. The DTW distance instead compares the March value of the black series with the February value of the grey series, which it is closer to, and conversely the March value of the grey series is compared with the April value.

repeated ten times to ensure the stability of the final partition. Confusion, i.e. the proportion of companies changing classes between these repetitions, remains close to zero in all these repetitions.

2.2.2. Explaining the Breakdown of Companies between Profiles: Implementation of a Classification Model

The identification of the trajectory profiles and the distribution of companies is based exclusively on the estimated monthly activity shocks, but the latter may be correlated with companies' characteristics. To explain retroactively the allocation of companies between these trajectories, we study the correlations between the profile assigned to companies and their characteristics.

The explanatory variables used in the model are the activity sector, the companies' size, their dates of creation and the existence of an export activity, as well as variables relating to the development of online sales, delivery systems, new products or services, reorganisation of the activity, pooling of resources with other companies and the investment in new technologies during the crisis. These variables are taken from FARE and survey data. Matching with survey data restricts the sample to 13,500 companies. To maintain a sample in which the proportion of companies assigned to each trajectory profile is similar to that of the sample and to have an identical distribution in terms of size, activity sector, date of creation and existence of export activity, weights are assigned to companies using a margin calibration method (Deville & Särndal, 1992; Rebecq, 2016). The classification model is an unordered multinomial logit model estimated by neural network with the Broyden-Fletcher-Goldfarb-Shanno[20] method.

3. Results

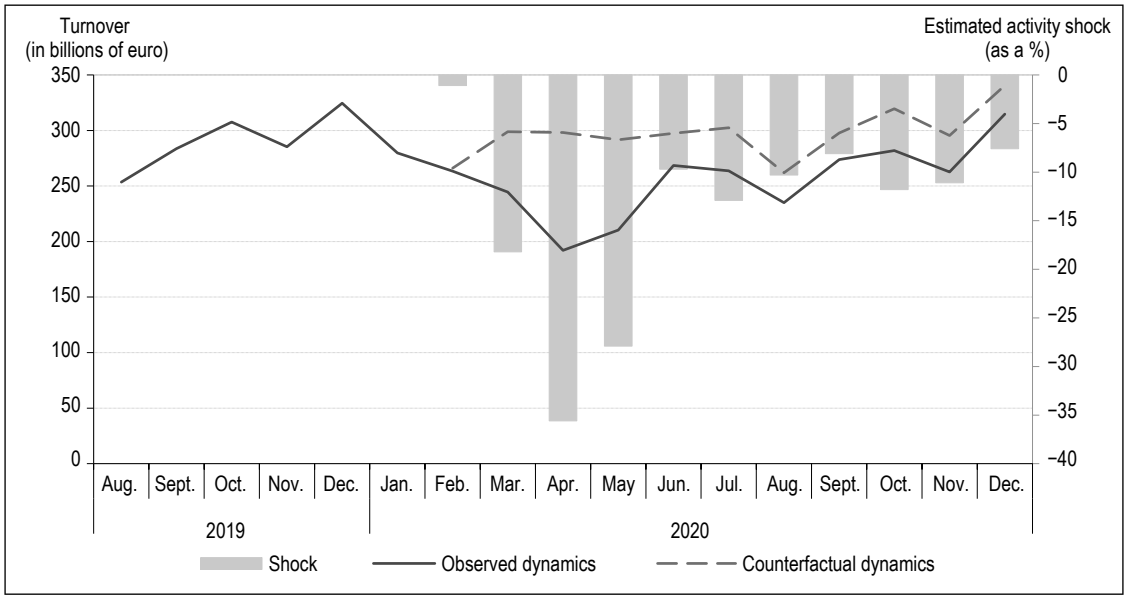
3.1. A Very Significant Impact on Business Activity with Varying Magnitude Over the Year

Total economic activity was very slow during the first lockdown of 2020. Between March and May, its level is 27% below its estimated level in the absence of a pandemic (Figure III). In April alone, this difference reaches −35%. Economic activity then rebounded between June and October, while remaining 10% below its expected level. The loss of activity in spring was therefore not offset by higher activity in the summer or early autumn. In the fourth quarter, which includes the second lockdown, the loss of activity is estimated at about 10%. On the one hand, the second lockdown was shorter and less restrictive than the first. On the other hand, companies were more able to adapt their strategies and organisation than at the beginning of the pandemic.

Over 2020, the total amounts of turnover in the French economy deviated from their expected trajectory, with varying degrees of intensity depending on the month studied. These consistently negative deviations at the macroeconomic level are the result of both positive

20. *Details in Bureau* et al. *(2021a, Appendix K, p. 91).*

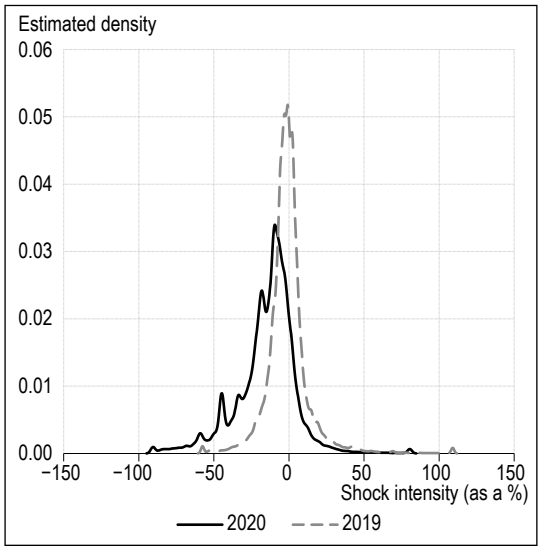
Figure III – **Change in the aggregate activity shock in 2020**



Sources: DGFiP, VAT returns. Calculations by the authors.

and negative activity shocks at the individual level. In the absence of a crisis (2019), the distribution of the modelled individual activity shocks is symmetrical, centred around zero and of low variance. On the contrary, in 2020, the distribution of annual shocks is no longer symmetrical: it has shifted sharply to the left, reflecting a higher proportion of negative shocks (Figure IV). The aggregate activity losses therefore reflect the greater prevalence, in 2020, of negative individual activity shocks, sometimes of great intensity.

Figure IV – **Distributions of individual activity shocks in 2019 and 2020**



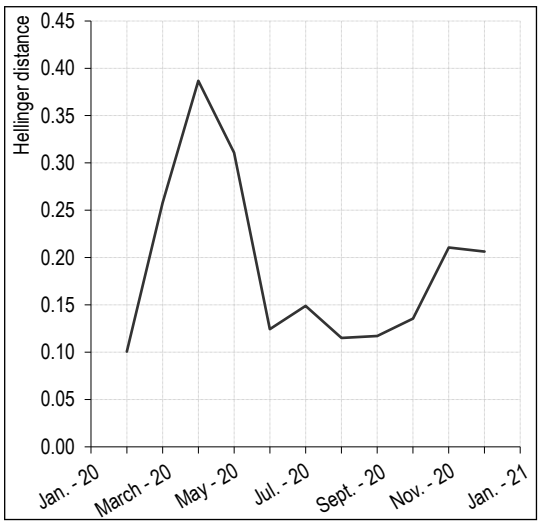
Notes: Density is estimated by kernel.
Sources: DGFiP, VAT returns. Calculations by the authors.

The distortion of the individual activity shock distributions changes monthly based on the intensity of the economic shock. The Hellinger distance, which compares the distributions of the activity shocks for the same month of 2019 and 2020, illustrates this change (Figure V).[21] The measured dissimilarity is very low for the month of February, the first month modelled during the early days of the crisis. Thereafter, the distortion of individual shocks seems to intensify depending on the timing of the restrictive measures: strongest in April before progressively reducing until October, when the curfew and then the second lockdown were introduced.

3.2. Heterogeneity of Individual Situations Exceeds Sectoral Affiliation

Even when the impact of the crisis is most severe, the distributions of individual activity shocks reveal that a number of companies experience positive deviations from their expected trajectories. In the midst of the first lockdown,

Figure V – **Hellinger distance between the monthly distributions of individual shocks in 2019 and 2020**



Source: DGFiP, VAT returns. Calculations by the authors.

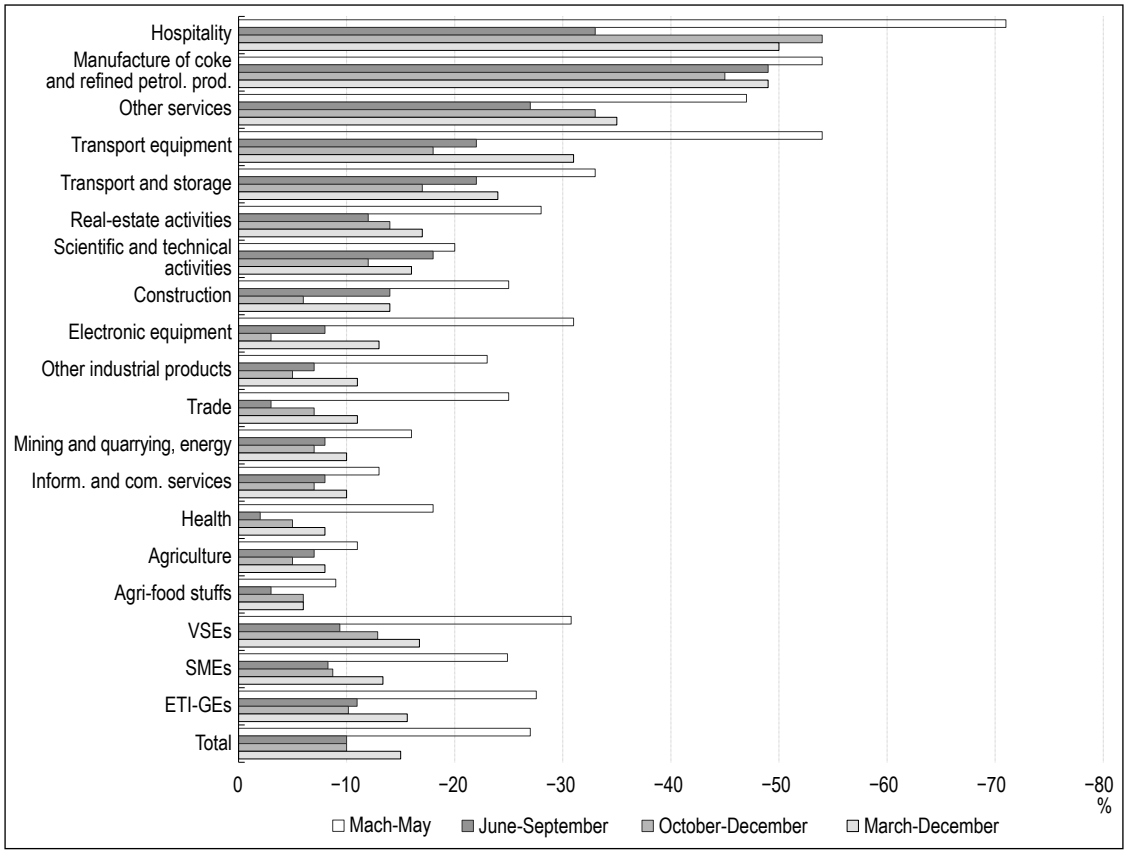
some companies are doing at least as well as they could have in the absence of a crisis. This heterogeneity raises questions, particularly with regard to the role of the activity sector in the observed differences, especially as the dissimilarities between the distributions of activity shocks in 2019 and 2020 are more pronounced during the lockdowns.

Indeed, the first lockdown constituted a shock for all sectors, but of varying magnitude. Hospitality and transportation equipment manufacturing were the two sectors who suffered the biggest losses in economic activity, with estimated activity losses of −71% and −54%, respectively, between March and May (Figure VI). The information and communication, agriculture and agri-food sectors were more resilient (respectively −13%, −11% and −9%). On the contrary, during the second lockdown, only some sectors saw their activity deteriorate significantly after the general moderate recovery in the summer: hospitality (−54%) and "other services" (−33%). For the bulk of the other sectors, the decline in activity was more limited.[22] In several industrial sectors, such as electronics and other industrial products, economic activity rebounded between the two lockdowns and almost recovered to the expected level for the latter (−3% and −5%, respectively).

While cross-sectoral differences are pronounced at this level of division, it is likely that they do not entirely explain the diversity of individual situations experienced by French companies. For each sector, Figure VII presents the main quantiles,

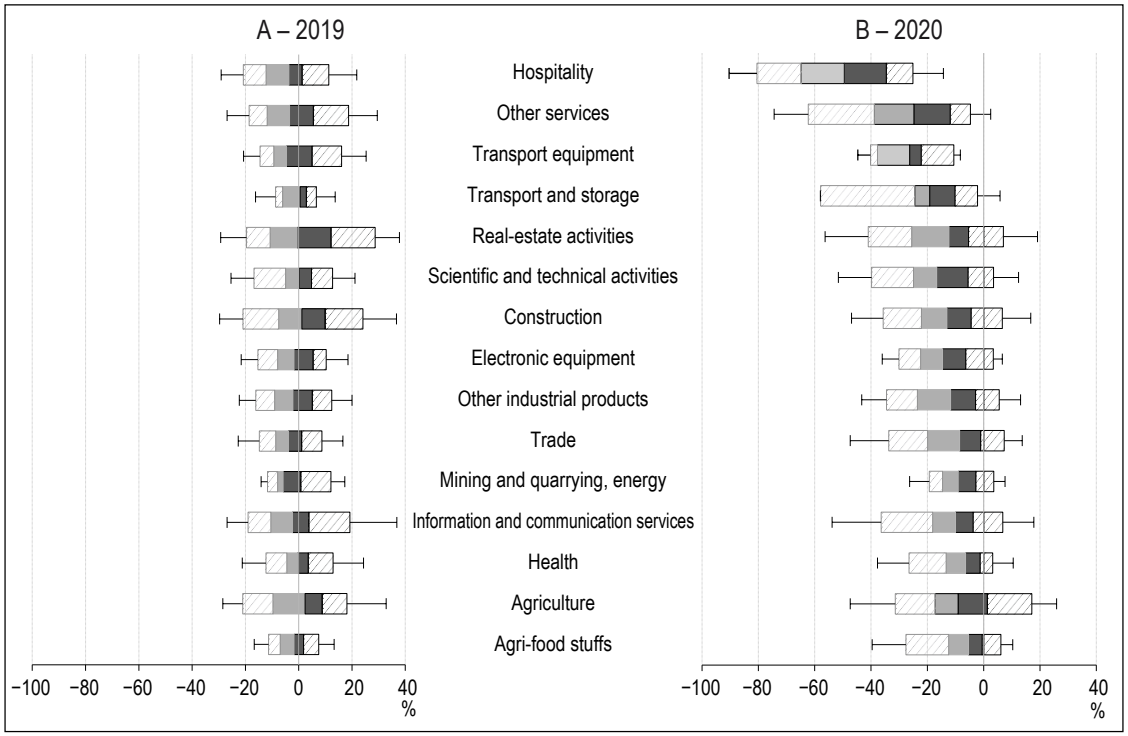
21. *Details in Bureau* et al. *(2021a, Appendix F.1.b, Figures F.2 and F.3).*
22. *Details in Bureau* et al., *2021a, Appendix E, p. 62*

Figure VI – **Combined economic activity shock from March to December 2020: sectoral breakdown**



Source: DGFiP, VAT returns. Calculations by the authors.

Figure VII – **Dispersion of the activity shocks by sector in 2019 and 2020**



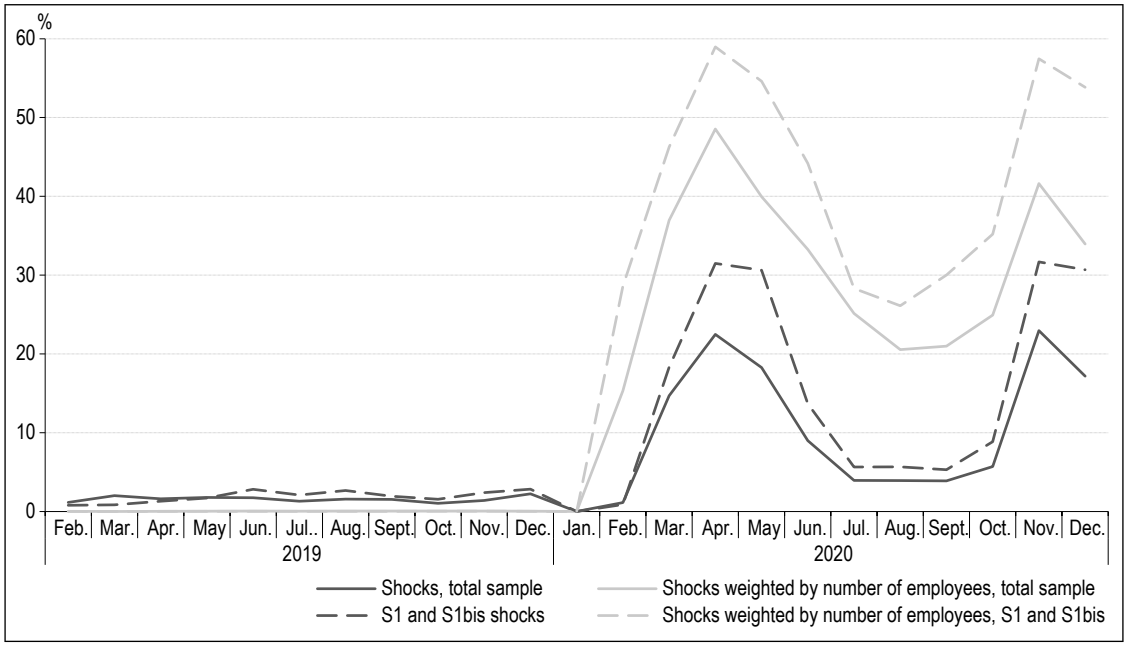
Notes: Each row represents the breakdown of individual activity shocks within a sector via a boxplot. The different segments of the boxes distinguish the quantiles at 10%, 25%, 50% (median), 75% and 90%. The whiskers represent the value of the 5% and 95% quantiles. Due to its low numbers, the coke and refined petroleum product sector is not represented.
Reading Note: In 2020, in the "Hospitality" sector, 5% of employees worked in companies that experienced an activity shock of at least −90.4% or less, and 50% with a shock of −50% or less.
Sources: DGFiP, VAT returns. Calculations by the authors.

weighted by the number of employees,[23] of the distribution of estimated activity shocks for the companies in each sector in 2020 and 2019. In 2020, the majority of companies in each sector experience loss of business, and the situation of the sectors are heterogeneous with very different median shocks. Therefore, each sector displays a substantial dispersion with some highly affected companies, sometimes ceasing all activity, and others that achieve their expected level of activity despite the crisis. These differences observed within a 17-sector breakdown can be explained by the fact that the health restriction measures, particularly the temporary closures, affected more finely defined sectors. At the finest level of the French classification of activities (732 categories or "sub-sectors"), the median annual shocks vary greatly between the sub-sectors of the same aggregate sector, even among those most affected sectors. For example, in hospitality, fast food establishments were more resilient (−34%) than beverage serving (−55%) or catering (−70%) activites, all forced to close in March.[24] For "other services", the largest loss relates to the operation of arts facilities (–80%), while funeral services continued (−4%). Similarly, the least affected sectors, such as trade and food manufacturing, also include heavily affected sub-sectors (department stores −52%, bakeries −23%) and others with moderate gains in activity (retail sale of household appliance +8%, pasta manufacturing +8%).

However, can the diversity of the situations of French companies during the COVID-19 pandemic be solely attributed to the activity sector, even when considered at its finest division? The breakdown of the monthly variance of individual activity shocks between a proportion attributable to the activity sector (732 categories) and a residual proportion allows an assessment of the contribution of the sector to the diversity of business situations. In 2020, the activity sector contributes 43%[25] to the variance of individual activity shocks, much more than in 2019 (Figure VIII). The contribution of the sector to the heterogeneity of shocks is also higher during the months of lockdown, which unevenly affected the various sectors. In April 2020, the sector contributed 48% to the variance of the workforce-weighted shocks. The role of the sector in the dispersion of shocks is also consistently greater in the S1 and S1bis sectors,[26] which were more affected by health restrictions and administrative closures.

23. The dispersion of individual workforce-weighted activity shocks reflects the dispersion of shocks for employees belonging to these companies. The unweighted dispersion reflects the dispersion of shocks for companies, i.e. for VSEs as they are predominant in both the economy and the sample.
24. See Bureau et al. *(2021b).*
25. Breakdown with weighting by number of employees.
26. The lists of sectors S1 and S1bis are defined by successive amendments to the Decree of 30 March 2020 concerning the solidarity fund. The development of these lists has been reconstructed, month by month, over 2020. The S1 list covers sectors particularly affected by the crisis and administrative closures, particularly in the areas of food service, tourism, event management, culture and sport. The S1bis list covers sectors related to, for example, film distribution and book publishing.

Figure VIII – **Contribution of the intersectoral variance to the variance of the activity shocks**



Notes: Each curve corresponds to the proportion of cross-sectoral variance in the total variance of shocks, each month.
Reading Note: In April 2020, the cross-sectoral variance represents 23% of the total variance of the sample shocks, 48% when weighted by number of employees.
Sources: DGFiP, VAT returns. Calculations by the authors.

The role played by the activity sector in individual deviations from the modelled activity trajectory is significantly greater in 2020 than in 2019. In 2020, th sector's contribution to the heterogeneity of situations is greater during the months with marked health measures. However, even at its peak, this contribution only represents half of the total heterogeneity, so other factors necessarily influence the observed activity shocks. To jointly address the heterogeneity of individual situations, month by month, and the various factors that can explain these differences between companies and their change over time, the analysis is extended in two stages: first by identifying a relevant typology of the different business trajectories during 2020 to group together companies whose changes in business gains or losses was comparable over the year. Then by studying the determinants of belonging to each trajectory profile using a multinomial classification model.

3.3. Four Profiles of Shock Trajectories During the Crisis

Establishing a typology of the individual trajectories of companies in 2020 allows us to identify four standard trajectories of monthly activity shocks in 2020 (Figure IX). Each of these profiles distinguishes itself from the others both by the magnitude of the shock experienced at the beginning of the pandemic and by the resilience displayed, i.e. the capacity to return to its expected non-crisis trajectory. Specifically, the following groups are identified:

- 'Unaffected' companies (36% of companies and 42% of employees):

The first lockdown had a limited impact on these companies, with an mean shock[27] of −14% in April, followed by a recovery towards the expected activity level from June on. With the exception of first lockdown, the distribution of shocks within this group is comparable with that of a "normal" year.

- 'Resilient' companies (38% of companies and 44% of employees):

Their initial loss of activity was more substantial, with a mean impact of −51% in April. From June onwards, losses are lower and the mean impact remains stable at around −20% until the end of the year.

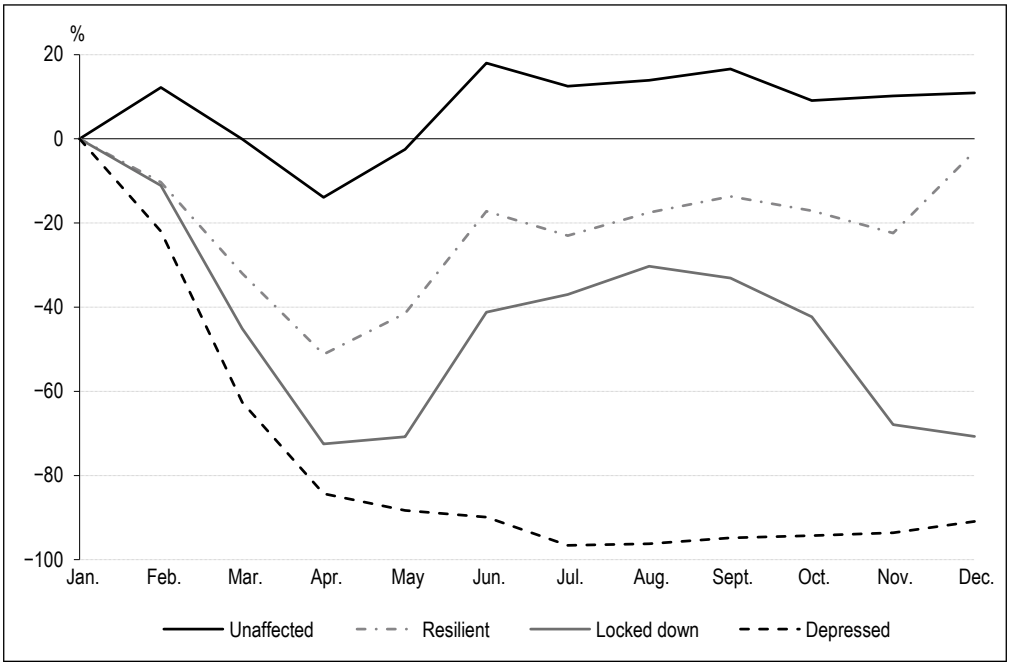
- 'Locked down' companies (20% of companies and 12% of employees):

Their average trajectory is characterised by major lockdown shocks (–72% in April, −70% in November and December) and limited recovery of activity during the summer.

- 'Depressed' companies (6% of companies and 2% of employees):

27. All means are calculated on right-hand winsorized series: shocks higher that the 95th percentile are reduced to the value of this quantile.

Figure IX – **Average shock for each trajectory profile**



Reading Note: Companies in the "Unaffected" profile experienced a mean shock of −14% in April 2020.
Sources: DGFiP, VAT returns. Calculations by the authors.

Their activity collapsed during the first lockdown (−84% on average in April), with no recovery in the summer. The median shocks among these companies are close to −100% from April to December 2020, and a third of them report zero turnover over this entire period.

3.4. Characterising the Activity Trajectory of Companies: Beyond the Activity Sector, Organisational Adaptation

The distribution of companies between the trajectory profiles is "unsupervised" and therefore depends only on each company's estimated activity shocks. The exploration of the correlations between the characteristics of companies and their trajectory profile makes it possible to clarify *ex post* the underlying logic behind the difficulties they may have encountered.

The coefficients resulting from the classification model studying these correlations are statistically significant[28] (Appendix A2). The activity sector is the dominant factor in the distribution of companies between these trajectories. It accounts for almost 85% of the allocation of the companies explained by the model.[29] This proportion is attributable to the very high sectoral dependence of the most affected profiles, which are almost entirely made up of companies from sectors administratively closed during the lockdowns. Conditionally to other variables, the sectors with the highest probability of belonging to the 'Unaffected' profile are those of consumer electronics manufacturing, food industry sub-sectors, veterinary activities and the medical sector. In the 'Resilient' profile, the majority are manufacturers of jewellery, computers, peripheral equipment and automotive equipment. The sectors with the highest probability of belonging to the 'Locked down' profile are those of rail transport, libraries and museums. Finally, in the 'Depressed' profile, the sub-sectors of culture, hospitality and tourism, and passenger transport are the most over-represented.

Conditionally to the sector, the effect of other variables on the probability of being in the different classes is significant, but smaller in scale. In other words, the absolute difference in the probability of belonging to a profile is much greater between two different sectors than between two modalities of another variable in the model. However, by expressing the effects of each of these variables as a percentage of change in the probability of being assigned to each profile,[30] several elements emerge (Figure X).

SMEs, particularly VSEs, which were more affected on average during lockdown, have, all things being equal, more chance of belonging to the 'Locked down' profile, illustrating the specific difficulties faced by VSEs in a number of sectors.

Exporting companies, in turn, have a higher likelihood of belonging to the 'Depressed' profile, probably owing to their dependence on foreign markets and falling external demand. The development of new products and retail systems following the crisis is associated with a higher probability of belonging to the 'Unaffected' profile and a lower probability of belonging to the most affected profiles. The same is true for specific investments in new technologies, particularly digital technology. The ability to adapt to health restrictions, particularly those affecting the way in which the supply and distribution of products are organised, was therefore important.

The reorganisation of activity and the pooling of resources with other companies are linked to a higher probability of belonging to both the 'Unaffected' and the 'Depressed' profiles. Companies that rapidly adapted their businesses were able to maintain their levels of turnover. On the other hand, pooling of resources may have been retrospectively necessary for the most affected companies, explaining a positive marginal effect in the 'Depressed' profile by a reverse causality mechanism.

These results allow for a more detailed exploration of the variables correlated with the heterogeneity of the observed situations. In particular, while the sector is indeed the main factor explaining companies' shock trajectories, the correlations observed with some of their other characteristics, including their adaptation strategy during the crisis, provide a better understanding of the observed dispersion.

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28. The observations are weighted by the coefficients from margin calibration during regression. This weighting can have a positive impact on the significance of the effects displayed.

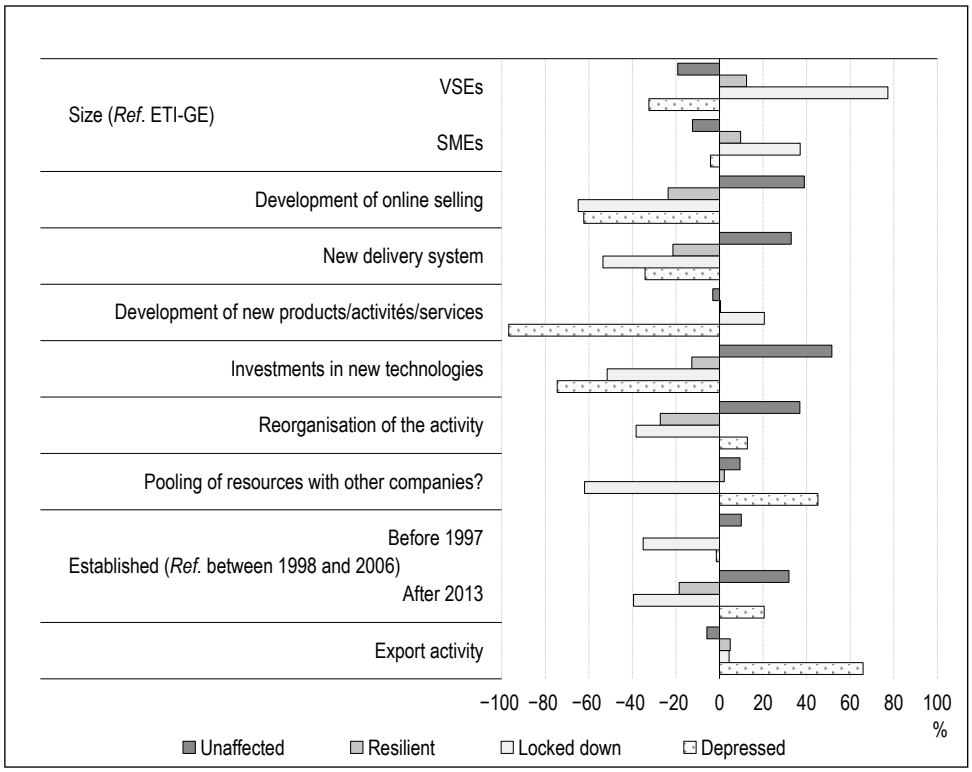
29. Estimate by use of the Cox-Snell (Cox & Snell, 1989) adjusted.

30. These effects are based on the calculation of the predicted probabilities at the mean of belonging to each profile for all the modalities of the categorical explanatory variables. Comparing these probabilities by varying only the modality of the same categorical variable, allows us to calculate the relative effect of switching from one modality to another based on the probability of belonging to each profile. Formally, the effect of a binary variable j *on the probability of belonging to profile* c *is:*

$$Effect_{j,c} = \frac{\mathbb{P}\left(Profile_c \mid X_j = 1, X_{-j}\right) - \mathbb{P}\left(Profile_c \mid X_j = 0, X_{-j}\right)}{\mathbb{P}\left(Profile_c \mid X_j = 0, X_{-j}\right)}, \forall c \in [1,4]$$

These effects were also calculated by taking the mean of the variations in the predicted individual probabilities, with no impact on the trends in the results. This measure makes the predicted probability changes attributable to each explanatory variable commensurable for each activity trajectory, regardless of the size of these groups. For the use of predicted probabilities for logit models, see Long, 1997; Pryanishnikov & Zigova, 2003; Stratton et al.*, 2008; Peng & Nichols, 2003; Wulff, 2015.*

Figure X – **Marginal effects of the classification model variables**



Reading Note: Companies that have developed online sales since the start of the crisis are 1.38 times more likely to belong to the 'Unaffected' profile than other companies. In other words, the marginal effect of online sales development on belonging to the 'Unaffected' profile is +38%. Formally:

$$Effect_{Online\ Sales, Profile_1} = \frac{\mathbb{P}\left(Profile_1 \mid X_{Online\ Sales}=1, X_{-Online\ Sales}\right) - \mathbb{P}\left(Profile_1 \mid X_{Online\ Sales}=0, X_{-Online\ Sales}\right)}{\mathbb{P}\left(Profile_1 \mid X_{Online\ Sales}=0, X_{-Online\ Sales}\right)} = 0.38$$

Sources: DGFIP, VAT returns; INSEE, Impact of the health crisis on business organisation and activity survey. Calculations by the authors.

* *
*

A striking result of this analysis is the high prevalence of companies that went through the crisis without deviating from the level of growth they would have experienced without the crisis. The aggregate loss of business is large but hides two dimensions of the crisis. On the one hand, not all companies experienced loss of business, and on the other hand, even if most companies were unable to compensate for the initial shock, a substantial proportion of them were able to recover their business trajectory to approach or even exceed the counterfactual scenario. It is particularly notable, for example, that the 'Unaffected' profile comprises more than a third of companies and employees, more than 'Locked down' and 'Depressed' companies put together. To better understand the consequences of the crisis, it is necessary to identify the companies that fared better at the other end of the spectrum, which includes companies that practically ceased their activity from March onwards. In this respect, organisational adaptations, particularly investments in new technologies, are important as they are correlate to the least affected activity trajectories and seem to have partially mitigated the difficulties associated with some health restrictions defined at the sectoral level. The fact that the ability to implement organisational adaptation strategies after the onset of the crisis may have been uneven among companies raises the question of its role in exacerbating or mitigating situations predating the crisis. In other words, were the activity losses more pronounced for companies that were already in trouble when the crisis began?

The Banque de France rating assesses the risks associated with loans granted to companies by estimating the companies' ability to meet their financial commitments within a three-year horizon[31] and thus offers an indicator of the financial health of companies

31. The rating is that of December 31st 2019. For profiled groups, the rating for the head of group, as documented in FARE, is used. If the SIREN number of the head of group is not known, the legal unit with the highest highest value-added within the profiled company is used.

before the crisis.[32] Combining this indicator with the activity trajectory category followed by companies in 2020 shows that the highest rated companies are more often found among the preserved ('Unaffected' and 'Resilient') profiles, while companies considered fragile before the crisis have more often experienced highly affected trajectories ('Locked down' and 'Depressed'). The ratings range from 3++, for companies whose ability to meet their commitments is considered excellent, to P, for companies in insolvency proceedings (i.e. compulsory receivership or liquidation).[33] Among the highest-rated companies (3++) at the end of 2019, 45% were 'Unaffected' (Figure XI). This proportion decreases as the listing levels fall to 30% for companies rated 5 and 12.5% for companies rated P. This gradient reverses for 'Depressed' companies, accounting for 1.5% of companies rated 3++, the lowest share among all rates. This proportion increases as ratings decrease, reaching 7% for companies rated 5, 16% for companies rated 9 and 45% for companies rated P.

These ratings may be correlated with the activity sector or other characteristics of the companies, such as their size or age and even their ability to adapt their behaviour and organisation during the crisis (Bureau *et al.*, 2021a). The statistics presented here are descriptive and should not be analysed independently of the results of the classification model presented,[34] but they do provide an additional lesson: the companies whose trajectory has moved the furthest away from the level of growth that would have been expected in 2020 are those that were already vulnerable before the start of the pandemic. In other words, the impact strictly attributable to the crisis was greater for companies that were vulnerable from the outset. So the crisis may have exacerbated pre-existing differences by weighing more heavily on companies that are already facing difficulties.[35]

The approach developed in this article aims to go beyond the theoretical debates on the crisis

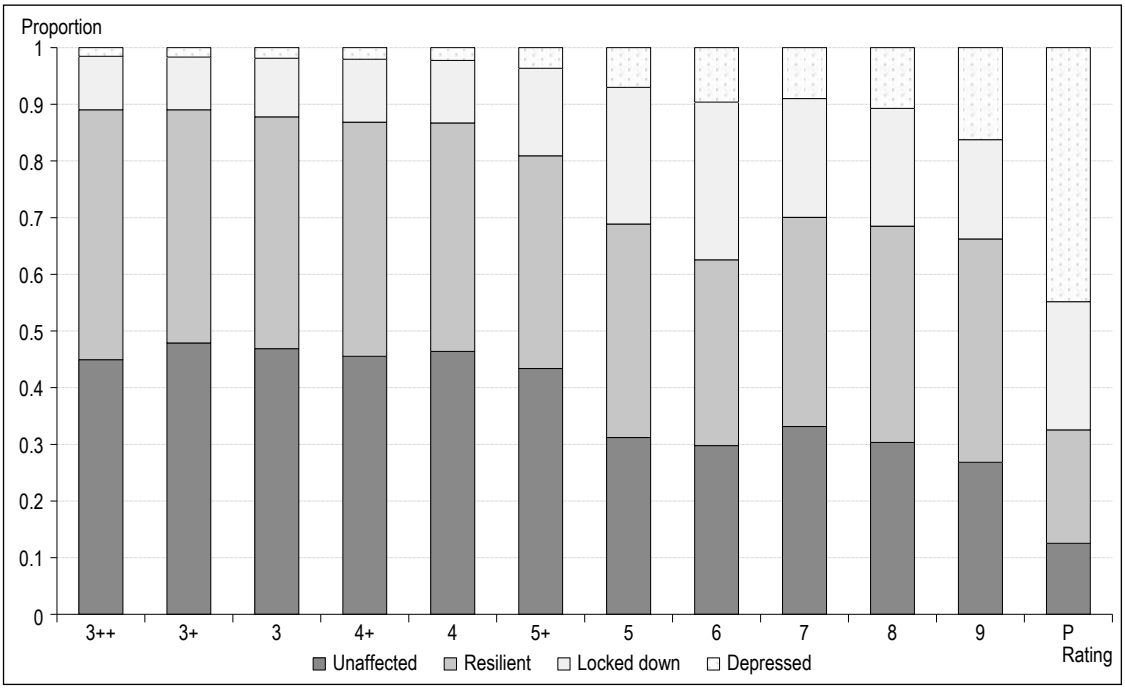
32. The rating is carried out by the Banque de France on the basis of an analysis of the accounting, financial and judicial information on the companies, their potential payment incidents affecting trade and qualitative information reported by company heads.

33. A number of companies are not listed and are given a 0 rating. These are the companies for which Banque de France does not have recent accounting documentation or has not gathered unfavourable information on trade bill payments or judicial information or decisions. These ratings are excluded from the breakdowns presented but account for fairly stable proportion between the different trajectory categories.

34. The limited access to these data allowed us to work only on the aggregate breakdown of companies by rating and trajectory profile established by our study. Inclusion in the multinomial model could have provided additional elements.

35. These findings echo the Institut des Politiques Publiques (IPP)' assessments that the crisis hit low-productivity companies harder, with a marked sectoral effect (Bach et al.*, 2020). Here, we show that this impact is more pronounced, even in relation to the trajectory that companies would have experienced without a crisis. Bureau* et al. *(2022) also show that public support measures have not benefited the most fragile companies* ex ante *any more.*

Figure XI – **Breakdown of companies by Banque de France rating as of December 31st 2019 and trajectory of activity in 2020**



Reading Note: Among the companies rated 3++ in 31 December 2019, 45% belong to the "Unaffected" profile.
Sources: DGFIP, VAT returns; Banque de France ratings. Calculations by the authors.

to study the impact that is actually attributable to it. By establishing individual reference scenarios, this work enables us to rethink the consequences of the crisis by taking into account the growth trajectories that companies followed before the pandemic, but also calls for an extension of the analysis to model the financial situations of companies during the crisis, by incorporating both public aid and adaptations of company behaviour (payment of dividends, intermediate consumption, investments). This financial model would enable an assessment of the financial needs of companies by incorporating the amounts of activity achieved (or lost) in 2020 and to quantify the amounts of cash flow required to resume a level of activity consistent with the dynamics experienced before the crisis, which could be estimated thanks to the counterfactuals in this study. These developments are the subject of further work. □

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APPENDIX 1

CONSTRUCTION OF SERIES OF TURNOVER

The formula for estimating turnover from VAT return data is as follows:

$$CA_{i,t} = CAF_{i,t} + CAE_{i,t}$$
$$\Leftrightarrow CA_{i,t} = \left(BI_{i,t} - AA_{i,t} - AOI_{i,t} + a.b.AONI_{i,t}\right) + \left(UE_{i,t} + HUE_{i,t} + a.(1-b).AONI_{i,t}\right)$$

with *a* and *b* set by default at 1.

Table A1 – **Dictionary of the variables derived from the VAT returns**

Taxable base excluding tax, in France(TB)	Transactions performed in France at a normal rate of 20% + in metropolitan France at reduced 5.5% rate + in metropolitan France at reduced 10% rate + in overseas departments at normal 8.5% rate + in overseas departments at 2.1% reduced rate + old rates + taxable transactions at a particular rate
Self-liquidated purchases (SLPs)	Purchase of intra-community services + Imports + Intra-community acquisitions + Delivery of electricity, natural gas, heat or cold taxable in France + Purchases of goods or services made from a taxable person not established in France
Other taxable transactions (OTTs)	Other taxable transactions
Other non-taxable transactions (ONTTs)	Other non-taxable transactions
Exports to the European Union (EU)	Intra-community deliveries to a taxable person − B2B sales + Delivey of electricity, natural gas, heat or cold deliveries non-taxable in France
Exports outside the European Union (OEU)	Exports outside EU

APPENDIX 2

RESULTS OF THE CLASSIFICATION MODEL

Table A2 – **Regression results of the mlogit model**

	Dependent variable					
Independent variables	Locked down profile		Resilient profile		Unaffected profile	
Size: VSEs	0.330***	(0.027)	0.786***	(0.044)	−0.178***	(0.054)
Size: SMEs	0.224***	(0.027)	0.447***	(0.044)	0.090*	(0.054)
Date of creation: Before 1997	0.385***	(0.009)	0.251***	(0.013)	−0.020	(0.022)
Date of creation: Between 1998 and 2006	0.481***	(0.009)	0.780***	(0.012)	0.091***	(0.020)
Date of creation: Between 2007 and 2012	0.343***	(0.009)	−0.098***	(0.012)	0.229***	(0.019)
Export activity	0.108***	(0.010)	0.103***	(0.014)	0.566***	(0.027)
Development of online selling	−0.598***	(0.013)	−1.375***	(0.022)	−1.304***	(0.037)
Development of new delivery systems	−0.525***	(0.013)	−1.049***	(0.022)	−0.703***	(0.036)
Development of new products/services	0.035***	(0.011)	0.219***	(0.016)	−3.410***	(0.063)
Investment in new technologies	−0.553***	(0.020)	−1.141***	(0.029)	−1.784***	(0.042)
Reorganisation of the activity	−0.632***	(0.013)	−0.797***	(0.021)	−0.194***	(0.035)
Pooling of resources	−0.068***	(0.013)	−1.057***	(0.022)	0.283***	(0.026)
Remote workforce	−0.004***	(0.0002)	−0.008***	(0.0002)	−0.009***	(0.0004)
Constant	−7.878***	(0.038)	−7.120***	(0.057)	−7.748***	(0.072)
AIC	1,199,764.000		1,199,764.000		1,199,764.000	
N	13,426					

*p<0.1 ; **p<0.05 ; ***p<0.01.
Sources: DGFIP, VAT returns; INSEE, Impact of the health crisis on business organisation and activity survey. Calculations by the authors.

A Granular Examination of the Impact of the Health Crisis and the Public Support Measures on French Companies' Financial Situation

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Abstract – We develop a microsimulation model fed by a particularly rich set of individual data in order to assess the impact of the health crisis on the financial situation of more than 645,000 French companies in 2020. We show that the relative stability in net debt at the macroeconomic level is concealing major disparities on an individual level. Heterogeneity is particularly significant between sectors (before and after public support measures) but is also present within each sector. Our simulations confirm the need for public intervention during the crisis: a mere adjustment in company behaviour is insufficient to absorb the shock. These support measures brought the share of firms with a negative cash flow shock in line with normal years, although "extreme" cash flow shocks occur more frequently than usual. One important lesson learned from this exercise is that sector and size cannot be the only criteria taken into account when drawing up crisis recovery policies.

JEL Classification: D22, G32, G38
Keywords: COVID-19, microsimulation, non-financial corporations, cash flow, debt

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The French economy suffered an unprecedented shock in 2020, with GDP shrinking by 7.9%.[1] To absorb the resulting loss of revenue, French companies resorted to huge amounts of debt, with the debt of non-financial corporations (NFCs) increasing by nearly 217 billion euros (+12%) in 2020. At the same time, their cash holdings also increased by more than 200 billion euros (+29%). At the end of 2020, the impact of the crisis on the net debt of French companies was therefore relatively limited, increasing by only 17 billion euros (+0.8%). However, liquidity and solvency risks analysis must go beyond this aggregate picture and assess risks at the individual level: it is crucial to identify which companies have additional debt, which have additional liquidity, and if the same companies have both.

In this article, we develop a microsimulation model in order to assess the impact of the health crisis on the financial situation of companies at the individual level, and to accurately identify the disparity in cash flow situations in 2020. Estimates of the cash flow shocks experienced by each company and their ensuing financing needs (before and after taking into account the effect of public support measures) also serve as a starting point for evaluating France's *quoi qu'il en coûte* ("whatever it takes") policy.

Our study joins a number of recent research studies that seek to evaluate the impact of the COVID-19 pandemic and of the resulting restrictions taken to contain it on companies' financial health. The lack of data enabling changes in companies' individual financial situations to be monitored and measured in real time as the pandemic progressed make this a particularly difficult task. In this context, it becomes necessary to use alternative, high-frequency data (monthly VAT data in our case) to capture changes in business activity during 2020, and to simulate the impact of this altered activity on the financial situation of each company, based on the most recent balance sheets available. Finally, as some public support measures to aid companies were actually implemented (secured loans, short-time work scheme, etc.) the simulation tools used is geared more towards analysing the extent to which they were used, their intensity and even their effectiveness.

We simulate, month by month, all of the cash inflows and outflows of nearly 650,000 companies, representing 85% of the value added for NFCs (excluding sole proprietorships). To do so, we use the data provided by Bureau *et al.* (2022, this issue), who recount the turnover developments of each company in 2020, based on their monthly VAT declarations. We reason on financing remaining the same (i.e. before any debt adjustments or increases), and we estimate the cash flow shock suffered by the company each month, which corresponds, assuming capital is constant,[2] to a variation in net financial debt.

We then use these results to evaluate the NFCs' financing needs, by quantifying a so-called "operational" need. In contrast with the cash flow exhaustion or illiquidity situation often discussed in the literature (Guerini *et al.*, 2020; Hadjibeyli *et al.*, 2021), this approach is based on the idea that companies need to maintain an operational cash flow cushion that can be used immediately to fund the operating cycle when activity does pick up. This operational need therefore corresponds to the external funding request submitted by NFCs to the financial sector.

From a methodological point of view, our work sits along the same lines as that of Guerini *et al.* (2020), Demmou *et al.* (2021a; 2021b), Schivardi & Romano (2021), Carletti *et al.* (2021) and Hadjibeyli *et al.* (2021). Most central banks (Anayi *et al.*, 2020; Blanco *et al.*, 2020; Tielens *et al.*, 2021) and major institutions (Maurin & Rozália, 2020; Connell Garcia & Ho, 2021; Soledad Martinez-Peria *et al.*, 2021) have also conducted similar exercises to ours. These simulations, carried out using individual accounting data, differ from more structural studies (Gourinchas *et al.*, 2021) and work based on survey data (Bloom *et al.*, 2021).

To our knowledge, our study is one of only three to conduct a comprehensive simulation of cash flows, alongside those of the Bank of England (Anayi *et al.*, 2020)[3] and the Bank of Spain (Blanco *et al.*, 2020). Investments, dividend payments and financial flows relating to client/supplier payments are effectively ignored in the other studies listed above, especially those that are based on France and that use relatively similar data to ours (Guerini *et al.*, 2020; Hadjibeyli *et al.*, 2021).[4]

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1. According to the estimation available at the time of writing and subject to revision, as are the other figures in this paragraph.
2. And excluding the disposal of assets.
3. Unlike ours, the Bank of England study is mainly based on large enterprises; it looks at 95,000 companies, the majority of which have a turnover of more than 10 million pounds (11.66 million euros). In the absence of any relevant data, the accounts and turnover of small enterprises are simulated in their entirety.
4. With the exception of Banque de France company rating data, which is original to our study.

One major advantage of our study is that it looks at the real activity of companies month after month using VAT data, while the most comprehensive studies in terms of modelling, such as that of the Bank of England, rely partly on modelling activity trajectories at the sectoral level. Unlike the Directorate-General of the French Treasury study (Hadjibeyli *et al.*, 2021), which imputes a sectoral activity shock, defined at the NACE 17 level, to firms for which monthly VAT data is not available, we choose to use only monthly activity shocks observed at the individual level, and thus have a smaller sample. We also have information on the effective use of short-time work and deferrals in social security contributions at the individual level, which allows us to analyse, in detail, the heterogeneity of individual situations. Finally, for the largest companies, we use the profiled accounts drawn up by INSEE (companies in the sense of the Law on the Modernisation of the Economy, see below), which enable us to implicitly take into account intra-group cash flows. This is especially important during times of crisis, when liquidity flows between subsidiaries, and is an original aspect of our study.

Firstly, we observe very strong heterogeneity in the cash flow shocks suffered by NFCs in 2020, between sectors, within the same sector, and between companies in the same size category or with the same risk classification. The occurrence and intensity of negative cash flow shocks as at the end of 2020 were correlated to companies' pre-crisis credit quality: the riskiest companies suffered the most acute shocks, while lower risk companies generally had more liquidity, and therefore fewer operational needs. In terms of amounts, intermediate-sized enterprises (ISEs) and large enterprises (LEs), which represent 1.5% of the companies in our sample, accounted for (after support) most of the total increase in the net debt of NFCs as at the end of 2020. Finally, we show that the support measures recenter the distribution of cash flow shocks so that they more closely resembled those seen in a "normal" year (2018), but the dispersion of these shocks remained high, with a higher proportion of very negative or very positive shocks: 21% of companies post a "significant" increase in net debt (more than one month's turnover) in 2020, compared to 13% in 2018, and almost 25% see a relatively "significant" fall in their net debt in 2020, compared to just 10% in 2018. This change at both tails of the distribution is even more noteworthy if we look only at the companies that were most vulnerable before the crisis.

The remainder of this article presents the data used and the scope of the study (section 1), followed by the microsimulation method (section 2) and the results (section 3). The conclusion draws lessons in terms of public policy for exiting the crisis and suggests avenues of development of the analysis.

1. Presentation of Data and the Sample

1.1. Data

We use five individual data sources which give us a good insight into companies' financial situations as well as the public support packages they benefit from:

- VAT data (DGFiP, *Direction générale des finances publiques* – Directorate-General for Public Finance): the monthly declarations submitted by companies to the DGFiP with regard to VAT payments; this data gives us the turnover of each company as the sum of all taxable and non-taxable activity conducted both in France and abroad. This data and the method used to apply it are detailed in our companion paper on the impact on activity (Bureau *et al.*, 2022, this issue).

- Company accounting data (INSEE, FARE, *Fichier approché des résultats d'ÉSANE* – ESANE approximate results database): FARE data provides information on the profit and loss accounts and balance sheets of legal units (LUs) incorporated in France. It is used to model changes in the accounting inputs into the simulation. Here, we use INSEE FARE data from 2018.[5] For analysis at the "company" level (with "company" defined by the Law on the Modernisation of the Economy), in its FARE data, INSEE also provides so-called "profiled" accounts which consolidate the activity of companies made up of several legal units (see Haag, 2019). For companies made up of several legal units, information on their profiled accounts is used, except in cases where the aggregate turnover obtained from VAT declarations (for the legal units that comprise the consolidated company) differs from that detailed in the 2018 profiled accounts. As this analysis is conducted on a sample of companies present in the 2018 FARE, it does not take into account any companies formed in 2019 or 2020. Please note that the characteristics of the companies evaluated may have changed between 2018 and 2020, in particular for the most fragile among them. This limitation is shared by all similar studies,

5. *When the study was conducted, data for 2019 was not yet available.*

as no financial statements were available for 2020 when they were conducted.[6]

- Data on short-time work scheme (DARES, *Direction de l'animation de la recherche, des études et des statistiques* – the Directorate for research and statistics of the ministry of labour): this data shows all of the short-time work permits granted to each establishment, as well as all requests for reimbursement of the compensation paid to employees under the short-time work scheme from January 2017 to November 2020.[7] We match the data declared for each establishment with the companies they belong to. In our sample, 60% of companies have at least one establishment appearing in this database.

- Data relating to social security contribution deferral and exemption schemes: the data on employer contribution exemptions/deferrals was provided by ACOSS. It covers the period from March to November 2020.[8] The database contains an entry for each month which indicates, per establishment, the amount of the social security contributions due and the amount of the social security contributions deferred. The data does not distinguish between deferred contributions (which represent social debt for the company) and contributions that are the subject of an exemption. Of all the companies in our sample, 64% have at least one establishment that appears in this database.

- Data relating to the Banque de France rating: the Banque de France rating assesses companies' ability to honour their financial commitments over a three-year period. Ratings range from 3++ (the company's ability to honour their financial commitments is deemed to be excellent) to P (the company files for bankruptcy). The rating 0 is given to companies for which the Banque de France has not gathered any payment defaults on trade bills, or any unfavourable judicial information or decisions, and does not have any recent accounting information.[9] Companies are only rated when they have a turnover of 750,000 euros or above. As a result, we document therafter a correlation between very small enterprises (VSEs) and ratings of 0. We use the rating in force at 31 December 2019.[10] Almost all companies in the sample have a Banque de France rating, although 70% of these ratings are 0. Table 1 summarises the individual data used in the study.

1.2. A Sample of More Than 645,000 Non-Financial Corporations

The study focuses on NFCs, excluding sole proprietorships, that declared their VAT on a monthly basis between 2018 and 2020. We exclude companies for which the data is imputed, those whose financial year is not 12 months long, those that have undergone a restructuring and those in the education (PZ) and public administration (OZ) sectors. Companies whose VAT data is not consistent with FARE balance sheet data are also excluded.[11] 745,806 legal units are analysed, reduced into 645,300 companies (66,986 companies profiled by INSEE and 578,314 companies made up of just one legal unit). The study sample covers 71% of the value added (VA) of NFCs (81% of the value added of ISEs and LEs, 72% of the value added of small

6. However, in 2019 and 2020, almost three quarters of new companies were set up under the micro-entrepreneur legal status (INSEE, "Enterprise births – December 2020", Informations Rapides N° 008, 15 January 2021) and therefore do not fall within the scope of our study, which only looks at companies. Please also note that using the 2019 FARE would have given rise to other issues, such as taking into account the CICE (crédit d'impôt pour la compétitivité et l'emploi – tax credit for employment and competitiveness) transforming into a reduction in long-term social security contributions and double counting in 2019.

7. For December, we do not have the amounts but we do have information on the use of the short-time work scheme. We therefore impute the compensation amounts paid in December while also extending the November compensation for companies whose short-time work period was still ongoing. For companies whose short-time work period ended in December, the compensation amount is set to zero.

8. For December, given the lack of observed data at the time this study was conducted, we imputed the amounts of deferrals declared in November.

9. For more details, please visit: https://entreprises.banque-france.fr/page-sommaire/comprendre-la-cotation-banque-de-france

10. For profiled companies, we use the rating for the head of the group. In the absence of a SIREN number for the head of the group, we use the rating for the legal unit within the profiled company with the largest value added.

11. In particular, we only analyse companies (legal units or profiled companies) for which we have identified a discrepancy of less than 35% between the annual turnover declared in FARE for the 2018 financial year and the annual turnover calculated based on monthly VAT data for the same period. Companies that are in the 2018 FARE but for which we had no VAT data in 2020 are also excluded.

Table 1 – **Individual data used in the study**

Data	Source	Years	Frequency
Turnover (VAT)	INSEE-DGFiP	2014-2020	Monthly
Balance sheets (FARE)	INSEE-DGFiP	2018	Annually
Employer contribution deferrals	ACOSS	2020	Monthly
Short-time work	DARES	2020	Monthly
Credit ratings	Banque de France (FIBEN)	2019	Rated on 31/12/2019

Notes: In addition to observed data, the microsimulation model also uses individual simulated data for solidarity funds and corporate income tax deferrals.

and medium-sized enterprises (SMEs) and 38% of the value added of VSEs).[12] Table 2 gives a breakdown by size and sector of the companies in our sample, and shows that VSEs are under-represented compared to the FARE database as a whole (96% of FARE companies and 52% of jobs). This is largely due to the fact that many VSEs are sole proprietorships and/or have data imputed in FARE and are thus excluded from our sample, or that they declare their VAT on a quarterly or annual basis and therefore cannot be included in this analysis. On the contrary, SMEs, ISEs and LEs are over-represented in terms of both workforce and jobs, compared to their weighting in the FARE database.

Some sectors appear to be under-represented ('*Trade*') or over-represented ('*Health*') compared to FARE in terms of number of companies (see Table 2). However, the sectoral breakdown of jobs in the sample is relatively similar to that for all economic activity, including in these two industries.

Table 3 describes the Banque de France credit rating distribution of our sample. The large amount of VSEs is reflected in the majority of ratings being 0 (around 70%). The best ratings (3++ to 4+, comparable to Investment Grade), represent 10% of companies in the sample (or one third of companies with a rating other than 0), while the less good ratings (4 to P, similar to the High Yield category) represent around 20% (or two thirds of companies with a rating other than 0). While the best ratings (3++ to 4+) only represent 10% of companies in the sample, they cover almost half of total employment (49%). On the contrary, ratings of 0, which represent 70% of companies in the sample, account for just 18% of total employment.

1.3. Overview of Companies' Financial and Economic Situations before the Crisis

Table 4 shows the main economic and financial characteristics of the companies in the sample in 2018. Firstly, it confirms that small enterprises dominate the sample: the median company has two employees and a turnover of 400,000 euros.

Net financial debt – financial debt net of cash holdings – was relatively low before the crisis. The median net debt was therefore negative (i.e. the liquidity held exceeded debt) and the financial leverage ratio (net debt to equity) was

12. If you exclude sole proprietorships, the coverage rate increases to 85% of the value added of NFCs.

Table 2 – **Distribution of study sample companies by sector and size**

	Companies			Jobs		
	Study sample		FARE 2018 total[(a)]	Study sample		FARE 2018 total[(a)]
	Number	% of the total	as a %	Number	% of the total	as a %
Agriculture[(b)]	729	0	0	3,768	0	0
Manufacturing Industry	58,524	9	6	2,338,316	24	21
Energy, Water & Waste	4,050	1	1	185,446	2	3
Construction	108,552	17	13	1,009,816	10	11
Trade	176,340	27	18	2,224,502	23	21
Transport	21,115	3	4	878,589	9	9
Hospitality	63,464	10	7	585,607	6	7
Information & Com.	23,607	4	4	517,119	5	6
Property	36,862	6	6	124,171	1	2
Other Services[(c)]	146,813	23	29	1,551,986	16	17
Health	5,244	1	13	284,899	3	4
Total	645,300	100	100	9,704,218	100	100
VSEs[(d)]	520,866	81	96	1,208,153	12	52
SMEs (exc. VSEs)	114,788	18	4	2,993,528	31	18
ISEs and LEs	9,646	1.5	0.2	5,502,537	57	29
Total	645,300	100	100	9,704,218	100	100

[(a)] Entirety of the FARE 2018 database, excluding sectors not included in the study ('*Financial and Insurance Activities*', '*Public Administration and Education*').
[(b)] FARE only gathers information about some companies in the '*Agriculture*' sector. Although these companies have been included in the sample as a whole, the *'Agriculture'* sector does not explicitly appear in the graphs when looking at inter-sector differences (see below).
[(c)] '*Other Services*' includes the MN ('*Scientific and Technical Activities'* and *'Administrative and Support Service Activities'*) and RU ('*Other Service Activities'*) sectors.
[(d)] Company sizes are as defined in the 2008 Law on the Modernisation of the Economy. The term "VSE" used in this study strictly corresponds to the term "microentreprise" (micro-enterprise) as used in said law.
Sources: data from INSEE-DGFiP.

Table 3 – **Distribution of companies in the sample by Banque de France credit rating**

	Companies		Jobs	
Credit rating	Number	% of the total	Number	% of the total
3++	6,682	1	961,415	10
3+	12,006	2	861,293	9
3	19,337	3	1,691,211	17
4+	26,615	4	1,232,873	13
4	37,785	6	1,198,785	12
5+	32,664	5	1,160,672	12
5	26,090	4	491,604	5
6	19,271	3	294,248	3
7	4,438	0.7	22,317	0.2
8	2,942	0.5	13,700	0.1
9	302	0.0	1,592	0.0
P	3,217	0.5	33,754	0.3
0	453,636	70	1,738,407	18
No rating	315	0	2,347	0
Total	645,300	100	9,704,218	100
Invest. Grade: 3++ to 4+	64,640	10	4,746,791	49
High Yield: 4 to P	126,709	20	3,216,673	33
0	453,636	70	1,738,407	18
No rating	315	0	2,347	0
Total	645,300	100	9,704,218	100

Sources: Data from INSEE-DGFiP and Banque de France FIBEN database.

Table 4 – **Descriptive statistics on the study sample in 2018**

	5th percentile	25th percentile	Median	75th percentile	95th percentile
Workforce	0	1	2	6	31
Turnover (€ thousand)	56	168	396	1 075	6 991
Value added (€ thousand)	13	69	162	405	2 126
EBITDA (€ thousand)	−39	4	25	76	459
Cash (days of turnover)	0	12	38	95	322
Total assets (€ thousand)	33	115	286	827	6 218
Profit share (%)	−28	5	18	35	93
Net debt/EBITDA	−13.6	−2.2	−0.3	1.7	12.3
Net debt/Equity	−2.2	−0.7	−0.2	0.4	3.7

Sources: Data from INSEE-DGFiP.

less than or equal to 0.4 for 75% of companies. However, some companies in their distribution tail had significant debt: 5% had a financial leverage ratio above 3.7 and a net debt/EBITDA exceeding 12.3.

With regard to cash holdings (available cash and marketable securities), the situation was very mixed: before the crisis, 25% of NFCs had cash holdings equal to or less than 12 days of turnover, while 25% had a cushion of cash totalling more than 3 months of turnover.

2. The Microsimulation Method

The accounting simulation is conducted in two stages: firstly, the impact of the health crisis on the cash flow of each company is estimated; then, this result is used to identify their need for financing.

2.1. Cash Flow Statement Simulation

The first stage of the simulation consists of tracking, for each company, all cash expenses and revenues that took place in 2020. More formally, it consists of simulating the impact of the COVID-19 crisis on the cash flow statement of each company.

In practice, cash flow statements are computed following the method used by the Banque de France's Enterprise Division for its annual study on the financial situations of companies (Bureau & Py, 2021). This approach follows a standard financial analysis framework. The concepts are therefore those employed in

corporate finance and not those used in national accounting. The final cash variation (or cash flow shock) therefore comes from: *(i)* cash flows from activity, including operating cash flows, non-operating cash flows from corporate tax and dividend payments, as well as cash flows linked to the main government support measures (excluding State-guaranteed loans) and *(ii)* cash flows from investing activities. Cash flows from financing activities (change in equity capital or in financial debt) are assumed to remain constant at this stage.[13] In the second stage of the analysis, debt becomes the adjustment variable to absorb cash losses and restore available cash to the target level (see below).

We began by simulating the $EBITDA_{ft}$. This is written as turnover T_{ft} minus intermediate consumption IC_{ft}, gross wages W_{ft} and production taxes PT_{ft}:

$$EBITDA_{ft} = T_{ft} - IC_{ft} - W_{ft} - PT_{ft} \quad (1)$$

From this simulated EBITDA, cash flow variation is written for each company *f* for the month *t* (compared to the same month *t* of the year *n*-1):

$$\begin{cases} \Delta Cash_{ft}^{w/o\ support} = EBITDA_{ft} - \Delta WC_{ft} - CIT_{ft} - \\ \qquad\qquad Int_{ft} + NOA_{ft} - Div_{ft} - Inv_{ft} \\ \Delta Cash_{ft}^{w/\ support} = \Delta Cash_{ft}^{w/o\ support} + \\ \qquad \underbrace{STW_{ft} + Def_{ft} + CIT_{ft}^{Def.} + SF_{ft}}_{Support\ measures} \end{cases} \quad (2)$$

Turnover is calculated using monthly VAT declarations. We simulate monthly changes in the other accounting inputs in 2020, combining information relating to the trend in turnover observed on an individual basis with snapshots of income statements at the end of 2018, and creating assumptions on how companies adjust their behaviour. These assumptions are summarised in the following Box and detailed further in Bureau *et al.* (2021, Appendices 2 to 4); a table in the appendix also contains all the data and values used in 2020 to construct the cash flow statement.

We created a cash flow statement for each company and for each month of the year 2020 (comparing the month in question in 2020 with the same month in the previous year).[14] As such, we have the variation in cash (or "cash flow shock") for each company ("before financing") for a given month and for the entirety of 2020. Table 5 shows the main components of the cash flow statement.

The variation in cash enables us to make an initial distinction between companies that experienced

13. We reason on financing being the same as in 2018, assuming that loans maturing in 2020 are rolled over with the same conditions as the initial loan.
14. As tax returns are completed annually, a monthly approach such as this is only possible with a simulation method like ours. As such, even if we had the tax returns for fiscal year 2020 now, they would still have to be put through the simulation to obtain monthly figures.

Box – **Assumptions on How Companies Adjusted their Behaviour**

Intermediate consumption (IC_{ft}):

- Fixed costs: this amount denotes the corresponding monthly sum of the annual fixed costs declared in each company's 2018 income statement;
- Variable costs: we assume that the 2020 ratio of variable costs to turnover is identical to that shown on the 2018 balance sheets; variable costs then fluctuate according to monthly observed changes in turnover and depending on the elasticity of such costs to turnover that we estimate at the sectoral level based on historic data.

Gross Wages (W_{ft}):

- Before taking into account short-time work, the annual wage costs for 2020 are assumed to be identical to wages declared in FARE for the 2018 financial year, and then made monthly;
- The analysis is therefore conducted with the same payroll structure as the one observed the 2018 FARE. The impact of this assumption should not be overestimated, as employment withstood much of the crisis in France in 2020. INSEE[(a)] reported that employment fell by 1.9% in the first quarter[(b)] and by 0.8% in the second quarter, before experiencing an upturn in the third quarter (+1.7%) and remaining stable in the fourth (−0.1%). However, employment dynamics varied considerably between sectors, with relatively restrained drops in construction (−0.2%) and manufacturing industry (−0.3%) and larger ones in traded services (−3.6%), which felt the effects of the decline in hospitality (−4.1%).

Production taxes (PT_{ft}): we assume that the production taxes (*contribution économique territoriale* – a regional tax –, *contribution foncière des entreprises* – corporate real estate tax –, etc.) are identical to those *recorded in 2018.*

Variation in working capital (ΔWC_{ft}): we abstract from the dynamics of inventories and assume that WC is equivalent to trade credit, which is modelled using the method described in Bureau *et al.* (2021, Appendix 2). Developments in trade credit follow those of turnover, based on the ratio of trade receivables and trade payables to turnover, measured individually in the 2018 balance sheets and assumed to be unchanged in 2020[(c)]. Not modelling changes on a monthly basis should have limited impact on the need for financing estimated at the end of 2020, assuming that activity has returned to pre-crisis level at the end of 2020; taking these changes into account on a monthly basis would however have plausibly led to liquidity needs being transferred from one period to another alongside increases and liquidation of inventories. Our assumption seems reasonable at the aggregated level and is supported by the *ex post* analysis of the →

Box – *(contd.)*

2020 balance sheets available for a sample of companies in the FIBEN (*Fichier Bancaire des Entreprises* – banking database of companies)[d].

Corporate income tax (CIT_{ft}) and interest expenses (Int_{ft}): these variables correspond to taxes on profits and to interest and similar expenses, respectively, which are assumed to be identical to the figures for 2018 and spread evenly over 12 months.

Non-operating activities (NOA_{ft}): this heading regularly gathers the net profit on joint operations, income less financial charges (excluding interest expenses), income less extraordinary charges on management activities, and transfers between expense accounts, excluding deferred charges. We neutralise the extraordinary elements and exclude transfers of expenses for which there is no information in FARE. The profit on joint operations is adjusted in line with the impact on activity, while the other items are assumed constant.

Dividends (Div_{ft}):
- For CAC 40 companies: we use the dividends recorded for the company in question in the 2018 FARE, to which we apply the observed rate of growth in the group's dividends between 2018 and 2020;
- For other companies: we assume that the companies that experienced a drop in activity in April 2020 did not pay dividends to external shareholders and reduced intra-group dividends by 50%. The sensitivity of our results to these different adjustment assumptions is further detailed in the Online Appendix C1[e]. This modelling method does however mean that we may have overestimated the reduction in dividends for small business owners, for whom dividends are often a key part of their remuneration and are therefore harder to reduce.

Investment (Inv_{ft}): we assume that companies reduced their investment expenditures in proportion to their individual drop in activity, based on a sector × size elasticity estimated using historic data (see Bureau *et al.*, 2021, Appendix 3). Such an assumption based on a constant elasticity of investment expenditure to turnover is of course simplistic, but given the lack of any infra-annual data on investment trends, we believed that this approach was the most reasonable. In Bureau *et al.* (2021, Appendix 3), we accompany this by two *ad hoc* investment reduction scenarios, which aim to illustrate the sensitivity of the estimated need to investment expenditure, and analyse the consistency of our results with macroeconomic changes in investment in 2020.

With regard to cash flows from public support scheme, we observe the amounts received from short-time work (STW_{ft})[f] and the amounts received from social security contribution deferrals and exemptions (Def_{ft})[g]. We simulate the amounts linked to exemptions and deferrals of corporate income tax (CIT_{ft}^{Def}), as well as those from solidarity funds (SF_{ft}). Our method for simulating the individual shock of these support measures is presented in the appendix (see Online Appendix C1 and Bureau *et al.*, 2021, Appendix 4). This simulation takes into account monthly changes in the rules for the schemes (eligibility thresholds and support calculation methods), individual monthly turnover data for 2019 and 2020, workforce, sector and geographical location in order to account for specific characteristics linked to the curfew imposed in some areas in the final quarter of 2020.

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[e] INSEE, Emploi salarié – quatrième trimestre 2020 (Salaried employment – fourth quarter 2020), Informations Rapides N° 061, 9 March 2021.
[b] Compared to the previous quarter, adjusted for seasonal variations.
[c] For illustrative purposes, Online Appendix C4 presents the infra-annual changes in cash flows linked to developments in trade credit in the 'Hospitality' *sector.*
[d] Using a sample of 102,722 legal units in the FIBEN database as at 31 December, and for which 2019 and 2020 company accounts are available, we observe that the total stock of the median inventory (raw materials, goods, finished products and products in production) did not change between 2019 and 2020. There are however significant individual differences, with the first quartile recording a 16% reduction in inventories and the third quartile recording a 16% increase.
[e] Link of the Online Appendix at the end of the article.
[f] With regard to short-time work, equation (2) is a simplified representation of the simulation for presentation purposes. In practice, short-time work is taken into account for net wages W_{ft} and therefore applied starting from the EBITDA. Specifically, net wage expenses are defined as:

$$\begin{cases} W_{ft} = \dfrac{W_{f,2018}}{12} & \text{without short-time work} \\ W_{ft} = \dfrac{W_{f,2018}}{12} - STW_{ft} \cdot \dfrac{1}{0.7 \cdot \left(1 + \dfrac{Social\ contributions}{Wages_{f,2018}}\right)} & \text{with short-time work} \end{cases}$$

[g] However, we cannot distinguish between exemptions and deferrals in our data.

a net increase in liquidity during the crisis and companies with a net decrease. Companies that posted negative variations in cash at the end of 2020 are able to mobilise different levers to bridge the gap: drawing from the cash they had available at the start of the year, making use of external sources of funding (bank credit, bond debt or the release of new capital), or even disposing of certain assets. With the exclusion of the issuance of equity and the disposal of assets, the variation in cash (before financing) measures the change in companies' net debt at the end of 2020. Whether this shock on cash flow is absorbed through the use of cash available as assets or by resorting to borrowing (or, more likely, a combination of the two), the effect on the change in each company's net financial debt is the same.

Table 5 – **Cash flow statement summary**

	Content	Calculation Assumptions
Flow of cash from activity	Surplus (or deficit) of cash generated by the company's operating cycle (= EBIDTA − Δ WCR), net of taxes and shareholder remuneration, and including income from support measures (STW, SSC deferrals, CT deferrals and SF)	- Flows simulated using observed monthly turnover (VAT data) - With adjustment assumptions for variable costs, fixed costs, inter-company credit and dividends - Observed STW and SSC deferrals - Simulated CT deferrals and SF
+ Net flows from investment	Disbursements net of cash receipts from acquisitions/disposals of fixed assets	Flows simulated using FARE 2018 data and a "*sector* × *size*" elasticity to turnover
+ Net flows from financing	Cash receipts and disbursements relating to choice of financing (injection of capital, loans issued and repaid)	Assumption based on financing structure remaining unchanged
= Variation in cash		

Notes: STW: Short-Time Work; SSC deferrals: deferrals of social security contributions; CT deferrals: corporate tax deferrals; SF: solidarity funds.

2.2. From the Variation in Cash to the Operational Need for Financing

Here, we are using need for financing to denote the portion of net expenses (negative variation in cash) that companies are unable to meet after consuming some or all of their liquidity. As such, they rely on external sources of financing.[15] In this sense, the aggregated need for financing can be assimilated to the request for financing submitted by NFCs to the financial sector following the impact of COVID-19.

We consider two scenarios for the consumption of available cash holdings ($Available\,CH_f$):

(*i*) liquidity shortage: this approach is based on a situation in which the company declares a need for financing, when consuming all available cash holdings at the start of the year does not allow it to fulfil its immediate payment obligations:

$$Liquidity\ shortage_{ft} = \begin{cases} Available\,CH_f - \Delta Cash_{ft} \\ if\ Available\,CH_f - \Delta Cash_{ft} \leq 0 \\ 0\ otherwise \end{cases} \quad (3)$$

In other words, the company has a need for financing only when it is conceptually in a "negative cash" situation at the end of 2020 (a situation referred to as "illiquidity" in Guerini *et al.*, 2020; Demmou *et al.*, 2021a, 2021b; Schivardi & Romano, 2021; Hadjibeyli *et al.*, 2021).

(*ii*) operational need for financing: this refers to resources required by the company to absorb the drop in cash as a result of the fall in activity, while maintaining a minimum cash buffer to support recovery. Further details on its composition can be found below.

From an economic point of view, approach (*i*) is not perfect in the sense that in order for companies to function, they need to have a build-up of operational cash to allow for time lags between revenue and expenditure in periods of activity. We therefore sought to identify a level of operational cash that would allow companies to resume operations in a period of recovery and below which companies would not want to drop. As such, we make the assumption that companies would want to maintain the same level of cash flow in terms of days of turnover as they had at the end of 2018. This operational cash buffer is itself calculated using a "target" turnover that took into account both the impact of the crisis on activity (which reduced the immediate need for cash) and forecasts for a return to normal. This "target" turnover is defined as the average between the mean turnover over the last six months $T_m^{Observed}$ and the mean counterfactual turnover $T_m^{Contrefactual}$ (i.e. the turnover that would have been achieved if no crisis had occurred)[16] over the following six months:[17]

$$T_t^{Target} = \sum_{m=t-5}^{t} T_m^{Observed} + \sum_{m=t+1}^{t+6} T_m^{Contrefactual} \quad (4)$$

The operational need is therefore defined as the need for financing required to restore the operational cash buffer ($Cash\,buffer_f$), which is itself dependent on "target" turnover:[18]

$$Ope.\,fin.\,need_{ft} = \begin{cases} \left(Available\,CH_f - Cash\,buffer_f\right) - \Delta Cash_{ft} \\ if\ Available\,CH_f - \Delta Cash_{ft} \leq Cash\,buffer_f \\ 0\ otherwise \end{cases} \quad (5)$$

15. *Excluding, for simplicity, asset disposals.*
16. *See Bureau* et al. *(2022, this issue) for more details on how this counterfactual turnover was calculated.*
17. *To be conservative, the target level of cash is also capped within each A17 sector to the median value of the distribution of cash in days of turnover.*
18. *No need for financing is deemed to exist if, at the end of 2020, the company have cash equal to or exceeding the target operational cash amount, or if the company posts an increase in cash during the crisis.*

As previously noted, FARE data for 2019 and 2020 was not available when this study was conducted, so our simulations rely on company accounts from 2018 for balance sheet data. However, we now have a selection of balance sheets ended in 2019 and 2020 thanks to the Banque de France's FIBEN database. This data are used in the Online Appendix C2 (Link at the end of the article) to validate our microsimulation model.

3. Findings

3.1. Dispersion of Cash Flow shocks and Effect of Support Measures

3.1.1. Estimate of Aggregated Shock

Firstly, the impact of the health crisis is estimated at the aggregate level. Specifically, we add up individual variations in cash at the end of December 2020, taken from cash flow statements, for every company in our sample. As such, reductions and increases in cash offset each other, as is the case in national accounting or on a macroeconomic level.

$$\Delta Cash^{2020} = \sum_{f=1}^{645\,300} \Delta Cash_f^{2020} \qquad (6)$$

Figure I below shows the succession of revenues and expenses, from the EBITDA simulated at the end of 2020 to the final shocks on cash flow. Ultimately, the aggregated cash flow shock for the companies in our sample, after taking into account the public support measures (short-time work, solidarity funds, social security contribution deferrals, and three-month corporate tax deferrals) totalled 5.2 billion euros in 2020, representing a slight increase in liquidity (i.e. a drop in net debt). Without public support, net debt would have increased by 51 billion euros. The aggregated effect of these public support measures on the companies in our sample was around 56 billion euros, which appears to be relatively consistent with the figures available for all NFCs.[19] The use of the short-time work scheme contributes to more than half of the decrease in the cash drop.

This overall picture of relative stability in net debt is consistent with the macroeconomic data now available on the evolution of debt among NFCs (see above). It is, however, difficult to interpret, in the sense that it hides the existence of very different individual situations, as cash excesses offset deficits: 41% of companies effectively record a reduction in cash at the end of 2020,[20] after public support measures, for an estimated total amount of 198 billion euros (Figure II).

3.1.2. Distribution of Cash Flow shocks

Figure III presents a simplified distribution of cash flow shocks. It also highlights the share of companies facing moderate or considerable negative or positive shocks.[21] In 2018, the proportion of negative and positive shocks was exactly equal (50% vs 50%). This once again illustrates the heterogeneity of the situations companies are in, even before the crisis. In particular, it underlines a key point in our analysis: what we measure as a cash flow shock reflects not only the impact of the health crisis but also the normal life of companies, whose net financial debt increases and decreases without that necessarily suggesting anything about their financial situation.

The distribution of cash flow shocks, excluding public support measures and without adjustments in company behaviour (i.e. under the assumption that investment expenditure is maintained unchanged and that all dividends are paid) shows that 6 in 10 companies would experience a reduction in cash (Figure III). Comparing this with a "normal" situation (that of 2018) clearly illustrates the deformation towards the left (i.e. towards a drop in cash) of the distribution of shocks due to the effect of the crisis.

The need for public intervention is made clear by the distribution after adjustments in company behaviour (according to the assumptions detailed in the box) and before public support: the distribution of negative and positive shocks is shown as 56% and 44% respectively, illustrating that solely adjusting investment expenditure and dividends is not enough to absorb the impact.

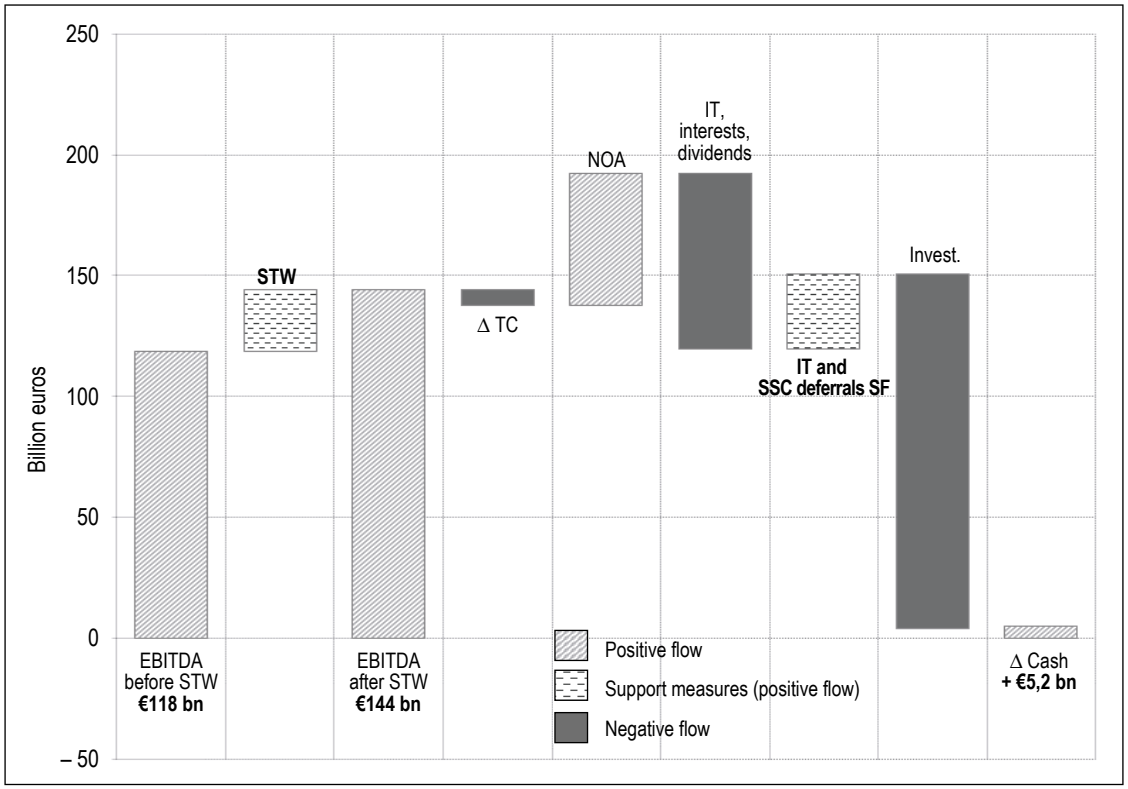
Finally, the distribution of cash flow shocks after support measures is recentred, at 47% and 53%, a slight improvement on 2018. Nevertheless, looking at "extreme" shocks paints a different picture: in a "normal" year, 13% of companies record a strong increase in their net debt (see 2018 in Figure III), but in 2020, this figure is 21% after adjustment and public support. The opposite is also true for companies estimated to have reduced their net debt following public

19. This sum of 56 billion euros can also be compared to around 77 billion euros at the end of 2020 for the four major measures taken into account in our simulations, representing a coverage rate of around 73%, which is consistent in terms of the value added of the NFCs in our sample.

20. Including some companies facing a very notable shock (and therefore a considerable increase in net debt) and others with a more moderate shock.

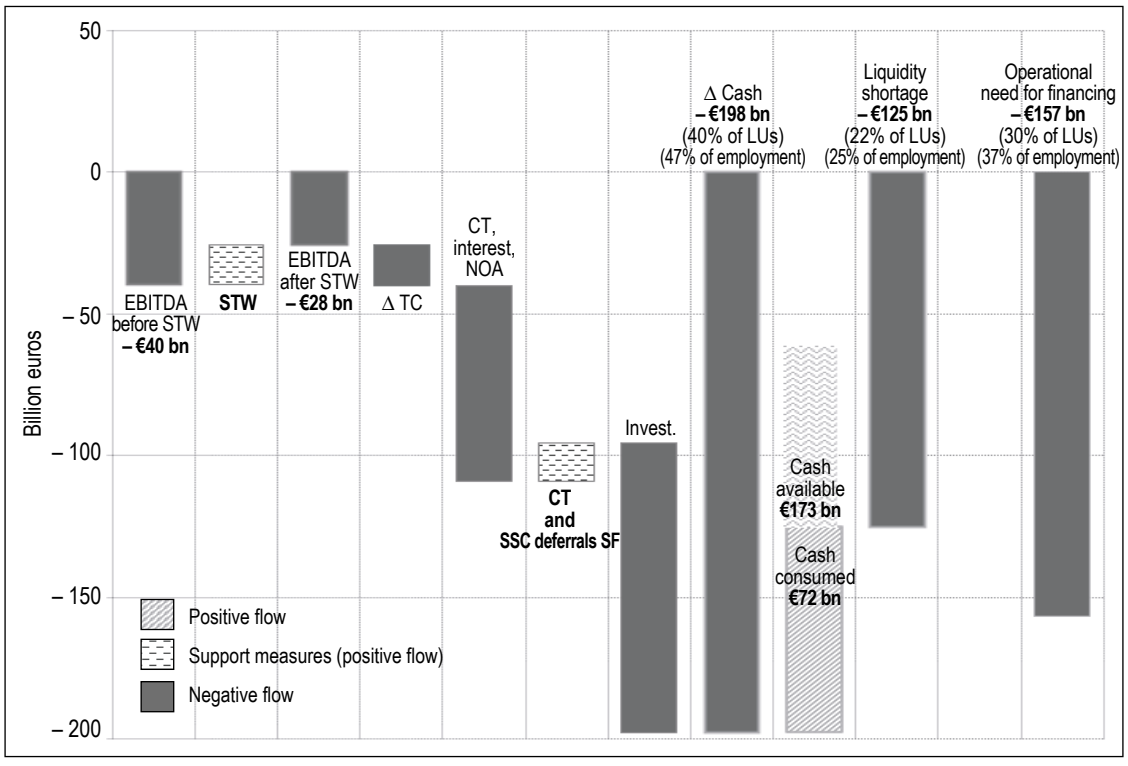
21. The threshold of 30 days of turnover distinguishing relatively more "strong" and more "moderate" shocks is determined on an ad hoc basis. Our conclusions are qualitatively robust to other threshold values. As an indication, before the crisis, the median cash level for companies in our study sample is 38 days of turnover (cf. Table 4).

Figure I – **Main cash flows aggregated for all companies in the sample at end December 2020**



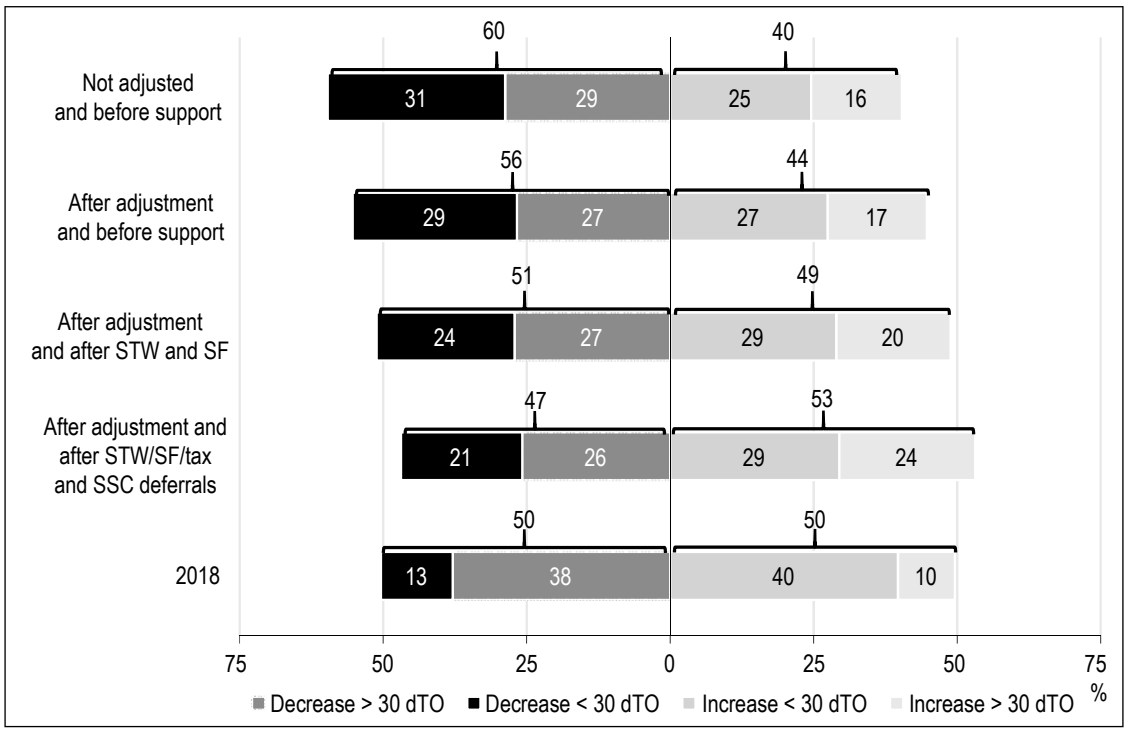
Notes: STW: short-time work. ΔTC: change in trade credit from previous year. NOA: non-operating activities. SF: solidarity funds. Invest.: net flows from investment.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure II – **Main cash flows aggregated for all companies in the sample with a drop in cash holdings at end December 2020**



Notes: See Figure I.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure III – **Share of companies (weighted by employment) with positive or negative shock on cash flow in 2020 with financing unchanged (%)**



Notes: Companies are weighted by workforce. Shocks are calculated with financing unchanged from the previous year, so before State-guaranteed loans. Black and very light grey bars indicate significant (negative or positive) shocks, while dark and light grey bars indicate moderate shocks. "Not adjusted" indicates where our assumption of reducing investment and dividends are not applied. In terms of public support, we firstly consider subsidy schemes: short-time work (STW) and solidarity funds (SF). We then integrate deferrals of tax and social security contributions that are to be paid at a later date.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

support: 1 in 4 companies posts a significant positive cash flow impact after adjustment and support measures at the end of 2020, compared to just 1 in 10 in 2018. Public support measures therefore help some companies to considerably improve their cash flow situation.

3.1.3. Sector Analysis

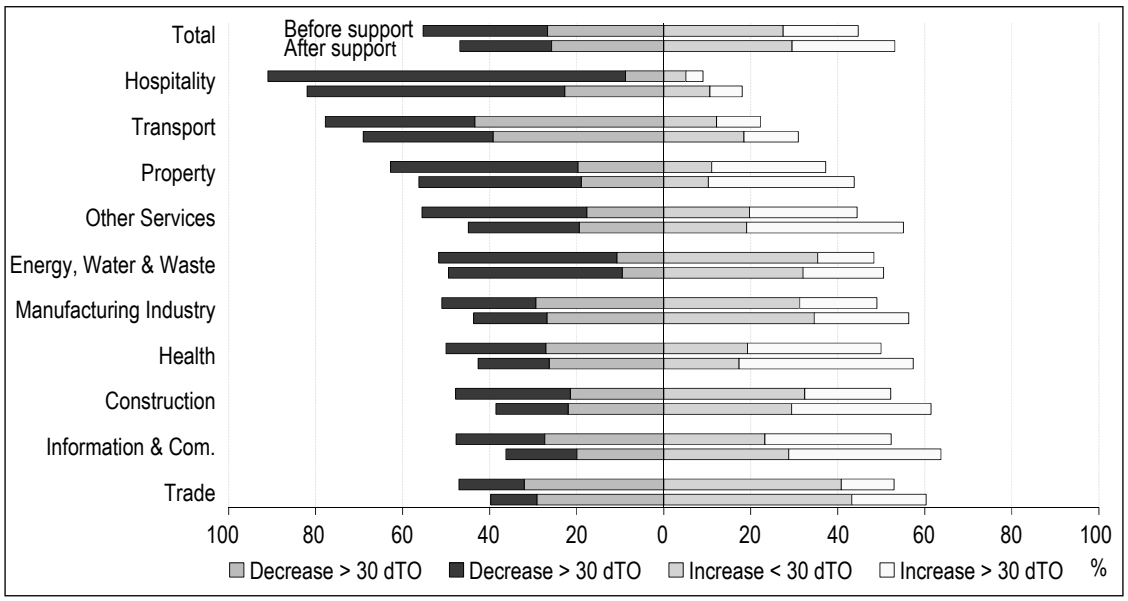
The cash flow shocks experienced also vary wildly between sectors, in line with the drops in activity (Bureau *et al.*, 2022, this issue): the sectors most affected were also those that suffered the largest estimated increases in net debt. In the '*Hospitality'* sector, 9 in 10 companies see their net debt increase before support measures (Figure IV). Although 80% of companies in the sector remained in a negative cash flow situation after receiving support, these measures help to ease the intensity of the shock – measured by the median shock – with the effect being more pronounced in those sectors most affected by a drop in activity (Figure V). As such, the median shock in the '*Hospitality'* sector is halved, and it falls by less than one third in the least affected sectors, such as '*Information and Communication'*, '*Property'* and '*Energy'*. The dispersion of cash flow shocks after support is also notable within each sector, including in sectors that withstood the crisis somewhat better. In '*Information and Communication Technologies*', for example, 15% of companies still experienced a significant increase in net debt. On the other hand, in the most affected sectors, such as '*Hospitality*', almost 20% of companies post a reduction in their net debt after support – twice as many as before receiving support. In addition to the impact of public support, the not insignificant share of companies that experience an increase in cash flow in each sector reflects the capacity of some companies to adapt, for example by switching to distance selling or by developing their online presence (Bureau *et al.*, 2022, this issue).

3.1.4. Analysis by Credit Risk

Finally, we conduct a cash flow impact analysis by Banque de France rating. The rating reflects the credit risk of each company in our sample at the end of 2019, before the COVID-19 crisis.[22] The rating scale reflects the likelihood that the

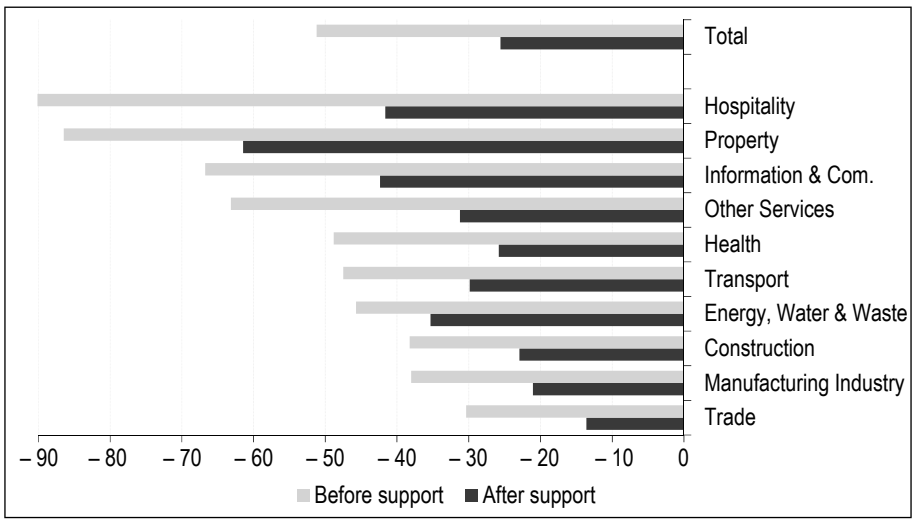
22. See Section 2, and Table 3 in particular, for more information on Banque de France ratings.

Figure IV – **Share of companies (weighted by employment) in each sector with positive or negative shocks on cash flow at end of 2020 (%)**



Notes: Support includes short-time work, solidarity funds and deferrals of tax and social security contributions.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure V – **Median negative shock on cash flow at end of 2020 before and after support measures, in days of turnover**



Sources and coverage: data from INSEE-DGFiP, DARES, ACOSS; companies posting a negative impact on cash flow before support measures. Authors' calculations.

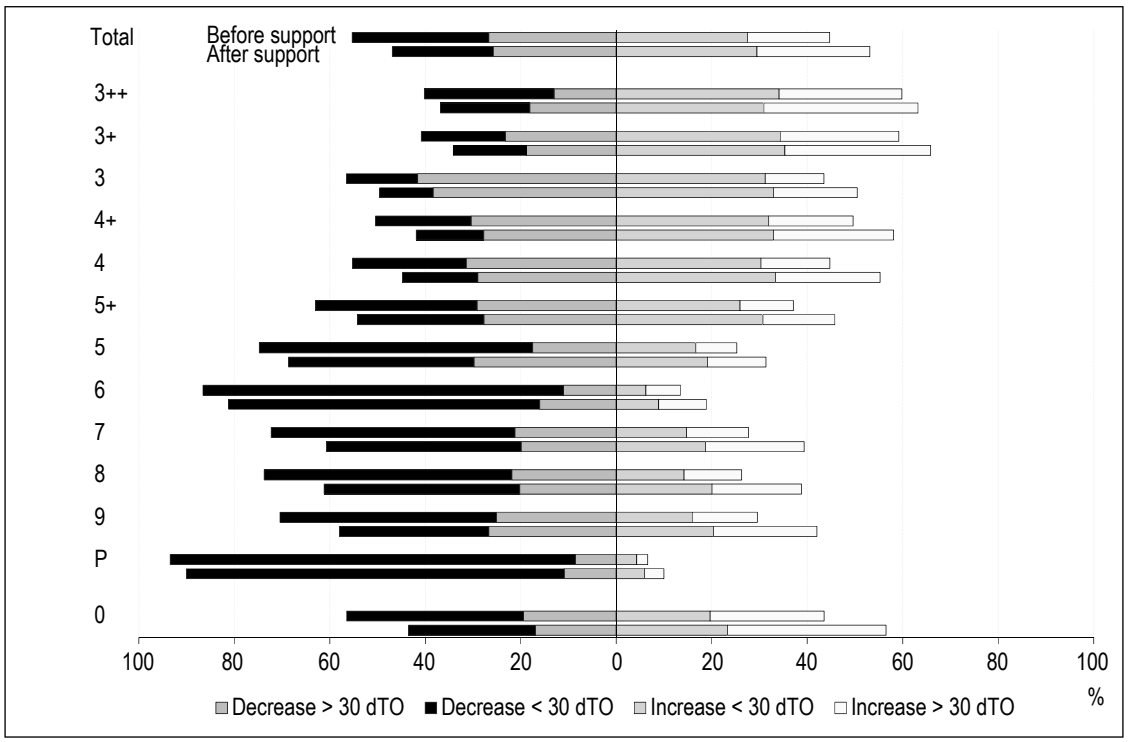
company may default within three years and ranges from 3++ for the best rated companies to P for those that filed for bankruptcy.

Figure VI illustrates the strong correlation observed between the occurrence and intensity of cash flow shocks on the one hand, and credit quality on the other. As such, from credit rating 5+ (equivalent to BB), at least half of companies in the category experienced a drop in cash. It should be noted that companies rated 5+ to P represent a significant share of employment (21% in our sample).

Several factors can help to explain this correlation between credit quality and cash flow impact: firstly, the effects of the composition of each sector, due to the under-representation of highly rated companies in the sectors most affected, such as '*Hospitality*'. In addition, the reduction in activity was generally less significant for companies with a higher rating, which may also suggest that they were better able to adapt during the crisis (going online, etc.).[23]

23. This point is yet to be thoroughly researched.

Figure VI – **Share of companies (weighted by employment) in each credit rating category with a positive or negative shock on cash flow at end of 2020 (%)**



Notes: See Figure IV.
Sources: Data from INSEE-DGFiP, DARES, ACOSS, Banque de France FIBEN database. Authors' calculations.

However, it is important to note that here, the correlation is not linked to the fact that more highly rated companies had larger reserves of liquidity *ex ante*, as this stage in the analysis was before any initial cash holdings had been used.

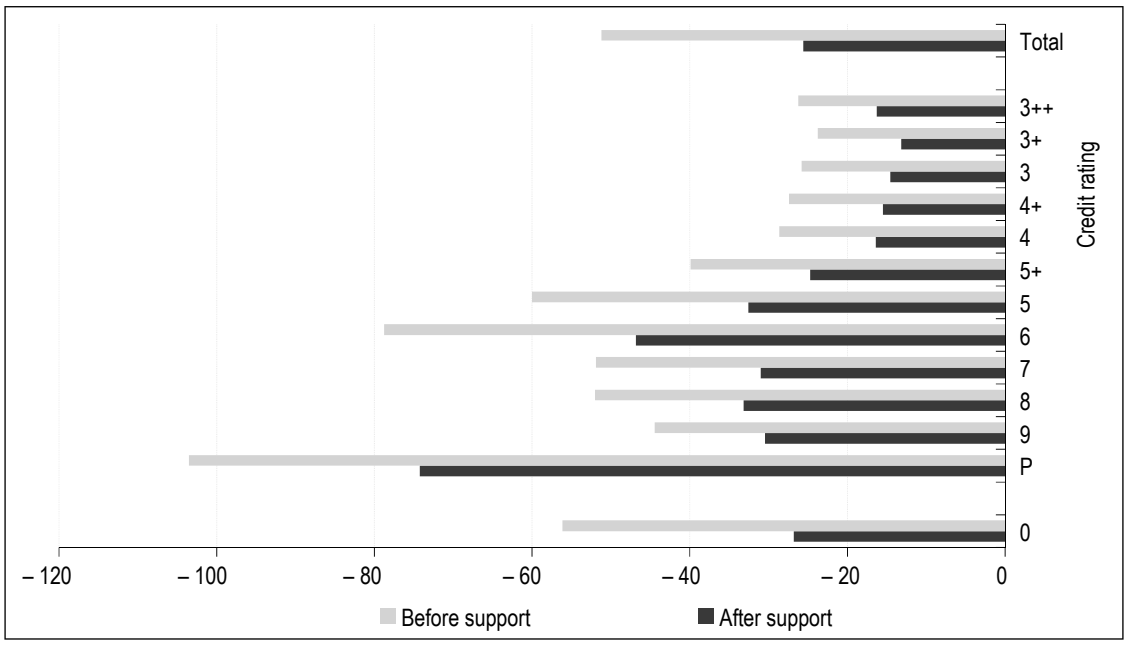
The decision of many European countries, including France, not to base public support on companies' pre-crisis financial situation means that non-viable companies were protected during 2020. Our simulations show that vulnerable companies did indeed benefit from the support measures implemented, but not more than the others. A quick look at Figure VI may suggest as such. In fact, thanks to the support measures put in place, the percentage of very vulnerable companies (those rated 7, 8 and 9) that experience a drop in cash flow fall more than those companies with other credit ratings (reductions of 12 to 13 percentage points [pp] compared to 3 to 10 pp for other ratings). This should not be over-interpreted, however: firstly, the effect is not verified for the category of most vulnerable companies, i.e. those in insolvency proceedings (rated P). Secondly, the impact of the support measures is similar for companies rated 7, 8 and 9 (reduction of 12 to 13 pp) and for companies rated 0 (reduction of 13 pp). Companies rated 0 are simply those for which the Banque de France has not recorded any unfavourable information regarding incidents relating to trade bill payments or judicial decisions. Zero-rated companies cannot be systematically treated as vulnerable companies but they have benefitted a lot from the support measures put in place.

If we now consider the intensity of the impact – measured by the median impact (Figure VII) – we can in fact see that the companies with the worst ratings (7 to P) benefit from the support measures less than other companies (28-40% reduction in median impact, compared to 38-52% for other ratings). It should also be noted that in terms of amounts, the increase in net debt is primarily concentrated in companies with the best ratings (Figure VIII): 50% of the total amount was covered by Investment Grade companies (rating equal to or above 4+).[24] The companies that were most vulnerable before the crisis (ratings 7 to P) represent just 0.6% of the aggregated increase in net debt.

To sum up, while it may appear that the companies that were most vulnerable before the crisis benefit from public support, the aid they received is not disproportionate.

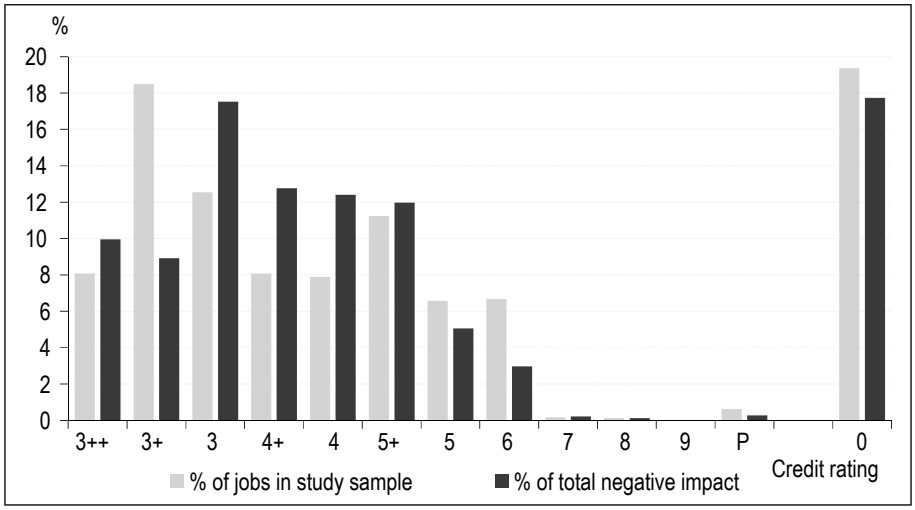
24. This is partly linked to the impact of size, with more highly rated companies also being larger in terms of structure.

Figure VII – **Median negative shock on cash flow before and after support measures at end of 2020 in days of turnover, by credit rating**



Sources and coverage: Data from INSEE-DGFiP, DARES, ACOSS, Banque de France FIBEN database; companies posting a negative shock on cash flow before support measures. Authors' calculations.

Figure VIII – **Distribution of total shock on cash flow at end of 2020 (€198 bn) after support measures, by credit rating**



Sources: Data from INSEE-DGFiP, DARES, ACOSS, Banque de France FIBEN database. Authors' calculations.

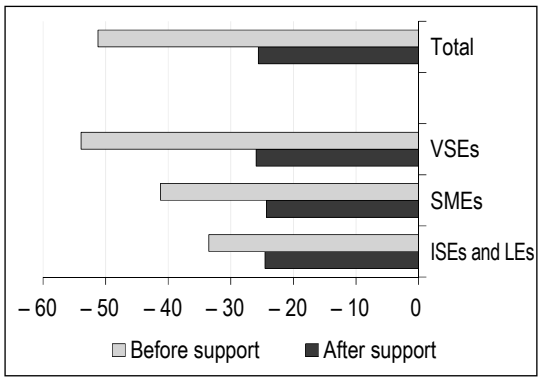
3.1.5. Analysis by Size of Company

Company size appears to be a secondary factor determining the occurrence of cash flow impacts: before support, net debt was estimated to have increased in around 50% of companies, regardless of their size. After support, this figure fell to 41% for ISEs and LEs, 44% for SMEs and 46% for VSEs. However, the public support mechanisms were better at alleviating the intensity of the impact for VSEs: the percentage of VSEs in great difficulty (cash drop exceeding 1 month of turnover) fell from 37% before support to 24% after, while the median cash flow impact among VSEs fell by half (Figure IX). Based on the amounts held by companies, ISEs and LEs represented nearly 60% of the total cash flow impact (Figure X).

3.2. From Cash Flow Impact to the Operational Need for Financing

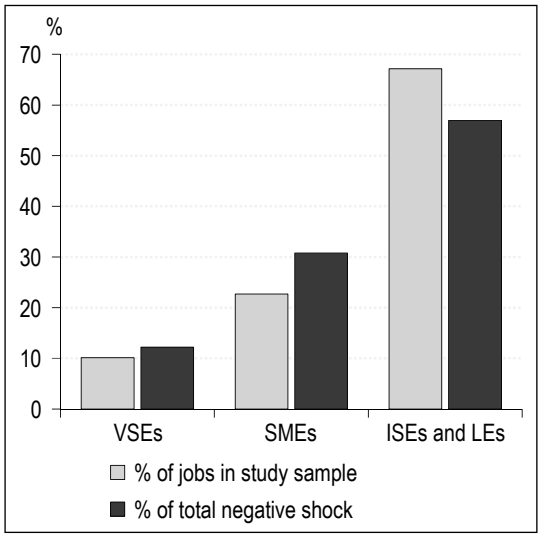
To finish, we will take a look at the analysis of the operational need for financing (see Section 2.2). In order to calibrate the operational cash buffer, this indicator takes into account a number of

Figure IX – **Median negative shock on cash flow at end of 2020 before and after support measures, in days of turnover, by company size**



Sources and coverage: Data from INSEE-DGFiP, DARES, ACOSS; companies posting a negative shock on cash flow before support measures. Authors' calculations.

Figure X – **Distribution of total shock on cash flow after support at end of 2020 (€198 bn)**



Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

additional factors compared to the cash flow shock indicator we saw in the previous section: the distribution of cash holdings at the start of the crisis among the companies, the intensity of the downturn in activity suffered by each company and each sector's growth outlook. To simplify matters, we concentrate on the points where the operational need provided additional insights to those offered by cash flow shocks.[25]

Of the 47% of companies that experienced a drop in cash, 1 in 5 are able to absorb this impact using cash holdings they have at the start of the year, without resorting to other external sources of financing, while maintaining enough of a liquidity cushion to be able to resume operations following the crisis (Figure XI). Before support, the share of companies with no operational need is thus 56% for all company sizes. After support, this figure is 68% for VSEs, 65% for other SMEs and 61% for ISEs and LEs.[26] The largest companies also have cash equivalents in the form of "available" lines of credit on which they can draw in difficult periods, and which are not taken into account here.[27]

At the sectoral level, liquidity differences change the hierarchy of the most affected sectors when a drop in cash becomes an operational need. '*Property*' in particular has liquidity that allowed it to absorb the impact: while nearly 1 in 2 companies experiences a cash flow shock (after support), only 1 in 4 recorded an operational need. In '*Trade*' on the other hand, the number of companies that experienced a reduction in cash falls by only 10 pp following use of some of their cash assets (Figure XII), such that companies in this sector represent more than 20% of the total operational need in the sample. However, '*Hospitality*' remains the sector most affected by the crisis, with 50% of companies recording an operational need exceeding one month of turnover – five times higher than for the '*Health*' sector, for example – and representing 10% of the aggregated operational need.

Finally, an analysis by risk reveals strong negative correlation between companies' operational needs and their credit quality before the COVID-19 crisis. As companies with better ratings have more liquidity, they are able to absorb the drop in cash more readily. As such, the majority do not have any operational need for financing (Figure XIII). More specifically, 65% to 75% of the NFCs with the best ratings (3++ to 4+, or Investment Grade) do not have an operational need, compared to 10% to 60% for NFCs with lower ratings (4 to P).

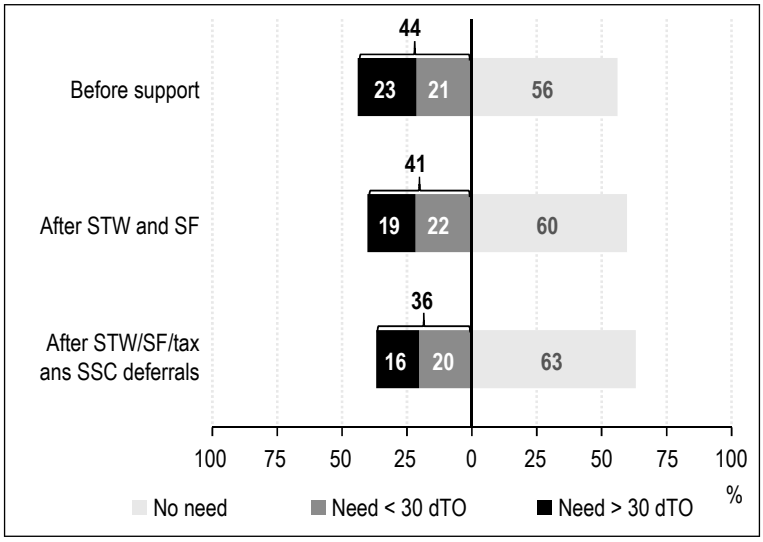
The intensity of the operational financing need is also higher and varies much more for companies with lower ratings. As such, the median

25. Online Appendix C4 presents the monthly changes in the aggregated operational need for financing before and after taking into account the support measures implemented. Changes in the operational need for financing reflect developments in the crisis as well as the increase in the power of support measures, which reduce the operational need for financing by 6% in March and April, 8% in May and 12% from July (compared to the operational need for financing that would exist without these support measures).

26. In Online Appendix C5, we briefly analyse some characteristics of companies with and without an operational need for financing and whether or not they benefit from support measures. This analysis identifies two aspects that may help to explain why, among the companies with no operational need for financing, some received assistance and some did not, as it relates to the cash holdings they have available before the emergence of the pandemic and the sector to which they belong.

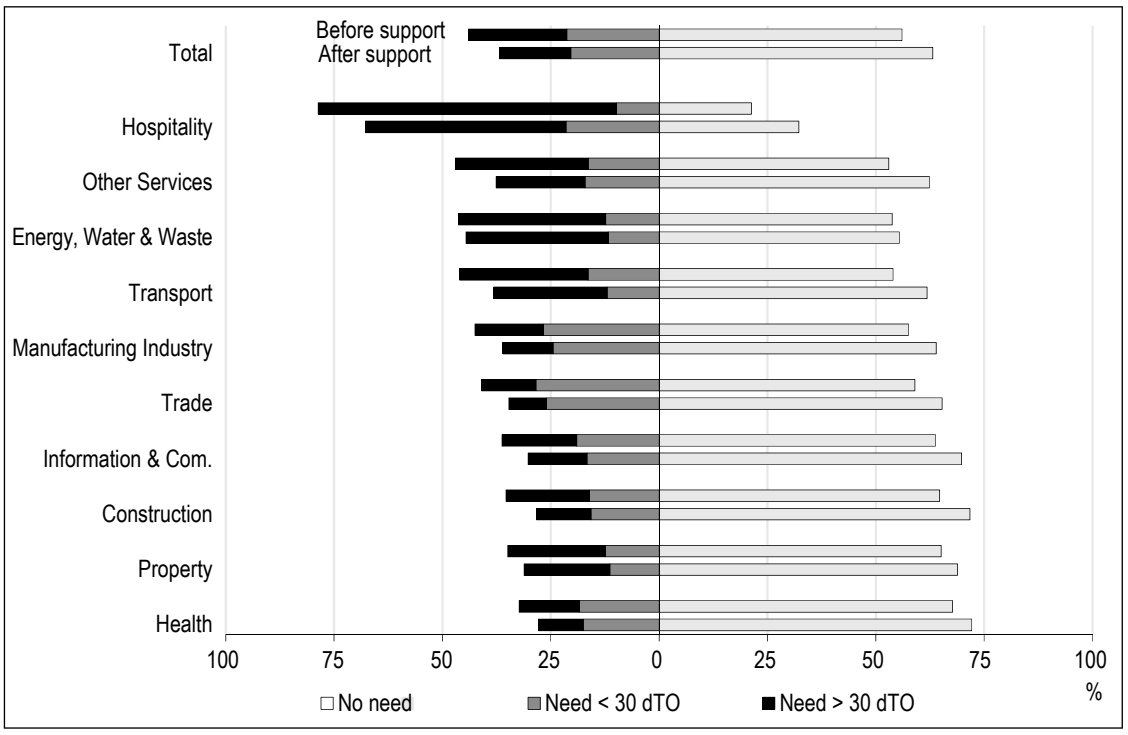
27. The ability to obtain these available lines of credit and the flexibility they provide in terms of liquidity risk management vary considerably depending on the size of the company. In December 2020, at the aggregated level, LEs have as much available credit as they have mobilised credit. On the other hand, for VSEs and SMEs, available credit represented just 12-13% of credit beyond what have already been used. This figure was 28% for ISEs (sources: Banque de France, FIBEN/Risk Division).

Figure XI – **Share of companies (weighted by employment) with operational need for financing at end of 2020**



Notes: Companies are weighted by workforce. The black and dark grey bars represent significant and slight needs for financing respectively, while the light grey bars represent no need for financing. In terms of public support, we firstly consider subsidy schemes: short-time work (STW) and solidarity funds (SF). We then integrate deferrals of tax and social security contributions that are to be paid at a later date.
Sources: data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

Figure XII – **Share of companies (weighted by employment) with operational need for financing at end of 2020 by business sector**

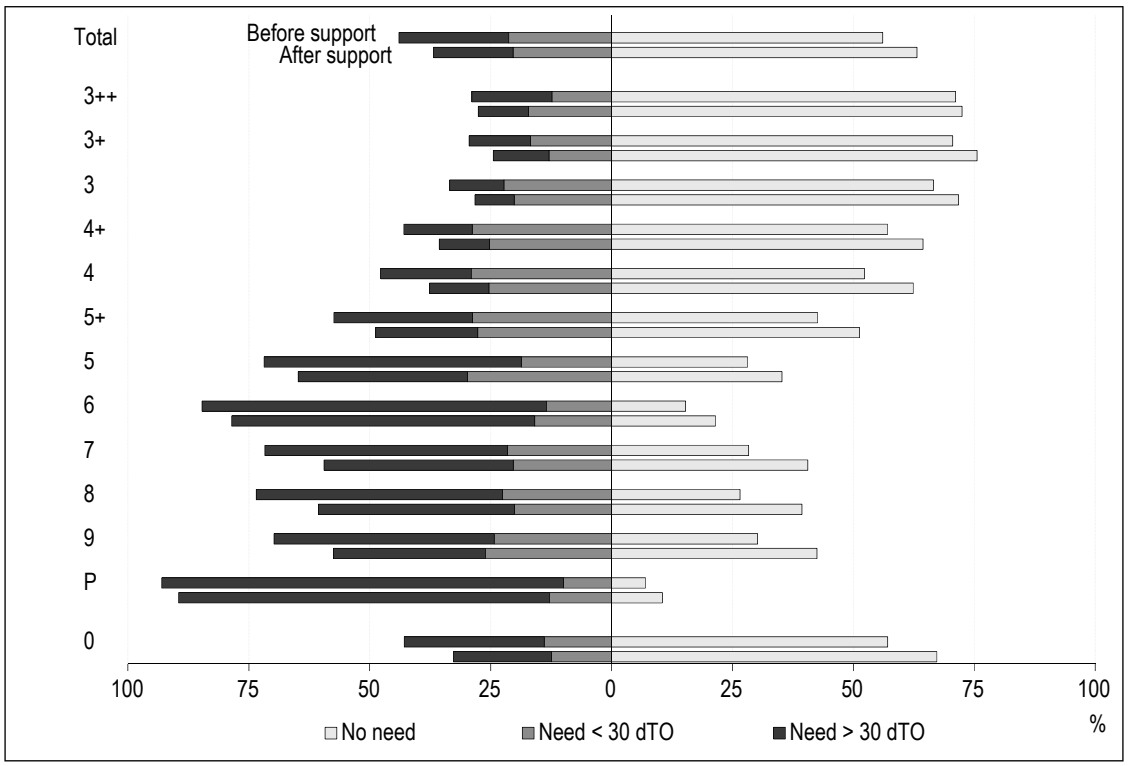


Notes: Support includes short-time work, solidarity funds and deferrals of tax and social security contributions.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

operational need is between 14 and 73 days of turnover for the lowest-rated companies, compared to just 10 to 16 days for the highest-rated. In terms of exposure, the companies with the highest ratings (3++ to 4+) represent almost 50% of the total operational need for financing. The risk in this category is, by definition, limited (Banque de France default rate over three years of 0.04% to 0.55% for companies rated at the end of 2016).[28] Those

28. A company is considered to have defaulted if it filed for bankruptcy or if it receives a rating of 9 as a result of major incidents relating to trade bill payments.

Figure XIII – **Share of companies (weighted by employment) with operational need for financing at end of 2020, by credit rating***



* As a reminder, the rating 0 is given to companies for which the Banque de France has not gathered any unfavourable data regarding incidents relating to trade bill payments, or judicial information or decisions, and does not have any recent accounting information.
Notes: See Figure XII.
Sources: Data from INSEE-DGFiP, DARES, ACOSS. Authors' calculations.

with lower ratings (4 to P) represent 35% of the total. While this exposure is substantial, it remains very limited for the worst-rated companies (7 to P), which represent just 1.1% of the total operational need. Attention should however be paid to those companies rated 5 and 6, which represent 14% of the total operational need, but only 7% of companies and 8% of the workforce in our sample.[29]

* *
*

This study uses a microsimulation model to assess the impact of the health crisis on more than 645,000 French companies. It highlights the high level of heterogeneity in the cash flow shocks experienced by companies in 2020, including within each business sector. This underscores the undeniable benefit of the microeconomic approach, which is essential for refining the macroeconomic diagnosis on the impact of the health crisis. It also underlines the need for caution when it comes to public policy: sector cannot be the only criteria used to define policies for emerging from crises.

In addition, this work shows that the support measures implemented by the French government have changed the dispersion of cash flow shocks to more closely resemble a "normal" year. However, in distribution tails, we also see an improvement in the situation of some companies and further weakening of other companies that were already vulnerable before the crisis. Some of these companies may therefore face difficulties when support measures are lifted. The main challenge in terms of public policy is, in this context, finding the right balance between maintaining the productive fabric and skills, minimising the social impact of the crisis and preserving the virtues of the process of creative destruction. One avenue on the matter is the improvement of restructuring processes, which can be made more efficient so that cases of companies in difficulty can be handled as well as possible. In addition to the arrangements put in place during the crisis to speed up these processes, promoting preventive safeguarding procedures and amicable settlements (*ad hoc* mandates and conciliation) could support the

29. More details on the distribution of the operational need by credit rating can be found in Online Appendix C3.

recovery of companies in difficulty (see Zapha & Fouet, 2021).[30]

It should be noted that while our microsimulation model is one of the most comprehensive and detailed to look at corporate liquidity shocks during the COVID crisis, there are still limitations inherent to this type of exercise to consider: firstly, certain expenses likely to affect companies' cash flows were not modelled (such as inventory variation). Secondly, the simulations is conducted on a sample of companies present in the 2018 FARE. As a result, they are not a perfect measure of the situation of companies at the start of 2020, they do not take into account young companies created in 2019 and 2020 and the analysis is conducted with staff numbers unchanged. Finally, taking into account two of the main support measures (solidarity funds and corporate tax deferrals) requires simulated data. This is not the case for short-time work and social security contribution exemptions and deferrals, for which we used observed data.

One avenue for extending this work would be to compare the operational need for financing estimated in the study with the actual increase in debt observed in 2020 (State-guaranteed loans, bond issuances, etc.). The difference between the two would effectively be an estimate of companies' "precautionary debt" during the crisis. □

30. Safeguarding procedures and amicable settlements are more successful, representing 60% and 70% of debt restructuring agreements respectively, compared to 25% for receivership. Epaulard & Zapha (2022) show that safeguarding performs better in part due to the negative reputation of receivership.

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6472311/ES532-33_Le-et-al_Online-Appendix.pdf

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APPENDIX

Table – Data, Assumptions and Values Used to Construct the Cash Flow Statement

	Underlying data used	Assumptions	Values used in 2020
Flow of cash from activity			
Turnover	Monthly turnover gathered from VAT data		TO_m: Monthly turnover observed up to the end of 2020
(–) Intermediate consumption	Fixed and variable costs declared in FARE 2018	Purchases adapt to and follow changes in activity. Other variable costs are partially adjusted. - Variable costs (VC): 2018 ratios in % of turnover - Fixed costs (FC): rental and leasing costs	$Purchases_m$ = ratio of purchasing x TO_m Other VC_m = ratio of purchasing x e x TO_m, where e is the estimated elasticity of the sector (0.6<e<0.9 depending on sector) FC_m = FC /12
(–) Personnel costs, adjusted for short-time work (STW) if applicable	Personnel costs (PC) declared in FARE 2018 + observed monthly compensation for short-time work (ACOSS)	Constant workforce. If short-time work, we assume in all cases: (*i*) compensation paid to the employee equal to 70% of gross remuneration; (*ii*) compensation 100% borne by public authorities; (*iii*) no additional pay; (*iv*) constant ratio of social security contributions (SSC) / salary (2018 figure)	If no STW: PC_m = PC / 12 If STW: PC_m = PC / 12 − STW_m/ [0.7 · (1 + 2018ratio $_{SSC / salary}$)]
(–) Variation in ICC	Trade receivables (TR) and trade payables (TP) declared in FARE 2018	Payable upon 60 days See simulation details in Appendix 2 of Bureau *et al.* (2021)	ratio of TR = TR / ($TO2018_{m\_close}$ + $TO2018_{m\_close-1}$) ratio of TP = TP / ($TO2018_{m\_close}$ + $TO2018_{m\_close-1}$) TR_q = ratio of TR x ($TO_{m,q}$ + $TO_{m,q-1}$) TP_q = ratio of TP x ($TO_{m,q}$ + $TO_{m,q-1}$) ICC_q = TR_q – TP_q Δ ICC = ICC_q – ICC_{q-1}
(–) Miscellaneous, including corporate tax (CT), dividends	Non-CAC 40: dividends from FARE 2018 CAC 40: dividends from FARE 2018 and observed dividend growth rate	Non-CAC 40: Companies reduced their dividends via intra-group and external shareholders (if downturn in activity in April)	% of dividends paid by head of the group = 0% % of intra-group dividends paid = 50%. CAC 40: FARE 2018 dividends x group's observed dividend growth rate
(+) Social security contribution deferrals	Deferrals observed in 2020 for employer AND employee contributions (ACOSS)	Employer contributions = 60% of total SSCs. No distinction between exemption and deferral	SSC deferral = 0.60 x deferral observed
(+) CT deferrals	Observed CT in FARE 2018	Three-month CT deferral for companies in the most affected sectors	Deferral of CT to Q2 = CT / 4 for the most affected sectors
(+) Solidarity funds	Eligibility for and amount of support estimated taking into account monthly developments in the rules for the scheme and based on: workforce, TO losses, sector, location	- Simulated data - See simulation details in Appendix 4 of Bureau *et al.* (2021)	Simulated data
Net flow of cash from investment	Investment in FARE 2018	Estimate of "*sector* × *size*" elasticity of investment expenditure to turnover. See simulation details in Online Appendix 2	Invm = Investment / 12 x e x drop in activity (0.1 < e < 0.6)
Net flow of cash from financing		No variation in structure of financing in the first instance. Implicit assumption of loans maturing in 2020 being rolled over	

Liquidity Shortfalls during the COVID-19 Outbreak: Assessment and Policy Responses

Lilas Demmou*, Guido Franco*, Sara Calligaris and Dennis Dlugosch*****

Abstract – The paper investigates the impact of stylised policy measures on the financial vulnerability of non-financial firms during the COVID-19 pandemic crisis. It evaluates the extent to which firms run into a liquidity crisis following the COVID-19 outbreak and the impact of policies to reduce the risks of such a crisis. The analysis relies on: an accounting model, a large dataset reporting firms' balance sheets for 14 countries and data on the magnitude of the shock at the sector level. Results suggest that, without any policy intervention, up to 38% of firms were to face liquidity shortfalls after ten months since the implementation of confinement. Comparing the impact of different policies, the analysis shows that government support to relieve wage bills is the most effective tool, followed by debt moratorium policies. Finally, the paper zooms into labour market policies and compares the cost-efficiency of short-term work and wage subsidies schemes, highlighting how their relative efficiency depends on their design.

JEL Classification: D22, D24, J38, H81
Keywords: COVID-19, liquidity, cash, job retention

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The health crisis caused by the COVID-19 outbreak in the beginning of 2020 has led public authorities to take unprecedented measures to contain the propagation of the virus. Administrative business shutdowns, quarantines and restrictions on mobility and social contact have had a severe negative impact on our economies. Annual growth of real GDP in OECD countries in 2020 fell by –4.8%, the largest annual decline of GDP in the history of the OECD (OECD, 2020a). While the economic impact of the COVID-19 pandemic was particularly pronounced in sectors that require close personal contact, e.g. events and recreation and accommodation and food sectors, sales across nearly all sectors plummeted throughout 2020 (OECD, 2020a). Nevertheless, financial commitments with respect to suppliers, employees, lenders and investors remained, depleting liquidity buffers of firms. The large number of firms that were simultaneously affected constituted a major challenge. Some producers, e.g. of intermediate goods or services, experienced a drop in sales even if confinement measures did not require them to shut down. Since several firms along the same supply chains have faced liquidity shortfalls, trade credit losses have increased, further adding to cash flow pressures.

With much less or no incoming revenues for an extended period of time and fewer options to deal with this shortfall, the liquidity crisis could have turned into a solvency crisis, as the viability of a large set of firms would have been at risk absent of policy support. A global corporate solvency crisis would have had dramatic consequences on the real economy and significantly delayed the recovery, dragging down employment, productivity, growth and well-being (Demmou *et al*., 2021). In particular, human and organisational capital would have been eroded and vanished with defaults of firms that prior to the virus outbreak were profitable and with healthy balance sheets. Moreover, corporate defaults of a significant number of firms could have undermined balance sheets of banks and institutional investors, drying up financial markets and feeding a self-reinforcing downside spiral in the corporate sector, in turn increasing the likelihood of a financial crisis.

Awareness of these risks has led governments to adopt a range of emergency measures aimed at supporting firms' liquidity. Aside from monetary measures taken by central banks, fiscal interventions include direct financing of the wage bill through job retention schemes (e.g. short-term work and wage subsidy schemes), support to laid-off workers (e.g. extension of the coverage and increase in the replacement rate of unemployment benefits), tax deferrals, debt moratoria and extension of state loan guarantees.

This paper evaluates the extent to which firms experienced liquidity shortages using a cross-sector sample of almost one million European firms. Additionally, the paper discusses the pros and cons of different kinds of public support measures. The analysis focuses on the first-round effects of containment measures induced by the crisis, abstracting from the potential cascading effects via supply chains, financial interconnections between firms, financial distress in the banking system as well as from the structural adjustments that will be needed in a second phase of the response to the crisis. Based on illustrative assumptions regarding the evolution of sales and elasticities of costs to sales, the paper sheds light on the risk of corporate insolvency.[1] Comparing the share of firms that would turn illiquid under a no-policy change scenario and under policy intervention, results emphasize the key role that policies could have played to avoid massive unnecessary bankruptcies: our model predicts that the share of firms running out of liquidity would have tripled due to the COVID-19 outbreak without any policy intervention and that government support have allowed to bring back this share closer to normal time standards.

The remainder of the paper is organized as follows. Section 1 details the empirical framework employed in the analysis. In Section 2, we present and discuss our findings and provide a wide range of robustness checks. Finally, we present our main conclusions and the key points that can be drawn from our results.

1. An Empirical Assessment of Firms Liquidity Shortages during the COVID-19 Outbreak

1.1. Size and Dynamics of the Economic Shocks

Measures of social distancing and mobility restrictions dramatically affect services involving direct contact between customers and providers, activities gathering people in public and private places, travelling, as well as manufacturing and construction activities involving close physical contact among workers. Activities that can be

1. The methodology is similar to the one used by Schivardi & Romano (2020) for the case of Italy, and is based on a number of assumptions detailed in the remainder of the paper. It is also close in spirit to De Vito & Gomez (2020).

undertaken remotely or automatized are relatively less affected – to the extent that the supply chain is not broken and consumer demand can be maintained, at least in part. It follows that the decline in activity is assumed to be different across sectors but identical across countries.

The analysis covers all manufacturing and non-financial services sectors.[2] The magnitude of the sales shock during confinement months is based on the first-round demand and supply shocks computed at a detailed sectoral level by del Rio-Chanona *et al.* (2020).[3] To quantify the supply shock, the authors classify industries as essential or non-essential and construct a Remote Labour Index, which measures the ability of different occupations to work from home: the supply shock is not binding for essential industries, while non-essential industries remaining production capacity is proportional to the ability to telework. To quantify the demand shock, they exploit a study of the potential impact of a severe influenza epidemic developed by the US Congressional Budget Office. In this article, we identify the resulting sector-specific – but country invariant – shock as the largest between the supply and the demand shock.[4]

Two alternative scenarios are considered with respect to the duration of the shock:

- An "upside" scenario, which foresees a sharp drop in activity lasting two months, followed by progressive but not complete recovery in the remaining part of the year. The recovery path is dependent on the initial shock, so that the most severely hit sectors face a larger absolute decline in revenues also after confinement, but the speed of the recovery is assumed for simplicity to be the same across sectors.

- A "downside" scenario, which overlaps with the "upside" scenario for the first seven months, but then embeds a second, relatively smaller outbreak from the eighth month onwards, accompanied by more limited lockdowns.[5]

The developments of the pandemic, characterized by localised outbreaks (at the time of writing), suggest that the recession may have been even deeper than modelled in the upside scenario but not as severe as in the downside scenario. It follows that the two scenarios could be more generally interpreted as a lower and an upper bound with respect to the magnitude of the shock. For the sake of exposition, the "downside" scenario is used as a baseline throughout the paper. In line with the projections for the Euro area provided in the OECD Economic Outlook 2021, the economic activity is modelled to remain below its pre-pandemic level by the end of 2020.

1.2. Methodology to Evaluate Firms' Liquidity Position during the COVID-19 Crisis

The approach relies on financial statements of non-financial corporations from the Orbis database, provided by the consulting firm Moody's Analytics, which collects balance sheets data on both listed and unlisted firms worldwide. To ensure firms' comparability across countries and sectors, the data are treated according to Gal (2013) and Kalemli-Ozcan *et al.* (2015). The data also exclude very small firms – those having less than 3 employee – to avoid concerns related to the quality of the data. The final sample consists of 859,299 unique firms, operating in manufacturing but also non-financial business services industries.[6]

At present, Orbis is the largest cross-country firm-level dataset available and accessible for economic and financial research. However, it does not cover the universe of firms, and the extent of the coverage varies considerably across countries.[7] To deal with these limitations, we focus on 14 relatively well-covered European countries, and purposely avoid cross-country comparisons, as well as the provision of absolute numbers on the aggregate depth of the shortfall.[8] Moreover, firms in Orbis are on average disproportionately larger, older and more productive than in the population, even within each size class. As these firms are on average healthier than their smaller, younger and less productive counterparts, the

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2. More specifically, it covers all economic sectors except the followings (Nace Rev.2 classification): agriculture (VA), mining (VB), financial (VK), public administration (VO), education (VP), human health (VQ) and activities of households and organizations (VT and VU).

3. The full dataset on the confinement shock provided by del Rio-Chanona et al. *(2020) can be found here: https://zenodo.org/record/3746661#.Xx7VATYUmhc.*

4. To see why this is the case, consider the following example. Due to confinement measures, a firm is able to produce 50% of its normal time output (supply shock). If the demand shock, due to changes in consumers' preferences, implies a 60% reduction in demand for the products of the firm, the firm will produce only what it is able to sell – 40% of its normal time output – and the demand shock will be binding. On the contrary, if the reduction in consumers' demand is expected to be lower (e.g. 20%), the firm will still produce at its maximum capacity during confinement and the supply shock will be binding.

5. See Appendix, Table A-1 for the detailed dynamic of each scenario. The implications of the second outbreak characterizing the "downside" scenario are assumed to be smaller than those of the initial confinement period, taking into consideration that the rise in infections and the death toll are assumed to be less than in the earlier outbreak (e.g. increased hospital capacity and workers protection, better targeted social distancing measures).

6. See Appendix, Table A-3 for firm-level basic descriptive statistics.

7. For a detailed discussion of Orbis coverage and representativeness, see Bajgar et al. *(2020).*

8. Countries included in the sample are: Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Poland, Portugal, Romania, Spain, Sweden and the United Kingdom. See Table A-2 in Appendix for details on the number of firms by country.

analysis is expected to deliver a lower bound for the liquidity shortages potentially affecting non-financial corporations.

The study assumes that the last available data for each firm (end of 2018) represent its financial situation in normal times with respect to its average revenue, operating expenses, debt payment and taxes.[9] The economic shock from measures of social distancing is modelled as a change in firms' operating cash flow, resulting from the decline in sales and firms' limited ability to fully adjust their operating expenses. To reflect this adjustment capacity, elasticities of intermediate costs to sales and of the wage bill to sales are estimated by assuming, for simplicity, that they are identical and constant across countries and sectors. Each month, firms' shock-adjusted cash-flow (assuming zero investment spending) is determined as follows:

$$\begin{aligned} &CashFlow_{it} = \\ &(1 - s_{st}) * Revenues_i - (1 - c * s_{st}) * \\ &Intermediates_i - (1 - w * s_{st}) * \\ &WageBill_i - Taxes_i - DebtPayments_i \end{aligned} \quad (1)$$

where s_{st}, c, w refer, respectively, to the size of the shock in sector s in month t, the elasticity of intermediates cost to sales, and the elasticity of wage bill to sales. Firms' sales, intermediate costs, wage bill, taxes and debt payments are annual values divided by 12 in order to obtain average monthly values. The counterfactual scenario where COVID-19 would not have happened is simulated by setting the revenue shock (s_{st}) to zero and thus using 2018 data as representative of normal times.

The elasticities of intermediate inputs and of the wage bill to sales are estimated through a panel regression analysis based on yearly data.[10] The former is close to unity, while the latter is estimated around 0.4. As expected, these estimates reflect that firms have a higher ability to adjust their consumption of intermediary goods than their workforce. To take into account the fact that the ability to adjust is lower when looking at monthly rather than at an annual frequency, in the spirit of Schivardi & Romano (2020), both elasticities are conservatively reduced to 0.8 and 0.2, respectively.

Next, the liquidity available to each firm is calculated month by month as the sum of the liquidity buffer held at the beginning of the period and the shock-adjusted cash-flow:

$$Liquidity_{it} = Liquidity_{i,(t-1)} + CashFlow_{it} \quad (2)$$

where $Liquidity_{i,(t-1)}$ refers to the liquidity remaining from the previous month and is equal to a firm's cash holdings in the first period.

Firms face liquidity shortages when they run out of cash and are unable to cover operating expenses, taxes due and costs of existing debt. By running this exercise month by month, we evaluate the share of firms that may have entered a liquidity crisis following the introduction of confinement measures. Importantly, this approach relies on the additional assumption that firms are not able to tap into external sources of working capital (e.g. short-term bank loans, trade credit) when facing a liquidity shortfall.

1.3. Simulation Results

1.3.1. The risk of Liquidity Shortages is High for a Large Portion of Firms

The main results suggest that, in the absence of government intervention, firms in our sample would have run out of liquidity relatively quickly: after one month, 18% of firms would have depleted liquidity buffers, 26% after two months, and 30% after three months (Figure I-A). The share of firms facing liquidity shortfalls could have even lifted to 34-38% by the end of 2020. To reflect the decision of most governments to provide cross-cutting support to firms in the first stage of the crisis, the simulations include also firms that would have faced liquidity shortfalls even in the absence of the COVID-19 epidemic, approximately 11% of the sample over a ten months period. It follows that the COVID-19 crisis would imply a three-fold increase in the share of firms experiencing liquidity shortages after ten months. These findings are thus in line with the burgeoning literature on the topic (Guerini *et al.*, 2020; Ebeke *et al.*, 2021; Gourinchas *et al.*, 2021): while the share of illiquid firms absent policy support varies across studies depending on specific modelling assumptions, most papers found an increase of between two and three times compared to a No-COVID-19 scenario.

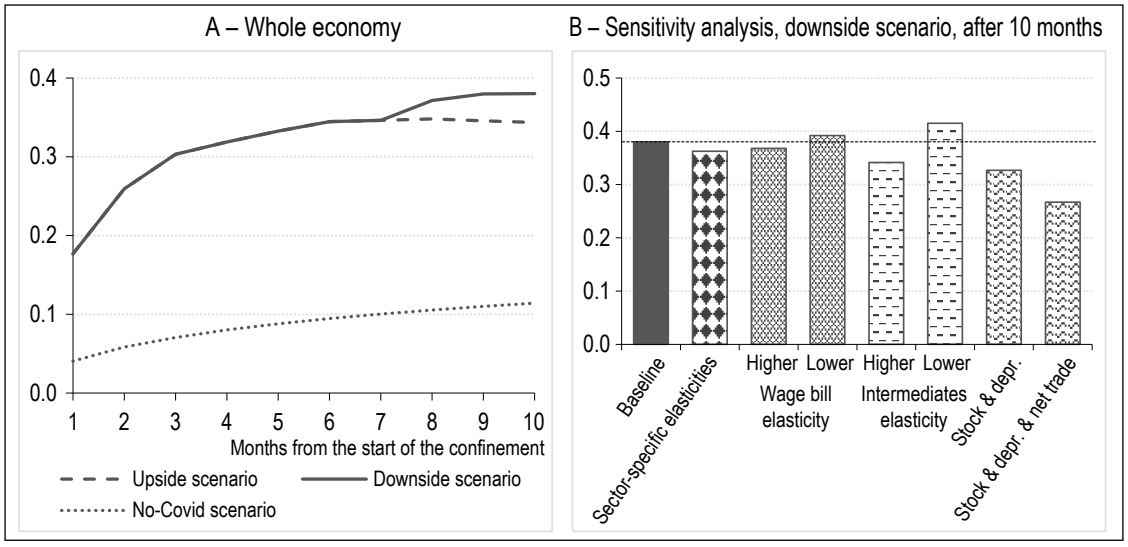
Next, we test the sensitivity of our results to changes of the main assumptions of the simulation model (Figure I-B).[11] First, using a (sector invariant) higher or lower wage bill elasticity (0.3 and 0.1 instead of 0.2) as well as a higher or lower intermediate costs elasticity (0.9 and 0.7 instead of 0.8) also provides findings in the same ballpark; the ability to adjust intermediate

9. Findings are unchanged if using 2017 instead of 2018 as the benchmark normal time year.

10. More specifically, we regress the growth in revenues on either the growth of intermediates cost or the growth of the wage bill, controlling for all shocks at the country-sector level and for firms' time-invariant characteristics (i.e., by including country by sector by year and firm fixed effects).

11. Results based on the "upside" scenario are not explicitly reported when they are quantitatively very similar, but are available upon request.

Figure I – **Share of firms facing liquidity shortfalls without government intervention**



Sources: OECD calculations based on Orbis® data.

costs appears more effective to reduce liquidity shortages. Second, considering that some firms and industries could have different ability and opportunity to adjust to an adverse shock (Buchetti *et al.*, 2021), we re-estimate elasticities of costs to sales allowing them to vary at the sectoral level (2-digits NACE Rev.2) and obtain very similar outcomes. Third, we tentatively expand our model to account for the potential role of inventories, depreciation and net trade credit. The share of illiquid firms is notably reduced when assuming that firms can use their inventories as liquid assets – proportionally to the monthly shock – and clear their trade credits and debits. However, the main message of the analysis remains valid as the share of firms facing liquidity shortages more than doubles also in this setting. We chose a simpler modelling in the baseline setting for three reasons:

(i) Inventories are difficult to model:

- The two main accounting standards (US GAAP and IFRS) allow for different methods in valuing inventories. Further, even within the same accounting regime, firms have leeway in valuation. Consequently, the value of inventories sold, which affects the income statement, and the stock of inventories, which is part of the balance sheet, can vary across and within standards, making any meaningful comparison across firms challenging.
- The extent to which they could be transformed quickly into cash during a crisis is questionable. Rather than monetising their inventories, some firms built buffers during the crisis to face supply chains disruptions. Consistent with this, aggregate statistics do not provide clear evidence on the role played by inventories during the crisis and suggest large cross-country and over time variations (Andersson *et al.*, 2020).

(ii) Trade credits and debits are also hard to be accounted for as the lack of data on cross-firm linkages does not allow to properly model the probability of payment conditional on the shock and firms' health. Preliminary evidence suggest that delays in clearing has increased substantially (Gonzalez, 2021). As a consequence, our baseline model assuming implicitly that trade credit payments are frozen may be more realistic than assuming a full clearance, especially when looking at a short time frame.

(iii) Finally, increasing the number of variables in the model implies a 25% reduction in the sample due to data availability. In particular, as reporting tends to be higher for larger firms, the reduction may prevalently concern small firms which have been particularly hit by the COVID-19 crisis.

Overall, given that running into a liquidity shortfall may trigger bankruptcy of otherwise profitable firms, our findings emphasize that the COVID-19 shock could have had large and permanent adverse effects on the corporate sector.

1.3.2. Heterogeneity across Sectors

The impact of the COVID-19 outbreak on firms' liquidity is heterogeneous across sectors. Without policy intervention, more than half of firms are predicted to experience liquidity shortages in the "Accommodation and food service activities", "Transports" and "Arts, entertainment

and recreation" sectors; by contrast, the "Utilities", "Information and communication" and "Professional services" sectors display a share of illiquid firms consistently below 20% in our sample (Figure II-A). Moreover, as shown in Figure II-B, firms in intangible-intensive or low external finance dependent sectors appear better positioned to weather the crisis compared to those in sectors intensive in tangible assets or highly dependent on external financing. This is consistent with their specific financial structure, often characterized by larger cash buffers in normal time, as well as with the higher ability of intangible-intensive firms to rely on innovative technologies and teleworking arrangements, thus being exposed to a less severe sales shock.

1.3.3. Heterogeneity across Firms

Solvency, Collateral Availability and Indebtedness

Firms run into a liquidity shortfall if their assets are not liquid enough to cover current expenses. However, they may still be solvent if the value of their assets is larger than the value of their liabilities or, equivalently, if they have collateral to pledge in order to obtain additional bank financing (Figure III-A).[12] Only a relatively small share of firms (around 11%) among those expected to face liquidity shortfalls would be close to insolvency when evaluating their overall net worth. Even though solvent, they could still have difficulties in accessing new bank financing: around 27% of firms turning illiquid during the confinement would lack the collateral to tap into additional debt financing (Figure III-A).[13]

Firms with higher debt tend to be more exposed to liquidity shortfalls (Figure III-B). While only around 25% firms with low debt run out of liquidity after 10 months, roughly 60% of the firms with high levels of debt face a liquidity shortfall over the same time horizon. Everything else equal, firms with higher levels of debt face higher interest payments and larger amounts of principal repayment, thus depleting any existing liquidity buffers faster.

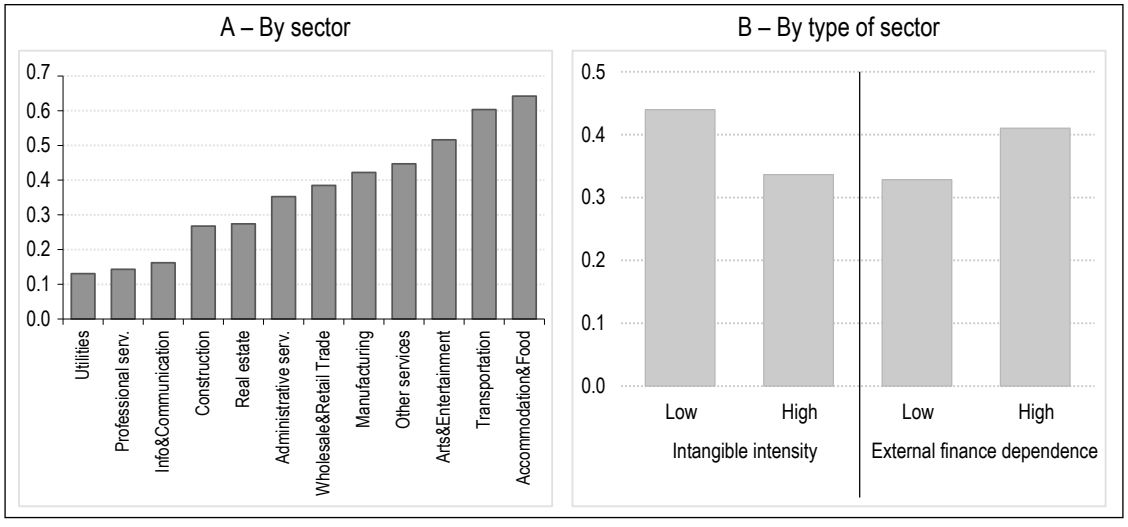
Type of Ownership

Firms could also differ in their reaction to an adverse shock depending on their ultimate owner. A stream of literature supports the view that the longer planning horizon of family firms could lead to more stable and longer lasting relationships with stakeholders, e.g. banks (De Massis & Rondi, 2020). This could indeed affect firms' capacity to adjust independent of firm-level observed financial data, for example by lowering agency costs resulting from asymmetric information. Similarly, family firms may find it easier to adjust their wage bills than widely

12. Collateral is proxied by the difference between fixed assets and long-term liabilities.

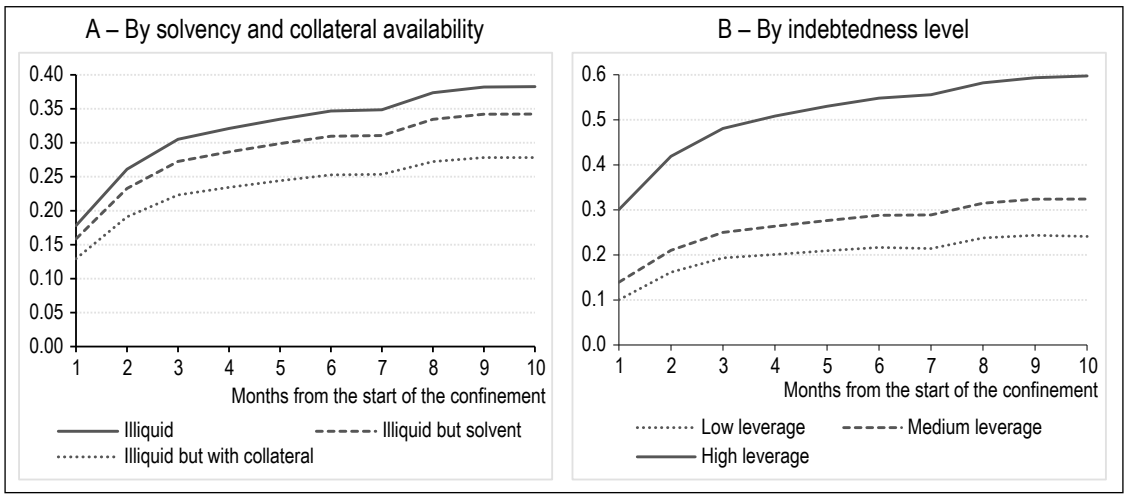
13. Access to financing options and lending conditions for bank loans also depend on the country-level degree of financial development. Firms operating in high financial development countries may alleviate liquidity shortages more easily due to i) *lower interest rates and higher availability of bank credit,* ii) *the possibility to tap capital markets to issue new equity or debt,* iii) *a more efficient deployment of policies involving financial intermediaries in the implementation phase. Our framework does not allow to model firms external financing options, but part of cross-country differences are implicitly taken into account in the cash flow equation through the magnitude of interest payments. Furthermore, the vast majority of the firms in the sample are relatively small and thus unlikely to have access to international equity or bond markets.*

Figure II – **Share of firms facing liquidity shortfalls without government intervention, by sector and by type of sector in terms of share of intangible assets and financial dependence, downside scenario after 10 months**



Note: Sectoral intangible intensity and external finance dependence are computed following Demmou *et al.* (2019).
Sources: OECD calculations based on Orbis® data.

Figure III – **Share of firms facing liquidity shortfalls without government intervention by solvency, collateral availability and indebtedness, downside scenario**



Note: Illiquid firms are said "solvent" if the value of their assets is larger than the value of the liabilities, while they are defined "with collateral" if the value of their fixed assets is larger than the value of their long-term liabilities. Low leverage corresponds to firms belonging to the lowest 1/3 of the leverage distribution within each sector; medium-leverage to firms belonging to the middle 1/3 of the leverage distribution within each sector and high-leverage to firms belonging to the highest 1/3 of the leverage distribution within each sector. Leverage is measured as the ratio between financial debt (short- plus long-term debt) and total assets.
Source: OECD calculations based on Orbis® data.

held firms (Mullins & Schoar, 2016). Empirical evidence based on weekly stock returns before and after the onset of the COVID-19 pandemic shows that share prices of family-owned firms indeed declined less than those of widely held firms (Amore *et al.*, 2021; Ding *et al.*, 2021).

The ownership data available through Orbis allows to disentangle the type of firms' global ultimate owners.[14] The most prevalent types are non-financial firms, financial firms (e.g. banks or asset management companies) and individuals or families. Firms owned by individuals or families tend to have higher cash holdings and lower financial debt, but also lower profitability and equity (Figure IV-A). Across all sectors, firms owned by individuals or families tend to be more exposed to a liquidity shortfall, though the differences with firms owned by non-financial or financial firms are not overly large (Figure IV-B). The higher share of firms owned by individuals or families running out of liquidity appears surprising, given that these firms tend to have higher liquidity buffers and face lower interest payments due to lower debt. However, their lower profitability, implying higher costs for the same amount of revenue, attenuates to some extent the effect of cash and debt. Nevertheless, it seems unlikely that financial data alone can explain the aggregate share of firms facing a liquidity shortfall by type of owner. Instead, it seems likely that ownership is not distributed uniformly across sectors. In particular, family firms tend to be more prevalent in the most hit sectors, e.g. food and accommodation sectors, and less in manufacturing sectors (e.g. Andersson *et al.*, 2018). Results by sector and type of owner confirm this intuition (Figure IV-B). In conclusion, it appears unlikely that a channel operating solely through ownership would significantly alter the share of firms facing liquidity problems.

2. Public Policies to Reduce Liquidity Shortages and Curb Bankruptcy Risk

While the above findings are based on several assumptions and must be interpreted with some caution, they underline the importance of swift and decisive public intervention to avoid potential bankruptcies of otherwise healthy companies. Such intervention has been crucial to prevent a more widespread corporate crisis, with serious consequences for the shape of the recovery and long-run growth prospects.

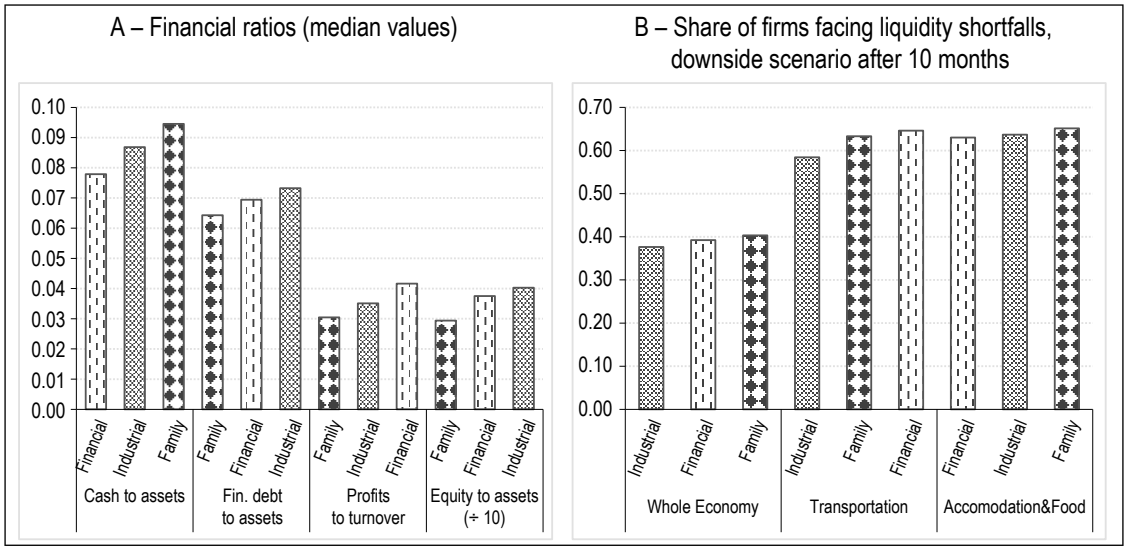
2.1. A Stylized Comparison of Policies Impact

Countries have introduced a wide range of measures to help firms dealing with the disruptions associated with COVID-19 (Box 1). The simple accounting model described above is used to shed light on the impact of stylised policy interventions in three areas:

- Tax deferrals. To support business during the epidemic, several countries have introduced

14. A global ultimate owner is the entity or individual at the top of the corporate ownership structure.

Figure IV – **Liquidity shortfalls without government intervention, by type of owner**



Note: Compared to the baseline simulations, the sample is restricted to firms with available ownership data.
Sources: OECD calculations based on Orbis® data.

tax deferrals. The tax deferral is modelled as the moratorium of the (hypothetical) monthly tax payments for the entire period considered (10 months).[15]

- Financial support for debt repayment. A large number of countries have also established legislative frameworks that temporarily allow firms to postpone their debt payments or, alternatively, that offer State guarantees to facilitate access to short-term debt facilities. The potential impact of such policies is modelled as a moratorium on short-term debt over the whole period in all sectors facing an initial sales shock larger than 20% during the first months of confinement.

- Temporary support to wage payments. A critical response to avoid widespread liquidity shortfalls consisted of relaxing firms' financial commitments vis-à-vis their employees. Schemes such as a shortening of working time, wage subsidies, temporary lay-offs and sick leave have been introduced across countries, though in different combinations. All these measures reduce the wage bill firms have to pay. The support is modelled in two alternative ways: as an unconditional reduction of the monthly wage bill by 80% in all sectors facing a sales shock larger than 20% in the given month (wage subsidy scheme);[16] as a support adjusted to the sectoral size of the shock and modelled through an increase to 0.8 of the elasticity of wage bill to sales (short-term work scheme).[17] Notice that, under these assumptions, the two schemes entail different fiscal costs, with the short-term work scheme being less costly. Further, it is

15. It is worth noting that the deferral of tax might not have a large impact in a period where sales and profits are expected to be limited. Moreover, due to data availability, the analysis does not allow distinguishing different types of taxes.

16. According to the OECD tracker the amount of labour subsidy varies across countries between 60 to 100% of gross wage, with a great majority of countries providing a support ranging from 70% to 90%. This is the case for instance of Canada, Denmark, France, Netherland, Norway, Sweden and Japan.

17. Indeed, in some countries the support is targeted only to firms experiencing a sizeable shock in their activity. The elasticity implies that the support is ranging from 40% to 80% depending on the size of the sectoral shock.

Box 1 – **Measures Adopted in OECD Countries to Support Workers and Firms in the Wake of the COVID-19 crisis**

This box provides some examples of concrete measures OECD economies have implemented to support workers and companies at the beginning of the COVID-19 crisis.

Many OECD countries subsidise temporary reductions of hours worked in firms impacted by confinement measures. Austrian authorities, for example, support wages of workers in all sectors (except public service) of up to 70%, in some exceptions up to 90%, of the net salary in the phase 3 of their short-time working scheme (November 2020). The scheme allows to temporarily reduce the number of hours worked to zero, however, workers are required to work at least 20% of the working-time calculated over the full period in which the firms receives support through the short-time working scheme. The maximum period of support through short-term work is of six months (at the time of writing of this article). The total amount taken over by the government varies with the gross salary. ➔

Box 1 – *(contd.)*

Another set of measures consists of financial support for debt repayment. The Business Credit Availability Program (BCAP) in Canada, for example, supports access to financing during the COVID-19 crises in various ways for firms across all sectors. Small businesses with up to CAD 1.5 million in total payroll costs in 2019 can receive interest-free loans up to CAD 40 000 to cover operating costs (e.g. utilities, payroll, rent, debt service). These loans are fully guaranteed by the public. One fourth of the loan is forgiven if it is repaid by the end of 2022. If not, the loan will be automatically converted to three year loan at 5 per cent interest. Larger businesses can tap additional bank-based debt financing up to a total loan amount of CAD 6.25 Million, guaranteed to up to 80% by the public. These loans comprise only operating costs and cannot be used to fund dividend payments, share repurchases and other shareholder payments, increases in the compensation of executives or to refinance or repay existing debt.

Besides guaranteed loans, a couple of OECD countries directly subsidize firms' operating costs. Norway, for example, compensates Norwegian firms that suffered significant losses of turnover due to the COVID-19 crisis. All taxable registered companies in most sectors (except oil and gas, financial industry, utilities) in Norway are eligible for this compensation under the condition that they were not already in financial distress before the crisis.

Temporary reductions in tax rate or deferrals of tax or social security payments constitute a further possibility to prevent liquidity shortfalls in the short-term. Korea has introduced a temporary special tax reduction for SMEs located in Corona-related disaster areas until the end of 2020. VAT payments by small businesses, i.e. businesses with less than KRW 80 million in annual revenues, are reduced as well until the end of 2020. Small businesses can further defer taxes up to 1 year and social security contributions up to three months.

Several OECD economies have complemented subsidies, loan guarantees and tax-related measures with "soft" tools to ensure repayments and to safeguard operating cash flow. In France, for example, authorities actively support mediation over credit conflicts between private parties with a free, fast and reactive mediation service. French SMEs can also mobilise credit mediation if they experience difficulties with one or more financial institutions. Furthermore, the Ministry of Economy and Finance has set up a crisis unit dedicated at inter-company credits to monitor the use of trade credit.

assumed that firms receiving support maintain unaltered workers earnings (i.e. firm top-up, see Box 2).

Figure V and Figure VI illustrate, respectively under the downside scenario and the upside scenario, the extent to which each measure is expected to curb the risk of a liquidity crisis compared to the no-policy intervention scenario. Both figures look at the two alternative temporary supports to wage payments. Tax deferral has the lowest impact on firms' liquidity positions, followed by debt moratorium policies. Overall, subsidies to the wage bill seem to be the most powerful measures (yet potentially costly), in line with the fact that wages and salaries are often the most relevant component of operating expenses. Adding up the three different measures, public intervention after two months, for instance, would decrease the number of firms running out of liquidity from 26% to 7% when assuming a wage subsidy scheme that implies a reduction of the wage bill by 80% in all sectors facing a sales shock larger than 20% (left panel), and from 26% to 13% when assuming a short-term work scheme, which is conditional on the shock's size (right panel).

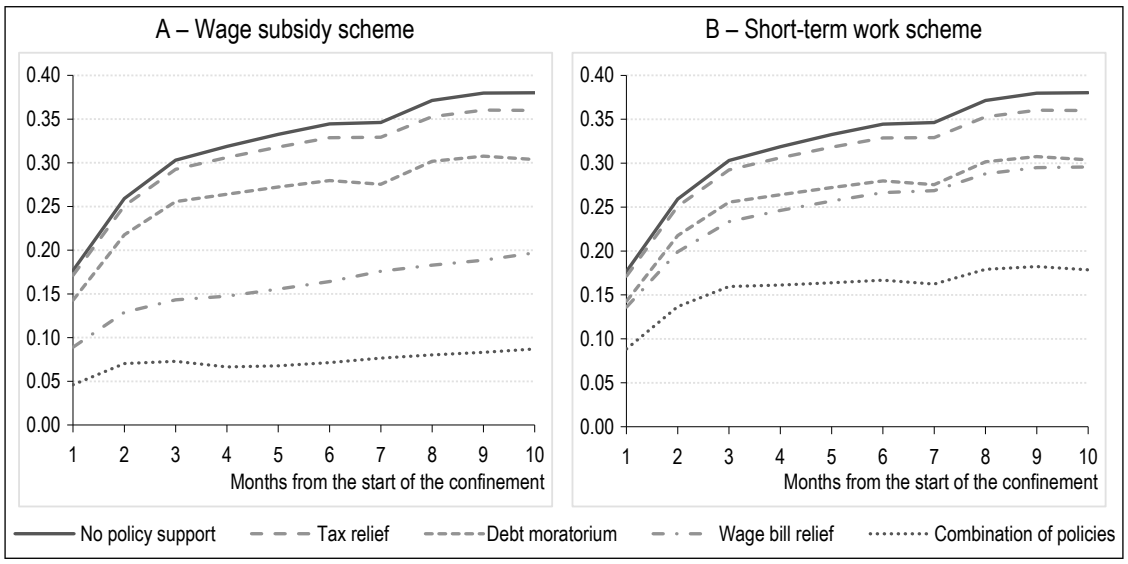
2.2. Zooming in on the Effects of Labour Market Policies on the Share of Firms Facing Liquidity Shortfalls

In this section, the model outlined in Section 2 is extended to evaluate the relative effectiveness of job retention schemes at reducing the share of firms facing liquidity shortages. In particular, the analysis focuses on the cost-effectiveness of two frequently employed schemes, the Short-Term Work scheme (STW) and the Wage Subsidy (WS) scheme.[18] To do so, we impose fiscal neutrality between the two schemes, which is achieved by ensuring that the surface under the cost curves for the government is identical under the various schemes. In particular, a 40% wage subsidy comes at a similar cost to the government as the STW scheme based on a replacement rate of 80% for hours not worked, but under the assumption that government support is uniformly distributed across firms experiencing a decline in revenues above a certain threshold (i.e. 20% as in previous section settings). It is further assumed that reductions in sales translate one-to-one in reductions in working time, while employment remains constant.

The likelihood that a firm becomes illiquid is affected by the way the burden of the adjustment of working hours is shared between government, firms and workers. An increase in the government support or a decline in wages both contribute to reduce the risk of a liquidity shortage. By contrast, the payment of a non-worked hours has the reverse effect. To disentangle the direct effect of the government support on the share of firms

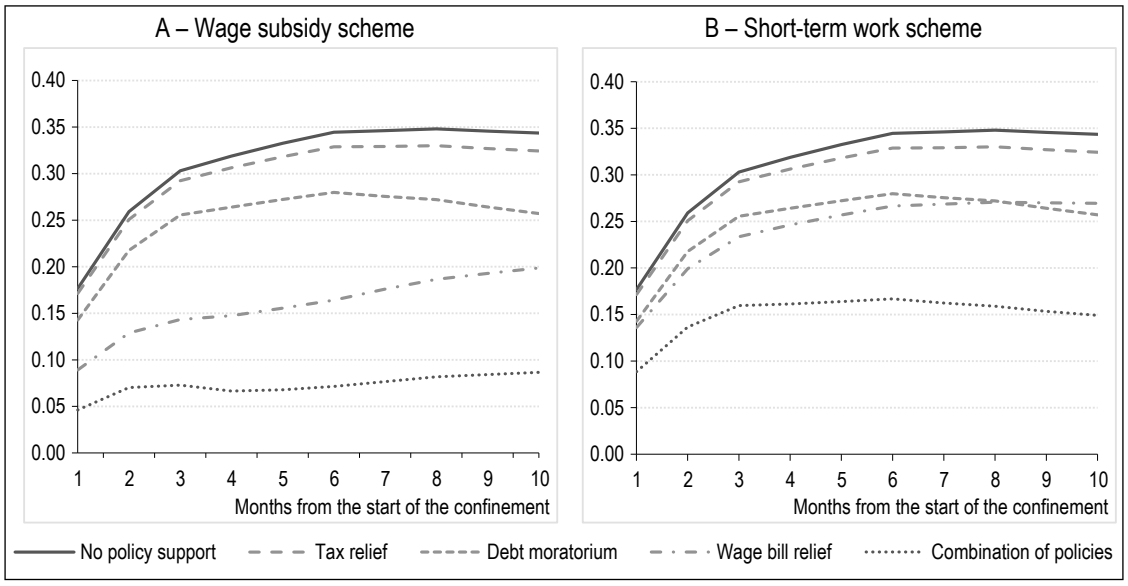
18. In this section, we ignore the effect of debt moratorium and tax deferral to focus on labour market policies.

Figure V – **Impact of support policies on the share of firms facing liquidity shortfalls under two schemes of wage bill relief, downside scenario**



Note: The wage subsidy scheme, implies a reduction of the wage bill by 80% in all sectors facing a sales shock larger than 20%; the short-term work scheme is conditional on the sectoral size of the shock and modelled through an increase to 0.8 of the elasticity of wage bill to sales.
Sources: OECD calculations based on Orbis® data.

Figure VI – **Impact of support policies on the share of firms facing liquidity shortfalls under two schemes of wage bill relief, upside scenario**



Note: See Fig. V.
Sources: OECD calculations based on Orbis® data.

with liquidity problems from the indirect effect that is due to the adjustment in worker earnings, two sets of simulations are conducted:

- Firms fully top up subsidies to maintain worker earnings despite a reduction in working time. Under this scenario, wages do not adjust, allowing to isolate the direct effect of government support in reducing the share of illiquid firms.

- Firms do not top up subsidies in the case of reduced working hours, implying that workers get paid only for hours worked or, alternatively, the subsidy if earnings are too low. Under this scenario, the share of illiquid firms is further reduced by the extent of the worker adjustment.

Box 2 provides details and explanations about the adjustments related to not worked hours by government, firms and workers in our stylised STW and WS schemes.

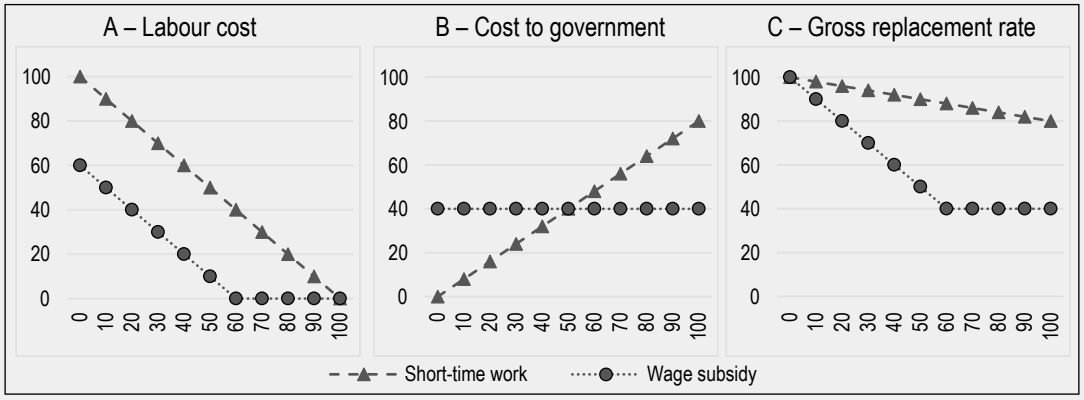
When firms top-up the subsidy in order to compensate for any wage decline, STW and

Box 2 – **A stylised comparison of STW and WS schemes**

In the stylised STW scheme, workers receive a compensation of 80% of their wage for any hour not worked. Absent of top-ups by firms, employers bear the full costs of any hours worked, but none of the costs of hours not worked. Consequently, labour costs decline towards zero at the same rate as hours worked (see Figure, Panel A), while the cost of this subsidy for the government increases (Panel B). Total earnings for workers decline (Panel C) with the number of hours not worked. If firms top-up the subsidy in order to avoid any wage losses for workers, earnings are unaffected by the reduction in working time, while firms have to contribute 20% of the cost of hours not worked.

Under the WS scheme, it is assumed that employers receive a subsidy equal to 40% of usual wage bill, irrespective of the reduction working time (Panel B). In the absence of firm top-ups, the reduction in labour costs for firms is equal to the subsidy (Panel A); firms' labour costs are zero if working hours are reduced by more than 60%. Employees do not receive any compensation for hours not worked unless earnings for hours worked fall below the level of the subsidy (Panel C). With full top-ups, workers earnings are unaffected by the reduction in working time, while firms cover the costs of hours reductions beyond 60%.

Figure – **Firms' labour cost, replacement rates, fiscal costs of stylized STW and WS in the absence of top-ups by firms**



Note: The x-axis represents the % of hours not worked; the y-axis variable is indicated in the title of each panel.
Sources: OECD (2020b).

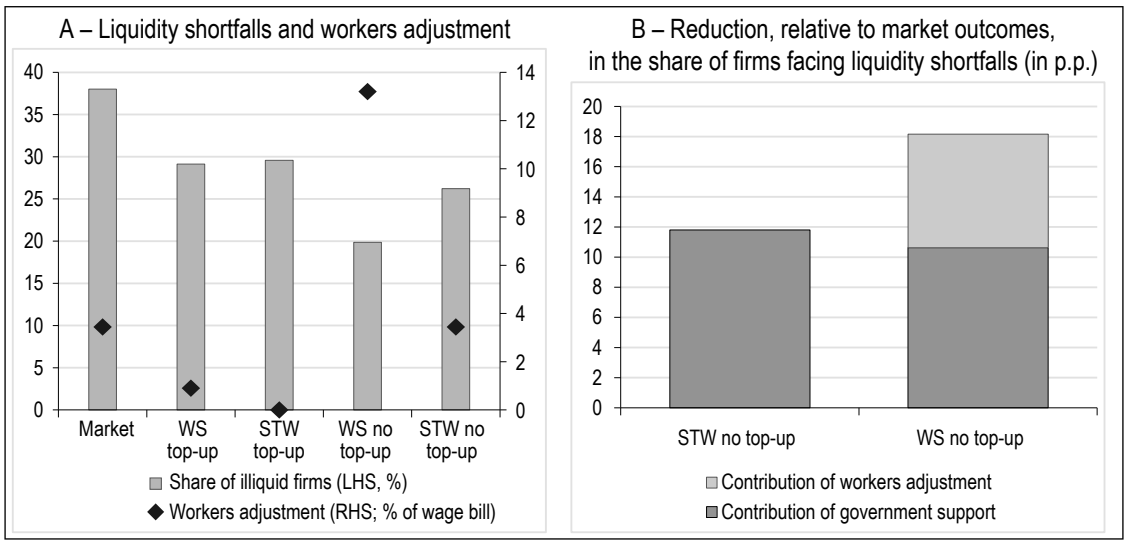
WS schemes subsidies are found to be similarly effective at addressing firms' liquidity shortages (see Figure VII-A). This is mainly because granting a wage subsidy to firms experiencing a large decline in sales ensures that government support is not too largely dispersed and broadly targets the same set of firms benefitting from STW; indeed, the removal of the threshold to access WS schemes would make STW relatively more cost-effective.[19]

In the absence of top-up by employers, WS schemes potentially allow for larger reductions in labour costs for firms compared to STW, at the cost of providing weaker income protection for workers on reduced working hours (Figure VII-A). Indeed, the share of firms facing liquidity shortfalls decreases considerably more under the WS stylised scheme (e.g. around 18 percentage points (p.p.)) rather than under the STW scheme (e.g. up to 12 p.p.). However, these estimates capture both the direct effect of the support and the indirect adjustments to workers earnings. Figure VII-B further illustrates how the burden of the adjustment is distributed between workers and government compared to a market adjustment scenario. The STW scheme envisages the same worker adjustment as in the market scenario and thus the 12 p.p. reduction in the share of illiquid firms is fully driven by the contribution of government support; on the contrary, government contributes only for 10.5 p.p. in the reduction associated with the WS schemes and the remaining 7.5 p.p. are due to worker adjustment. As a result, in the absence of firms top-up, STW work schemes appear slightly more cost-effective.[20]

19. Detailed calculations available upon request. Under the WS scheme with firms top up and no threshold, the share of firms facing liquidity shortages would rise to 32% compared to the 29%. Indeed, the lower the threshold, the higher the number of eligible firms and lower the level of the wage subsidy for each firm at a given overall fiscal cost.

20. It is worth noticing that the exercise is stylized in nature and aims at illustrating the adjustment mechanisms related to STW and WS schemes; the several ways in which STW and WS could be designed may have a relevant impact on their cost-effectiveness (e.g. extent of wage adjustment, eligibility thresholds). Moreover, the stylised comparison and the simulations below abstract from the difference in labour costs for firms and gross wage for workers due to the presence of employer social security contributions.

Figure VII – **Simulated reduction in the share of firms facing liquidity shortfalls with the STW and WS schemes, downside scenario at 10 months**



Sources: OECD calculations based on Orbis® data.

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This paper examines the vulnerability of non-financial corporations in the context of the COVID-19 crisis. Without any policy intervention, our model predicts that corporate liquidity buffers would have run out quickly: 18% of the firms in our sample would have run out of liquidity after one month, 26% after two months, 30% after three months and 38% after ten months. The impact of the shock is highly heterogeneous across sectors and type of sectors, while firms facing a high risk of experiencing liquidity shortfalls appear to be mostly profitable and viable companies. However, a sizeable share of these firms does not have enough collateral to bridge a shortfall in liquidity with additional debt and/or is too highly leveraged to bridge the crisis through further bank loans.

Policy makers have taken a wide range of actions to mitigate the risk of a liquidity crisis, including job retention schemes, debt moratoria and tax deferrals, but also a set of complementary policies to bridge remaining liquidity needs (e.g. loan guarantee programmes and direct support). Adding up different policy measures (tax deferral, a debt-moratorium and wage subsidies), our simulation suggests that government interventions brought back the share of firms running out of liquidity to normal time levels, offsetting the shock on sales for the average firm. Further, among the wide range of measures introduced across OECD countries, direct and indirect support to wage payments seems to have been a pivotal policy to curb the liquidity crisis, given the high share of wage costs in total spending. Imposing an identical fiscal cost for governments, the effectiveness of short-term work (STW) and wage subsidy (WS) schemes in limiting firms' liquidity shortages depends on their design. In the absence of an eligibility threshold, STW schemes appear more cost-effective than WS. The higher the eligibility threshold, the more STW and WS schemes are found to achieve similar outcomes. Moreover, WS schemes can reduce even further the share of firms facing liquidity shortfalls, but at the cost of lower income protection for workers.

While economic growth has picked up in 2021, helped by strong policy support, the deployment of effective vaccines and the resumption of many economic activities, several challenges potentially undermining the strength of the recovery should be closely monitored:

- An effective exit strategy from policy support packages is needed to maximize their benefits as long as possible and to reduce their drawbacks. While firms have already gone through the hardest part of the crisis, liquidity shortages may persist as social distancing measures in hard-hit sectors may still apply and it may take time for firms to generate again the stream of profits needed to meet their financial commitments. SMEs, which have been the most hit during the crisis, may in particular not be able to exploit fully the international recovery, as for instance their larger competitors are doing. As a consequence, support programmes may need to remain active in the short-term to avoid that a premature withdrawal may induce a collapse of credit flows (FSB, 2021).

- The shock could still translate into a wave of corporate insolvencies. While the swift and decisive response of policy makers has been effective to keep a lid on bankruptcies in 2020 (Djankov & Zhang, 2021; OECD, 2021), the number of non-financial corporations in distress has likely increased worldwide as the shock diminished sales and profits, thereby putting downward pressure on the value of firms' assets (Carletti *et al.*, 2020; Guerini *et al.*, 2020; Hadjibeyli *et al.*, 2021). Similarly, the use of debt instruments to cover liquidity shortages has led to a surge of indebtedness in segments of the corporate sector. Hence, one challenge for over-indebted but viable firms consists in restoring equity buffers and ensuring the sustainability of pandemic-induced debt.

- The consequences of the crisis and of the large policy support on productivity are still largely unknown. The crisis may have cleansing or scarring effects on productivity, depending on the productivity of firms that are forced to exit the market and on the dynamism of business formation. By affecting the type of firms "saved" over the productivity distribution and the barriers to enter the market, policy support has the potential to alter the market selection process and thereby aggregate productivity performance. Preliminary analyses suggest that policies have contributed to an hibernation of the corporate sector rather than a zombification, thus being beneficial also from a productivity standpoint (Cros *et al.*, 2021; Laeven *et al.*, 2020). A progressive phasing out and targeting of policy support toward viable firms, as well as incentives to facilitate the entrance of new firms in the market, are important to design productivity-friendly policy packages and to favour the reallocation of resources across firms and sectors when needed.

- Governments will face different policy challenges depending on the severity of the shock and the choice of the policy mix. While the range of policy tools used by public authorities to support the corporate sector has been broadly similar, they were implemented in different combinations. Where policies aimed at smoothing financial obligations over time (e.g. tax deferral, extending loan maturities, loan guarantee programmes) have been prevalent compared to direct support policies involving a mutualisation of losses (e.g. liquidity injections, direct subsidies), public debt is predicted to augment less, but firms' leverage ratios are expected to increase more, potentially leading to debt overhang in the corporate sector. Symmetrically, the prevalence of direct support will leave firms with a lower debt burden, but would rather increase public debt, hence entailing future fiscal policy challenges. □

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APPENDIX

Table A-1 – **Detailed dynamic of the three alternative revenues shock scenarios**

Months from the start of the confinement		1	2	3	4	5	6	7	8	9	10
Size of the shock	Upside scenario	S	S	S*0.75	S*0.4	S*0.4	S*0.4	S*0.2	S*0.2	S*0.1	S*0.1
	Downside scenario	S	S	S*0.75	S*0.4	S*0.4	S*0.4	S*0.2	S*0.75	S*0.4	S*0.2

Note: The table shows the detailed dynamic underpinning each of the alternative scenarios. The revenues shock (S) is sector specific and calculated each month with respect to normal time revenues.

Table A-2 – **Number of firms by country**

Country	Total number of firms	% of the sample
BEL	12,037	1.40
DEU	2,801	0.33
DNK	1,840	0.21
ESP	202,731	23.59
FIN	17,670	2.06
FRA	52,614	6.12
GBR	18,999	2.21
HUN	82,821	9.64
IRL	1,473	0.17
ITA	288,091	33.53
POL	22,526	2.62
PRT	108,638	12.64
ROU	5,499	0.64
SWE	41,559	4.84
Total	859,299	100

Sources: OECD calculations based on Orbis® data.

Table A-3 – **Firm-level descriptive statistics**

	p5	p25	p50	mean	p75	p95
Number of employees	3	5	8	38	19	106
Gross revenues	113,306	380,421	985,592	10,800,000	3,149,000	26,100,000
Value added	39,191	128,364	307,468	2,293,000	871,795	6,137,000
Intermediates	46,000	203,669	597,060	8,481,000	2,125,000	19,400,000
Cash Flow	–21,634	11,850	46,843	775,265	179,690	1,607,000
Ebitda	–20,355	16,963	62,582	827,842	226,270	1,910,000
Total Assets	56,700	245,835	731,839	6,567,000	2,539,000	20,900,000
Fixed Assets	2,117	29,407	134,781	4,927,000	615,528	6,652,000
Cash Holdings	1,368	15,269	62,429	515,844	243,048	1,900,000
Current Assets	31,348	153,291	475,153	5,271,000	1,643,000	13,100,000
Total Liabilities	25,305	131,880	419,238	6,191,000	1,479,000	12,200,000
Current Liabilities	16,398	90,118	291,689	4,056,000	1,046,000	8,870,000
Short-term financial debt	0	0	0	601,248	58,366	1,410,000
Non-Current Liabilities	0	3,533	57,657	2,102,000	285,000	2,582,000
Long-Term financial debt	0	0	8,830	1,461,000	142,138	1,677,000
Fixed Assets over Total Assets	0.01	0.08	0.22	0.29	0.46	0.82
Fixed Assets over Wage Bill	0.02	0.17	0.59	3.76	1.73	8.24
Cash Holdings over Total Assets	0.00	0.03	0.10	0.18	0.26	0.60
Cash Flow over Total Assets	–0.06	0.03	0.07	0.09	0.14	0.33
Total Liabilities over Total Assets	0.14	0.41	0.65	0.68	0.85	1.03
Financial Debt over Total Assets	0.00	0.00	0.07	0.16	0.26	0.57
Current Liabilities over Revenues	0.06	0.16	0.27	0.45	0.46	1.11
Interest Coverage Ratio	–8.17	4.60	15.70	2567	66.40	1312
Net worth (total assets - total liabilities)	–4,755	53,195	209,915	2,535,000	876,364	8,361,000
Fixed Assets minus Non-Current Liabilities	–267,533	0	46,558	1,395,000	308,069	4,137,000

Note: Monetary values are in EUR current (2018) prices.
Sources: OECD calculations based on Orbis® data.

COMMENT

Public Support to Companies in Times of Crisis: The Value of Microsimulations based on Company Data

Xavier Ragot*

Abstract – The use of company data to simulate the effect of an economic shock or a public policy is a new method of *ex ante* forecasting and evaluation of public policies. Microsimulations are based on assumptions about the behaviour of firms, which can be discussed. However, as the three articles in this thematic section show, microsimulations allow us to identify the characteristics of firms that best capture their trajectory. During the crisis, the sector of activity proved to be the primary factor. Pre-crisis liquidity and productivity levels of firms then explain the fragility of firms within each sector. These simulations then show that public support has been fairly well targeted, and that the least productive companies have not been particularly helped. The possible overcompensation of sectors needs to be studied. It will be important to compare these simulations with the *ex post* evaluations, once the company data are available.

JEL Classification: D22, G38, H81
Keywords: COVID-19, liquidity, microsimulation, companies

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The three-article thematic section of this issue focuses on non-financial companies during the 2020 health crisis. Although they are being published today, some of these studies were carried out very early in 2021, thereby contributing to our understanding of this unique crisis and the impact of the business support measures implemented. Before summarising their findings, we need to put this period into perspective in order to clear up the retrospective illusion, which would suggest that the state of the economy was known at the time: the economic policies described in these articles were put in place in Europe and France against a backdrop of huge uncertainty: the scale and duration of the health crisis were unknown; the behaviour of consumers and employees faced with the risk of infection had therefore to be considered within an unprecedented environment. The impact on activity of periods of lockdown had never been studied and brought about a rethink of the very concept of activity measurement (Bignon & Garnier, 2020; Blanchet & Fleurbaey, 2022). In addition, some of the measures put in place to support the economy were new in design and involved exceptional amounts. Finally, the impact on companies and the State budget was equally uncertain. Suffice to say that the contribution made by these three articles, which analyse company dynamics and the impact of the support policies implemented in 2020 is more than welcome.

Company Data and Microsimulation

All three articles make use of company data to perform microsimulations for the year 2020. It is important to emphasise not only the benefits, but also the limitations of such an exercise. Its main benefit lies in the fact that the databases allow a large number of companies to be tracked. The two articles by Bureau *et al.* (2022a and 2022b) track 645,000 non-financial companies (NFCs) in France using data from FARE (*Fichier approché des résultats d'ÉSANE* – compilation of annual company statistics –aggregate results file). These companies represent 71% of the value added of NFCs. Demmou *et al.* (2022) track 859,299 companies in 14 European countries based on balance sheet data from the ORBIS database. These large sample sizes allow us to understand companies' dynamics, by sector, by size, based on their financial robustness before the crisis, as well as the diversity of the individual situations beyond these factors.

However, the exercise is restricted by the availability of data: In the two articles by Bureau *et al.*, the 2018 FARE data are used to simulate the year 2020, using other data, such as monthly VAT data for 2020, as additional information. The ORBIS data used for the analysis date from late 2018. In addition, aggregated data from 2020 are used to improve the quality of the simulations. The three articles therefore do not analyse company data from 2020, which are not yet available, but informed forecasts of what happened in 2020, based on the 2018 data. As others performing the same exercise, in particular Gourinchas *et al.* (2021) or Guérini *et al.* (2020), the value of such studies lies in their ability to show that, even when faced with such inevitable limitations due to data availability, the use of company data and microsimulations provides an essential additional tool for understanding radically new events, such as the health crisis.

Now, in order to put the findings of these articles into perspective, we must refer to the significant economic challenges identified during the health crisis as regards the nature of the economic shock and the objectives of economic policy.

The Economic Shock during the Health Crisis

The value of company data lies in its ability to provide us with information concerning the nature of the economic shock caused by the health crisis. In early 2020, this shock was addressed with standard economic concepts: was it a demand or supply shock, a sectoral or aggregate shock? The use of company data and the construction of microsimulations have made it possible to shift the focus of the analysis to other essential elements. The first key element is a measure of the loss of operating income suffered by companies, without prejudging its cause (production difficulties or lack of customers). Second, it was understood that the findings were heavily reliant on the ability of companies to adjust their inputs downwards, and in some cases upwards, for example for payroll and for production costs, such as rent or electricity. Access to credit was also identified as a key factor in production dynamics in times of stress. Company data makes it possible to differentiate their weight between sectors, which turns out to be essential, as well as by size of the companies, shedding new light on the complexity of the economic shock on companies.

Economic Policy Objectives and Trade-Offs

Once the nature of the shock has been established, the economic policies put in place during the crisis must be evaluated. As is pointed

out in the article by Demmou *et al.* (2022), every European State intervened heavily to support companies with measures that were similar in nature, but applied in different ways, such as a deferral of tax payments, help to access liquidity and support for wage payments. In order to understand the lessons from these articles studying the impact of the measures involving the liquidity of companies (Bureau *et al.*, 2022b and Demmou *et al.*, 2022), we must first summarise the major trade-offs that the support policies put in place for companies had to face. We can identify three main trade-offs, i.e. elements for which the public authorities must choose between benefits and costs. We acknowledge in this regard that the identification of such trade-offs is much easier after the crisis and therefore suffers from the aforementioned retrospective bias.

The first trade-off, which will be the one discussed in the most detail here, is between the provision of financial support to companies and the cost to public finances, which are primarily financed through public debt. The answer to this trade-off was the selection of a set of measures that aimed to avoid waves of bankruptcy without defining a precise budget, a policy summarised as "whatever it costs". As a result, the measure of the cost to public finances is itself an object of analysis. It is useful to focus on this trade-off as there is no obvious answer. Indeed, the economic costs of bankruptcy are not easy to ascertain. A bankruptcy or default on payment involves either a dramatic restriction of business or the cessation of business. The company closes, but the production resources that it used are now available to other companies. The bankruptcy of a company has a net cost to society if specific capital is destroyed along with the company, a capital that is difficult to identify in times of crisis. However, the management of the 2008 financial crisis in Europe, particularly in Germany, made it possible to identify a stable relationship between employees and the company as an important form of productive capital. The use by Germany of *Kurzarbeit* allowed companies to retain workers while benefiting from government support for the payment of wages. The rapid implementation of partial activity in France was an import of that German crisis management into the French schemes. The mass use of wage subsidies in France contrasts with the decision made in the United States to support companies directly. The preservation of "human capital" as physical capital was therefore an objective sought by crisis management.

However, the preservation of capital is not the preservation of what already exists, as the value of such capital depends on the future activity of the companies. For an economist, the value of capital is not the book value of an acquisition, but the present value of the business generated. The value of the capital therefore depends on the anticipated business of the company. After a debate during the crisis regarding the profile of the GDP trajectory – "U", "L", "W" or even "K"-shaped[1] – the post-pandemic forecasts were very varied in 2020: would we emerge from the crisis quickly or slowly? Would we observe lasting changes in consumer behaviour that would render the business plans drawn up before the crisis obsolete?

The "whatever it costs" approach was retained based on the assumption of a short, sharp crisis that would not bring about any radical changes in behaviour. Now, in 2022, that assumption appears reasonable. A further benefit of preserving companies is a reduction in economic uncertainty for companies and households. A wave of redundancies increases uncertainty among companies as it has a direct impact on value chains (suppliers and customers). In addition, bankruptcies bring about an increase in unemployment, which reduces household income and increases precautionary saving. Both effects bring about a reduction in companies' activity.

Faced with an uncertain environment, the choice seems to have been to minimise bankruptcies. The figures for business failures in 2020 now show that the result has been achieved: the number of failures in 2020 was significantly lower than in 2019. This first trade-off with regard to total volume does not yet fully cover the impact on public finances. Indeed, the provision of support to companies can be achieved by means of subsidies (for example, direct support for the payment of wages) or loans, for which the budgetary cost is far lower. The economic policy option selected in France has brought about an increase in public debt, financed at a historically low interest rate, in both nominal and real terms.

The second key trade-off concerns the way in which support is targeted: should it be targeted specifically at certain companies, at the risk of not helping others in need, or distributed more widely, at the risk of unnecessarily allocating

1. The hypothesis of a K-shaped profile emerged in view of the strong sectoral heterogeneity of the recovery. Some sectors are experiencing a persistent decline in activity (the bottom segment of K), while activity in other sectors is rapidly returning to pre-crisis levels (the top segment).

resources to companies that do not need them or that are too reliant on them. Indeed, the targeting of support can be broken down into two distinct problems. The first sub-problem is to avoid causing a windfall effect, in other words transferring resources to companies that are liquid and solvent. The second sub-problem is the provision of public support to companies that are undoubtedly in need of money, but are unproductive and would have gone bankrupt even if the health crisis had not occurred. The aim of these two objectives is to minimise the negative impact on public finances, as well as to avoid keeping unproductive companies afloat through support measures, since this would needlessly absorb and even damage public and private resources. These so-called "zombie companies" became a subject of attention during the crisis (see Cros *et al.*, 2020).

The third trade-off concerns the choice between public and private debt. During the crisis, companies experienced a sudden decline in income, which was predicted to be temporary. They therefore had to deal with significant liquidity problems, which are discussed in the articles by Demmou *et al.* (2022) and Bureau *et al.* (2022b). There is a real difficulty in distinguishing between temporary liquidity issues, which will be reabsorbed following the emergence from the crisis, and long-term business downturns that first manifest themselves as liquidity issues before progressing to solvency issues, defaults on payment and then the cessation of business. The microsimulations presented in the articles within this dossier provide an appropriate analysis of the liquidity of companies to avoid having to qualify their solvency, which would require a forecast of their turnover.

In addition, the provision of liquidity to companies can be achieved in a number of ways, whether that be by means of direct subsidies, bank loans or State-backed public or private loans, an example of which is the State-guaranteed loan (PGE) in France. The trade-off between these three tools (subsidy, bank loan, State-backed loan) relates firstly to the cost for public finances. Subsidies are direct budgetary expenditure, guaranteed loans cost far less since part of the loan is paid back. This means that this third trade-off involves corporate debt: subsidies do not increase corporate debt, whereas loans (whether guaranteed or not) do. The impact of the increase in interest rates seen in 2022 on French NFCs, which are known to be heavily in debt when compared with companies in other countries, will require new analyses. However, the trade-off between subsidies and loans during the crisis cannot be formalised without taking account of these new, post-crisis dynamics.

Three Studies Using Microsimulations on Company Data

A quick overview of the articles will allow highlighting common findings. Bureau *et al.* (2022a) analyse the crisis through the monthly business shocks suffered by NFCs in France. They model the development of activity using a process of estimation before the crisis for the period from 2015 to 2020, which therefore supposes a stable turnover model. Then the authors simulate the turnover during the crisis from February to December 2020. The difference between the simulated and the observed turnover defines the monthly shock experienced by each company, which is studied by the authors. They examine the 645,000 companies, representing 71% of the value added of non-financial companies (NFCs).

These shocks, which are calculated for each company, provide important information regarding the different impacts of the crisis and the health measures adopted. Their skilful presentation consists of classifying the companies into four categories with well-defined profiles: "unaffected", "resilient", "restricted" and "depressed" in ascending order of the difficulties encountered. They find that a significant number of companies, around one third, did not experience negative shocks on average ("unaffected" companies). For the majority of companies, business followed the average situation ("resilient" and "restricted") and, finally, a group of around 6% "depressed" companies saw their businesses go under. The majority of these companies were already fragile before the crisis. The main factor for explaining the category that a company falls into is the business sector it is active in. However, there remains a residual heterogeneity. Finally, the companies that remained unaffected are the ones more likely to have restructured their business, invested in new technologies, developed online sales and used new delivery systems.

Demmou *et al.* (2022) evaluate the liquidity requirements of companies and the impact that the policy measures had on their liquidity. The authors use monthly company data (ORBIS) and track 859,299 companies in 14 European countries. They simulate the liquidity dynamics of each company, introducing limited adaptability of the companies' inputs. Here too, the lack

of liquidity is primarily explained by the sector to which the companies belong. The simulations show that, without State intervention, around a third of companies would have been facing a cash deficit after 10 months, three times higher than in normal times. Most crucially, those companies that would have faced cash flow risk appear, for the most part, to be both profitable and viable.

A slightly different contribution of this study is the recognition by the authors of the difficulties of modelling realistically the details of companies' behaviour: For example, inventory dynamics are difficult to take into account and the reimbursement of trade credits is tricky to identify (linked to bank behaviour).

The deteriorating situation of companies without State intervention and the current reassuring bankruptcy figures show the aggregate effectiveness of State support measures. These were massive and differentiated. The authors provide a recap of the nature of the public measures in the countries concerned, which included tax deferrals, financial support for debt repayment and temporary support for wage payments. The comparison of these measures based on their contribution to reducing cash-flow risk among companies shows that payment support is both the most effective and the most costly solution, while moratoriums on corporate debt and tax deferrals have much a smaller impact (but they also cost less). For a given budget cost assigned to each measure, the picture is more nuanced: the effectiveness of partial activity and wage subsidy schemes depends on their design, in particular the amount of any eligibility threshold.

The ending of company support schemes is only given a brief mention in the article, since the study period ended in early 2021. However, the authors do stress the need for a gradual exit from the support measures with one great unknown: the impact of the support measures implemented during the COVID-19 crisis on productivity.

In their contribution looking at the financial situation of NFCs, Bureau *et al.* (2022b) construct a microsimulation tool for companies, based on French data, using monthly VAT data to track the actual monthly activity of the companies. The lessons drawn from these simulations based on French data are consistent with those of the European simulations by Demmou *et al.* (2022), but allow for more accurate estimates. The State support measures helped to reduce the negative cash flow shock seen in 2020 by half. The sectoral dimension is still essential to understand the extent of the financing need. As expected, the magnitude of the shock differed across sectors and the impact of government policies appears to be more effective in reducing the liquidity shock in the most affected sectors. For example, the negative cash flow shock in the hospitality sector, the worst affected, was halved by the State support. In the sectors that were the least affected by the crisis, such as the energy and information and communication sectors, public measures only reduced the intensity of the shock by a third. The companies that were the most fragile before the crisis (fragility measured by the Banque de France rating) certainly benefited from the government support, but they were not helped disproportionately.

Common findings

The first lesson, which is clear from reading the three articles, is the value of microsimulation tools and company data for understanding economic dynamics during crises. In the case of France, FARE data (INSEE), VAT data (DGFIP), scheme use data (DARES) and financial data (Banque de France) can be accessed quickly to allow for an analysis of the productive system. However, access to these data by researchers not affiliated with the administrations that produce them must be considered now to allow for more analyses to be carried out during crises.

The second lesson is that large-scale economic shocks, such as the health crisis, cannot be understood without a breakdown at least at the sectoral level. In all three articles, the sector (in the current classification) appears to be the main variable explaining the differences between companies. However, the three articles also point out a strong intra-sectoral residue, that should be the focus of future studies.

The value of these three articles also lies in their ability to point at the difficulties associated with microsimulation tools and possible improvements. Company data from 2018, so two years before the health crisis, are used, which highlights the benefits that faster access to data would provide. They also point to the difficulty of modelling the measure and the dynamic nature of company inventories.

As regards government policies, the two articles on NFCs' financial situation focus on liquidity issues to avoid inherent difficulties in measuring solvency. The first lesson seems to be that the schemes were successful in compensating for the liquidity issues experienced by companies, and it seems that they were quite effective. In France,

the companies that were the most fragile before the crisis (according to the Banque de France rating) were not helped disproportionately. The support tools offered to companies helped to reduce liquidity issues in the sectors where they were felt the most. The point of concern is the possibility of robust companies being overcompensated (windfall effect) while productive companies are undercompensated, or non-productive companies overcompensated. The simulations provide indications, but of course not decisive on this point, which will require studies to be carried out once the data become available.

In addition, the support measures for the payment of wages turned out to be powerful levers for the provision of liquidity. However, the effectiveness of these measures per public euro spent depends on the details of their implementation, as shown by Demmou *et al.* (2022). The tax deferral measures and assistance to pay private debts cost little, but also have a relatively small impact. These findings are consistent with those of other studies (Guérini *et al.*, 2021; Gourinchas *et al.* 2021; Héyer & Timbeau, 2020).

The Issues Ahead

These articles analysing the year 2020 bring us to the importance of the strategy for exiting the health crisis. It is important to recognise that the gradual end of partial activity and the solidarity fund did not result in an increase in bankruptcies and, at the time of writing this commentary in June 2022, the employment rate was high. The data for 2020, which will be available in a few quarters' time, will allow refining the analysis of liquidity and the effectiveness of the tools against this objective. The analysis of the effectiveness of the tools aimed at solvency, i.e. the survival of companies in the long-term, and the dynamism of the productive system, will be extremely difficult, since the French – and more broadly European – economy is facing a new, significant shock: the energy crisis and the unprecedented rise in energy prices, production prices and consumer prices. The increase in interest rates following these price increases will affect French companies, which are highly indebted. It is in this new environment that the issue of capital allocation and the trade-off between public and private debts will need to be studied. □

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Values, Volumes, and Price-Volume Decompositions: On Some Issues Raised (Again) by the Health Crisis

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Abstract – The health crisis has highlighted the need for national accounts able to trace the activity and financial situations of various groups of economic agents as quickly as possible. It also raises several questions about how real GDP aggregates quantities of heterogeneous goods and services that meet very different needs, the relative priorities of which have been, at least temporarily, affected by the crisis. We focus on two aspects of this question: the theoretical properties of chaining volumes at market prices for the market component of GDP and the related problems of measurement and aggregation for its non-market components. Beyond the short-term shock, the crisis provides an opportunity to revisit some substantive issues regarding the interpretation of production and volume growth indicators, issues that the post-crisis period should continue to fuel.

JEL Classification: E01, C43
Keywords: national accounts, GDP, production and income, aggregation, price-volume decompositions, chain indices

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When the health crisis began, INSEE set out as soon as possible to assess its impact on two of the main national accounts indicators: gross domestic product (GDP) and household spending. These were snapshot assessments, whereas forecasters usually only provide assessments for an entire quarter. At the time, assessing an impact on a quarter's GDP or household spending would have implied a forecast of the duration and conditions for lifting the first lockdown restrictions, which nobody was able to provide. France was the first country to offer such snapshot assessments. Other countries gradually followed suit, after which the data returned to the usual form of quarterly and annual estimates, paving the way for many comparative comments on the extent and course of the shock between these different countries: where had GDP dropped most, why and how, and when would it return to its pre-crisis level?

This context has highlighted the usefulness of national accounts and of early estimates of its main aggregates, which are essential for calibrating measures to support the economy. The crisis has also led to renewed interest in the use of input-output tables, a key component of national accounts, which help to assess interdependencies between sectors and therefore the risks of spillover effects, both upward by demand constraints, and downward by supply constraints (Dauvin *et al.*, 2020; OFCE, 2020; Baqaee & Farhi, 2020; Barrot *et al.*, 2021).

But there have been questions, particularly regarding the measurement of certain output items. What was the value of continuing to measure self-production of housing services by homeowners? How would the drop in government output be measured? Did the methods used ensure international comparability of data? Some of these questions are addressed in this article, but its main theme is broader. Beyond the questions about certain sectoral components of GDP, there is the question of the meaning of their aggregation: even with perfectly well measured sectoral outputs, what meaning could be given to their aggregation when their changes were following highly contrasted paths?

The crisis has thus highlighted an aspect of real GDP that we do not always bear in mind: the fact that it also relates, in its own way, to the category of composite indicators that reduce to a single figure a set of core data that can be very disparate. All that is aggregated indeed relates to production flows of goods and services. But this remains a patchwork, combining current consumptions, light and heavy capital goods, services, including a growing share of intangible services, health care, teaching hours and so on. What distinguishes GDP from other composite indices is the aggregation of these components based on a metric that seems to make them perfectly commensurate, the money metric. As long as nominal GDP is concerned, and for its market component, it is not physical quantities of goods that are aggregated but only the income generated by their production. This is a good reason to favour what is called the "income" reading of GDP for which aggregation does not seem to pose any problem: since incomes can be added and subtracted, it makes sense to calculate their aggregate and then to examine how it is distributed before or after redistribution between major categories of economic agents – which is what agent accounts do – or at the microeconomic level of companies and individuals – as do various attempts to disaggregate accounts at a higher level of granularity (Alvaredo *et al.*, 2020; INSEE, 2021). Actually, it is this dimension of income that the users of the figures had most in mind during the crisis: not what the drop in GDP represented in terms of fewer cars or meals at restaurants, but what it represented in terms of less earned income for the companies or establishments concerned and, therefore, solvency and risk of bankruptcy, with their potential consequences on the labour market.

However, the question of the meaning to give to the aggregation of quantities rather than monetary values remains central. It arises first when turning to the question of the purchasing power of this income, since it involves comparisons of the baskets of goods that different levels of income allow to consume when there are simultaneous price variations, therefore a comparison of groups of quantities of heterogeneous goods. And it is as an aggregate of variations in quantities that the growth of real GDP is presented when we want to read it as an indicator of production rather than a measurement of the income generated by this production. This reading in terms of production is required, in particular when considering the case of public services, which are productive of in-kind services directly made available to households (Carnot & Debauche, 2021), but without being income generators in the usual sense of incomes generated by a company's sales.

However, this concept of aggregate in volume of production is complex and must be approached without excessive positivism and in full awareness of the issues it raises. As well explained by

Vanoli (2002, pp. 512–518), such an aggregate is not the objective measurement of a tangible reality as is that of a physical magnitude; rather, it is a conventional object, the interpretation of which can give rise to debate. The challenge is to find the most accurate of these interpretations, both in times of crisis and in normal times.

In order to do so, can we proceed without the economist's toolbox, particularly the concept of consumer utility? Public accountants are frequently reluctant to using such concepts, because of the fear of being drawn too far into issues of well-being measurement, which GDP does not purport to provide. Clearly distinguishing between measuring GDP and measuring well-being is indeed essential. But this cannot dispense with any reference to the associated concept of consumer utility, as illustrated by the pre-crisis debate on the handling of new services from the digital economy.[1] On the one hand, we have seen economists spontaneously inclined to express this problem in terms of utility or the contribution of these new goods to well-being – Aghion *et al.* (2020) use the term of "utils" to describe the unit of account implicit in calculations of real GDP – and, on the other hand, public accountants reminding us that this was going beyond what is normal to ask of GDP, but at the risk of ending up in a somewhat uncomfortable position. They cannot just recall what real GDP does not measure; they must be able to give a positive definition of it, and this is difficult to do without reference to this concept of utility because we do not see how to aggregate quantities of heterogeneous goods and services according to any other target standard than the service rendered to the consumer. This is ultimately acknowledged by accountants when they invoke the connection between marginal utility and market price to justify the aggregation of quantities according to these market prices (Lequiller & Blades, 2014). It was even to strengthen this link that the 1993 System of National Accounts (SNA) extended the practice of calculating chain-linked volumes by updating the reference price system annually rather than keeping it at its base year level. This chaining enables weighted prices to be as representative as possible of the instantaneous relative marginal utilities of various goods and services, rather than referring to increasingly dated relative utilities as you move away from the base year.

However, this relationship to the concept of utility raises other issues. We know, for example, that chaining, which appears very well founded in theory, can have undesirable properties, especially in the event of a large-scale economic shock. One argument, which has long halted its acceptance, is that it makes the comparison of the state of the economy at two distant dates t and t' dependent upon the path followed between these two dates, whereas the comparison of the two states should, in principle, only involve their individual characteristics (Berthier, 2003). This problem of path dependence is well known to price statisticians. It explains that they do not use chaining at a sub-annual level because this could lead to a continuous drift in the general price level in the presence of seasonal movements affecting prices and quantities on a cyclical basis without any trend component. The same problem leads the SNA to advise against chaining for items whose non-regular changes alternate upwards and downwards. However, this type of movement is precisely what we experienced with the crisis. Added to this is the fact that the crisis, by temporarily changing preferences, may have further weakened the reading of GDP in terms of consumer utility, which has temporarily ceased to be a stable benchmark.

The reference to economic concepts is, therefore, both necessary and a source of many questions. Questions about path dependence, the instability of preferences and their consequences for reading aggregates have been raised in recent works by Baqaee & Farhi (2020) and Baqaee & Burstein (2021). The question is, what economic concept did GDP measure against in such a disrupted context? Related questions arise at the microeconomic level: the property of non-homotheticity of preferences that we will see to be the cause of the path dependency problem prohibits the assumption that price increases have the same impact for households with different incomes, forcing the consideration of differentiated measurements of inflation between categories of households (Jaravel, 2021; Jaravel & Lashkari, 2022).

The aim of this paper is to propose some introductory discussions of these topics. It will initially focus on the market sector. A few simulations show that it seems possible to put the problem of path dependence into perspective, but only in the presence of rigid relative prices, which would have made them temporarily

1. *See Blanchet* et al. *(2019) for a review.*

deviate from their function of revealing the instantaneous marginal utilities of goods and services. This is not without paradox, since the good performance of the indicator would, therefore, have been due to the relaxation of the assumption that usually legitimises it. Anyway, this relaxation has been only partial and temporary, as the effects of the health crisis are now being combined with those of a geopolitical crisis that is disrupting both absolute and relative prices. Having temporarily escaped path dependence does not, in any way, mitigate the general problem of which it is only one of the manifestations: the impossibility of constructing volume indicators that are consistent with any assumption about the form and evolution of the preferences of economic agents, a problem encountered when reading long-term growth indicators.

We then, more briefly, address the issue of aggregating the market output thus obtained and non-market output. Here, the question is what sense it made to continue to aggregate the provision of intensive medical care and teaching hours, both between themselves and with the number of meals in restaurants, given the very different nature of the types of services rendered. One can argue that it is only temporarily that the aggregation of all these elements would have lost its meaning, and that the return to normal conditions of activity should make it possible to return to its usual reading. But the conclusion must be more nuanced. While the context of the crisis has had a temporary magnifying glass effect on problems of interpreting real GDP, these problems also arise in assessing long-term growth; therefore, they cannot be neglected in normal times, particularly if the post-crisis situation leads to non-marginal changes in our growth model.

1. Volumes, Prices and Consumer Utility: Some Reminders

As just mentioned, GDP does not measure well-being, but this does not make it possible to avoid the question of how it is related to it (Schreyer, 2016; Blanchet & Fleurbaey, 2020). Firstly, because it is one of its main uses to show whether the economy is doing well, and this can only be assessed in terms of its contribution to the ultimate well-being of individuals. Secondly, from a more technical point of view, both public accountants and price statisticians cannot escape using the akin concept of consumer utility when they want to legitimise their practices concerning volume/price decompositions.

As a first approximation, it remains of course possible to reduce this problem of volume/price decomposition to simply substracting the effects of general price rises from aggregate nominal changes, and this is how the problem is generally perceived. For example, in a simple case in which nominal income increases by 3%, assuming that all prices increase by 2% in parallel with quantities that all increase by 1%, it is natural to assume that overall real growth is also 1%. But such a characterisation only works well if you do not move too far from this double assumption of stability for both relative prices and consumption or production patterns. The difficulty is to have a characterisation of what we call volume that also works when the relative price and/or consumption patterns become distorted. If, as another example, we take the case of two goods initially consumed in the same quantity of 1, with changes in nominal income and relative prices leading to the new consumption basket of respectively 1.05 and 0.95, shall we say that there has been growth, decline or stability in the total volume of consumption? To take a third example, shall we say that there is more overall growth when the quantity of good 1 increases to 1.1 while that of good 2 remains stable, rather than the reverse. Everything depends on what is thought to be the gains and/or losses in utility associated with these unequal movements of the quantities of the two goods.

The reference to utility therefore appears inescapable. With regard to price statistics, whose indices feed the accounts, the "constant utility" index serves as a reference model that measures the increase in nominal income required to maintain the same level of final utility when prices rise (Sillard, 2017); dividing a nominal income by this type of index leads to a concept of real income that is necessarily related to that of consumer utility. With regard to accounts and the direct measurement of volume as a chained product of increases in the quantities of goods weighted by their prices, justification of the weighting by the fact that prices reflect relative utilities also means that what is measured links with utility. Ultimately, in the continuous-time language of the Divisia indices (the theoretical model underlying chaining; see Hulten, 1973), if the prices p_i of goods consumed in quantities q_i perfectly represented their current marginal utilities $\partial U / \partial q_i$, one could directly write $\sum_i p_i dq_i = \sum_i \left(\partial U / \partial q_i\right) \cdot dq_i = dU$ and there would be perfect equivalence between the instantaneous growth in utility and the instantaneous growth in volume, an equivalence that

would therefore be also guaranteed for long-term changes.[2]

The link to well-being or utility in the broad sense is, of course, much more partial and complex for two main reasons. The first is a given: overall well-being or utility depends on factors other than those covered by national accounts, *a fortiori* those of the market sub-field on which we focus initially. The second is that even if well-being depended only on market consumption, the aim of national accounts could still not be to measure or even approximate this well-being, but only an intermediate concept of standard of living. The two concepts are related but distinct. Standard of living refers to the means available to people to lead their lives as they see fit; the way to weight them must consider their contribution to their well-being or utility and, all other things being equal, an increase in the standard of living therefore contributes to well-being, but there is no reason to observe a systematic proportionality between the two variations. Comparisons of standards of living between people can thus differ significantly from comparisons of well-being. An important tradition in economic theory of equity (and in political philosophy following Rawls) postulates that it is the standard of living that is most relevant to public policy, while the more subjective concept of well-being depends in part on purely private life choices.

More technically, the difficulty in establishing a strict correspondence between volumes and utility stems from the fact that prices only partially reflect the marginal utilities of goods and services. They only provide information about their *relative* marginal utilities, i.e. only a correspondence between the ratios p_i/p_j and the ratios $\left(\partial U/\partial q_i\right)/\left(\partial U/\partial q_j\right)$: the relative prices indicate whether there is more gain in increasing the quantity of a good 1 or good 2 by the same percentage, and it is in this respect that they make it possible to say whether the standard of living increases or decreases when these quantities change in an uncoordinated manner, but without saying what the absolute values of the gains or losses are.

An elementary theoretical framework can help to clarify all this. Suppose that, in addition to the vector $q=\left(q_1\ldots q_m\right)$ of production/consumption of goods giving rise to monetary value, well-being depends on a group of other determinants $z=\left(z_1\ldots z_n\right)$, which can be both elements of exogenous context as well as production, consumption or, more generally, actions outside the scope of what is put in national accounts, in keeping with Hulten & Nakamura (2017) or more recently with Fleurbaey *et al.* (2021). Let us then assume that it can be accounted for with a utility function $U\left(q,z\right)=f\left(g\left(q\right),z\right)$ where $g\left(q\right)$ is a scalar function of the vector $\left(q_1\ldots q_m\right)$. This form is not general because it assumes separability of the effects of q_i and z_j; it is, therefore, a very simplified version of the type of interaction between the economic and non-economic spheres considered by Fleurbaey *et al.* (2021), but it already captures much of the idea that well-being results from a combination of market or quasi-market factors and other contextual or behavioural elements of agents. We can assume that g is the function that measures standard of living, and we can see clearly how U may vary significantly from g for two reasons: the presence of other determinants of well-being (z) and the transformation of g by f, which can be specific to the individual.

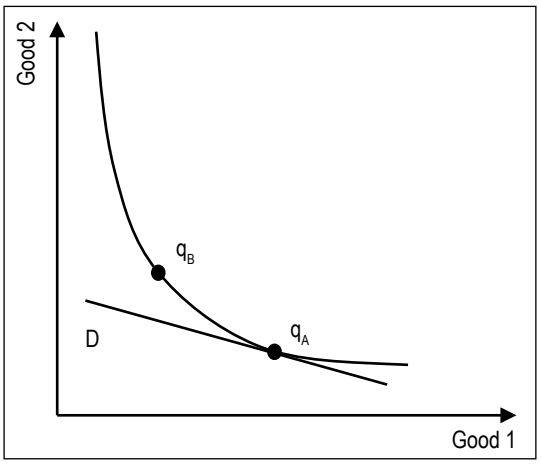
What can we then quantify that relates to the function g, under the additional simplifying assumption of the representative agent? Let's start by restating the importance of doing this with chaining rather than volume calculations at base year prices. The problem posed by the latter is illustrated in Figure I for two goods.

If q_A is the base year quantity vector A and D_A the associated budget line $R = p_{A,1}q_{A,1} + p_{A,2}q_{A,2}$, the ratio of volumes at base year prices between q_B and q_A equals $\left(p_{A,1}q_{B,1}+p_{A,2}q_{B,2}\right)/\left(p_{A,1}q_{A,1}+p_{A,2}q_{A,2}\right)$ and is greater than 1 because q_B is located above the line D_A. Yet, in this example, q_B provides exactly the same utility as q_A. There is more because all the points between the isoquant and the initial budget line are seen as corresponding to increases in volume although they correspond to losses in utility.

Faced with this problem, the contribution of chain-linked volumes is to take into account the gradual changes in the slope $-p_2/p_1$ when moving along the isoquant. If μ is the proportionality coefficient between prices and marginal utilities, the movements along the isoquant verify both $dU=(\partial U/\partial q_1)dq_1+(\partial U/\partial q_2)dq_2=0$ and $p_1dq_1+p_2dq_2=\mu dU=0$, whatever the unknown value of μ. The chaining of infinitesimal movements, all of which are neutral, leads us to say in the end that q_B corresponds to no more or less

2. *There is a similar link with the concept of consumer surplus, i.e. the addition of marginal utilities associated with the consumption of each good unit. Accountants are accustomed to saying that GDP or income do not measure this surplus because they value all quantities* q *at the marginal utility of the last unit consumed. But this objection only concerns the interpretation of levels of GDP. In terms of variation, calculating integrals* ∫pdq*, chain-linked volumes are akin to a calculation of surplus variation between two dates.*

Figure I – **Inconsistency between preferences and measurement of aggregate volume at base year prices**



Reading Note: At prices of period A represented by the straight line D_A, the combination q_B represents a higher volume than the combination q_A, yet it offers exactly the same utility. The set of points located between the line and the isoquant also correspond to a growth in volume compared to q_A, although they correspond to lower utilities.

volume than q_A. Along the isoquants, the ordinal structure of preferences is respected.

But what about the cardinal properties? Among all the g functions that are candidates for representing ordinal preferences, real GDP quantifies the one that verifies the fact of growing in the same way as all its arguments when these all grow at the same rate, i.e. the function g that would be homogeneous of degree 1, verifying $g(\lambda q) = \lambda g(q)$ for all λ, since the volume indicator is forced to verify this homogeneity property: when all the items grow at the same rate, overall growth follows the same rate, regardless of the weights given to the various items.

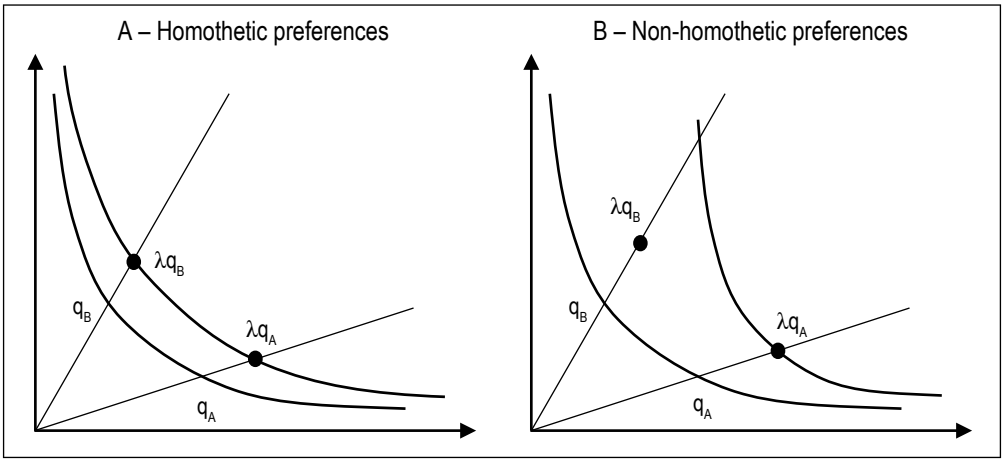
Unfortunately, this possibility to link volume and utility is not guaranteed; it is the exception rather than the rule because it requires a strong assumption about the type of preferences for goods q_i. For these preferences to be representable by a homogeneous function of degree 1, they must verify a homotheticity assumption, namely that indifference between any two baskets q_A and q_B implies indifference between the baskets λq_A and λq_B, for any value of λ. However, this assumption is not validated by observation: in particular, it is in contradiction with the fact that consumption patterns become distorted when incomes rise. As soon as this assumption is no longer verified, the volume measures something that maintains a connection with the group of eligible g functions but cannot be one of the elements of the group. This problem affects the interpretation of the aggregate over a long period and is at the root of the problem of path dependence where there are irregular economic changes.

This is illustrated in Figures II and III. Homotheticity is assumed to be verified in Figure II-A. In this case, the same increase in volume by a factor λ along the two oblique axes corresponds to comparable increases in the associated utility levels: we start at the same first isoquant including the points q_A and q_B, and we arrive at the same second isoquant including the points λq_A and λq_B. But this is no longer the case in Figure II-B: here, the volume indicator continues to consider that there is the same growth to go from q_A to λq_A and from q_B to λq_B, although the latter point is less valued in terms of overall utility. This problem could be avoided only if we knew how to quantify the fact that this multiplication by λ produces less utility when it is carried out from q_B than from q_A, information that we do not have.

Path dependence stems directly from it, as illustrated in Figure III. Going from a point q_A to a point λq_A corresponds to growth in chain-linked volume at a ratio λ if the movement takes place in a radial manner, but in the example offered, it corresponds to growth in volume of $\lambda' > \lambda$ by an alternative looped path through the points q_B and $\lambda' q_B$. If we then return to point q_A radially, the volume is thus declared increased by λ' / λ while we have returned to the starting point.

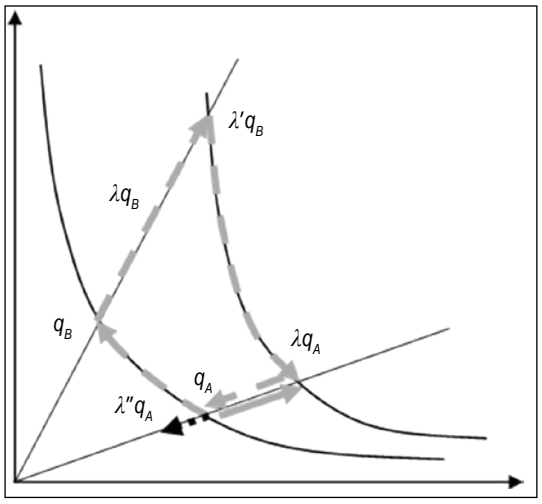
Summarising this initial review, we have identified two risks of inconsistency between volume indicators and consumer preferences: one that is inherent in volume calculations at base prices shown in Figure I, and one that affects the calculations at chained prices illustrated in Figure III. In order to avoid these two problems, there is, in theory, a third method, that of equivalent income. Equivalent income associates with each isoquant the minimum income required to reach this isoquant, once chosen a reference price system; it is detailed in Box 1. This measurement of standard of living classifies baskets of goods in a way that fully respects the ordinal preferences of the consumer. At the same time, with regard to the structural problem that non-homothetic preferences constitute, it cannot provide a definitive answer, which is by nature impossible: the consequence of non-homotheticity is that the assessment of growth between two points depends on the price system chosen as a reference. Replaced in this framework, the path dependence that is often presented as a specific pathology of chaining or

Figure II – **Importance of the homothetic preferences assumption**



Reading Note: Graph A represents two indifference curves for homothetic preferences: indifference between baskets q_A and q_B implies indifference between baskets λq_A and λq_B, which is not the case for the indifference curves represented on Graph B, where λq_A is preferred to λq_B. In both cases, a volume index indicates that the passages from q_A to λq_A and from q_B to λq_B represent the same growth of λ, which is consistent with the utility variations in the homothetic case (A) but not in the non-homothetic case (B).

Figure III – **Non-homotheticity and path dependence**



Reading Note: When moving linearly from q_A to λq_A (grey continuous arrow), the volume increase is λ, but it is $\lambda' > \lambda$ if we follow the grey dashed trajectory. If we close this trajectory by returning directly from λq_A to q_A, we see that the volume has increased by λ' / λ while we have returned to the starting point (grey dotted line). And, by exceeding the point q_A towards the left, we can have points $\lambda'' q_A$ with $\lambda'' \leq 1$ to which chain-linked volumes higher than the starting volume (black dotted line) are associated, while the final level of utility is lower than in q_A.

of continuous-time Divisia indices, is therefore only one possible manifestation of a more fundamental problem that no approach to standard of living can avoid.

2. Path Dependence in a Crisis: Is It Possible to Put the Problem into Perspective?

Was this problem of path dependence, demonstrated theoretically, so severe in response to the crisis? And if this is not the case, how did we escape it? These questions are particularly relevant given that the crisis also led to a temporary distortion of preferences between categories of goods. When preferences change, it is even more difficult to imagine any stable correspondence between output indicators and consumer satisfaction, while it is always on the basis of this satisfaction that we would like to assess matters.

Regarding the example in Figure III, in practice, two factors are involved, one that decreases the risk of path dependence and one that increases

Box 1 – **Non-homothetic preferences: What does the alternative approach using equivalent incomes offer?**

Without embarking on an exhaustive review beyond the scope of this article, it is useful to describe another perspective on the concept of volume: the equivalent income approach (Fleurbaey & Blanchet, 2013). This approach makes it possible to be fully consistent with ordinal consumer preferences by associating a monetary value to each utility isoquant – a so-called money metric utility – once a stable reference price system has been chosen. This concept corresponds to the traditional concept of the expenditure function in microeconomic consumer theory, i.e. the level of income necessary to obtain a given level of utility at given prices.

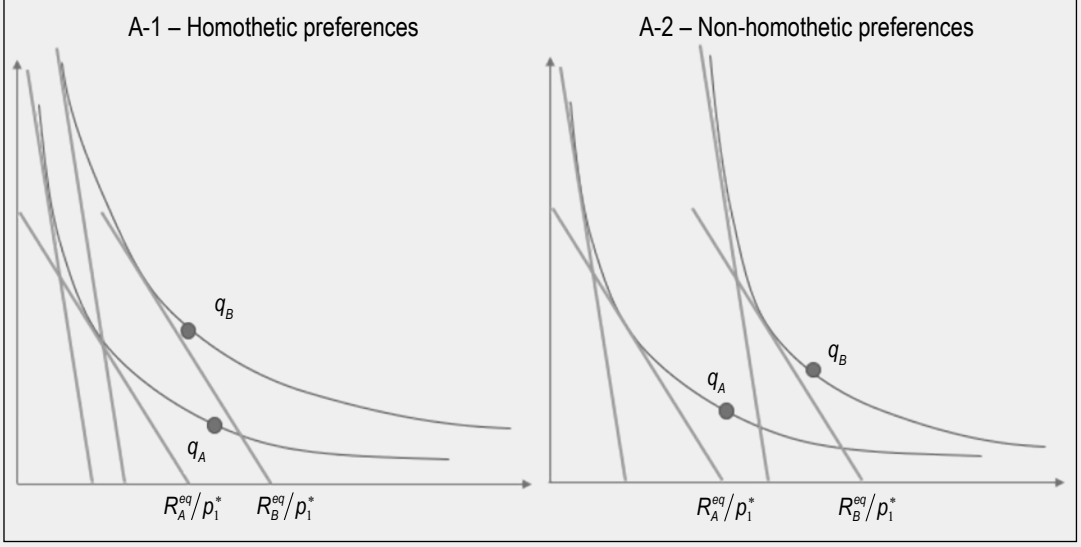
Figure A shows the method for homothetic preferences. In the p^* reference price system, each isoquant is associated with the minimum monetary income required to reach the isoquant. On the graph, it is reconstructed from the points of intersection of the tangents to the isoquants with one or the other of the two axes, for example, the points R_A^{eq} / p_1^*

➔

Box 1 – *(contd.)*

or R_B^{eq} / p_1^* on the horizontal axis for the isoquants containing the market baskets q_A and q_B. The method associates a much higher income to the point q_B than to the point q_A. Choosing a reference price system may give the impression of returning to a calculation of volume at the price of a base year, but the difference is that, contrary to the situation in Figure A, all the points of the same isoquant are this time attributed to the same monetary equivalent.

Figure A – **The equivalent income approach**



How does this relate to chain-linked volume calculations? For homothetic preferences, the relative difference between the two isoquants thus assessed is independent of the price system used as a reference: the ratio between equivalent incomes is the same with the reference price system giving budget lines with more strongly negative slopes. We are therefore in a case in which chain-linked volume and equivalent incomes overlap. They assign the same values to all points of the same isoquant, and multiplication by the same factor of all quantities increases the chain-linked volume and equivalent income by the same factor, regardless of the reference prices used for the latter.

For non-homothetic preferences, the contribution of the equivalent income method is to avoid the problem of path dependence. It does this by construction: at given reference prices, the assessment of various states depends only on their characteristics, not on the trajectory chosen to move from one to the other. On the other hand, the comparison of states becomes sensitive to this reference price system, as seen in Figure A-2. The ratio of abscissae to the origin is higher for the steeper of the two price systems. There is a similar problem with the associated concept of constant utility index (Sillard, 2017). The calculation of the increase in income that is required to preserve utility in the face of a given price increase depends on the level of utility taken as a reference, as soon as the consumption patterns depend on this level of utility. The result is not the same depending on whether you take a low level of utility as a reference in which some essential expenditures weigh heavily in the budget or a high level of utility in which they weigh much more lightly. The fact that it is impossible to propose a price index with universal value is a well-known problem assumed by price statisticians. It is normal that the same applies to the dual concepts of volume or standard of living.

Regardless of the point of view taken, the problem is that the price system or the utility used as a reference can gradually lose relevance over time. You might want to remedy this by updating them step by step, but in doing so, you inevitably encounter the problem of path dependence. It is therefore necessary to choose between this problem and that of having indicators whose message varies depending on the states that are taken as reference.

it. The risk decreases because a return to the pre-crisis situation has no reason to take place following such a circuitous path as that represented in Figure III. If the movement is only a round trip on a unique road, the second leg must precisely compensate for what was done on the first leg. This is the case in continuous time, even if the two movements are not at the same speed. But this is no longer necessarily true in discrete time: relying on an approximation in discrete time acts in the opposite direction and accentuates the risk of not falling back to the starting value. One stylised example will confirm this possibility, always with a simplified framework with two goods, and a general equilibrium approach that makes it possible to treat both the effects of supply shocks and preference shocks.

We use a simple type of preference with two market goods, with a component g of the CES/Stone-Geary–type well-being function, which is written $g(q_1,q_2)=\left[\alpha_1(q_1-\beta_1)^{\rho}+\alpha_2(q_2-\beta_2)^{\rho}\right]^{1/\rho}$ where $\sigma=1/(1-\rho)$ is the elasticity of substitution between $q_1-\beta_1$ and $q_2-\beta_2$. The preferences represented here are homothetic, and the function g is a homogeneous function of degree 1 when β_1 and β_2 are both equal to zero; they are non-homothetic when one of the β_i's is non-zero, $\beta_i>0$ corresponding to an essential good, the consumption of which must be at least equal to β_i, and $\beta_i<0$ corresponding to a non-essential good, the consumption q_i of which can be zero and only ceases to be zero for a high enough income or a low enough price. In simulations, good 1 is considered essential ($\beta_1>0$) and good 2 non-essential ($\beta_2<0$).

Given this pattern of demand, there is a basic supply structure with a total population $l_1+l_2=1$ distributed in both sectors producing both goods q_1 and q_2 with labour productivities π_1 and π_2. In the initial state, we assume a workforce distribution that maximises the function U. The initial equilibrium prices p_1 and p_2 of the two goods are deducted, first in relative value, then at absolute level depending on an exogenous overall amount of liquidities $M=p_1q_1+p_2q_2$. The initial values of the parameters are set at $\alpha_1=0.25$, $\alpha_2=0.75$, $\beta_1=1$, $\beta_2=-1$, $\sigma=0.5$, $\pi_1=\pi_2=2$ and $M=1$.

From this initial state, the supply shocks are modelled as shocks in π_i, which may include the case $\pi_i=0$ of a full interruption of activity, but only for good 2, the non-essential good. The sectoral allocation of the workforce is assumed to be fixed throughout the duration of the shock because redeployment is impossible over the short term. On the other hand, there are two assumptions regarding prices:

- Adjustment of prices balancing supply and demand of both goods, always under the constraint $M=p_1q_1+p_2q_2$. The fixity of M accounts for policies of economic support thanks to which economic agents always have the same nominal budget to spend, but where the negative supply shocks result in price rises of the goods concerned, ensuring full balance between supply and demand in nominal value.

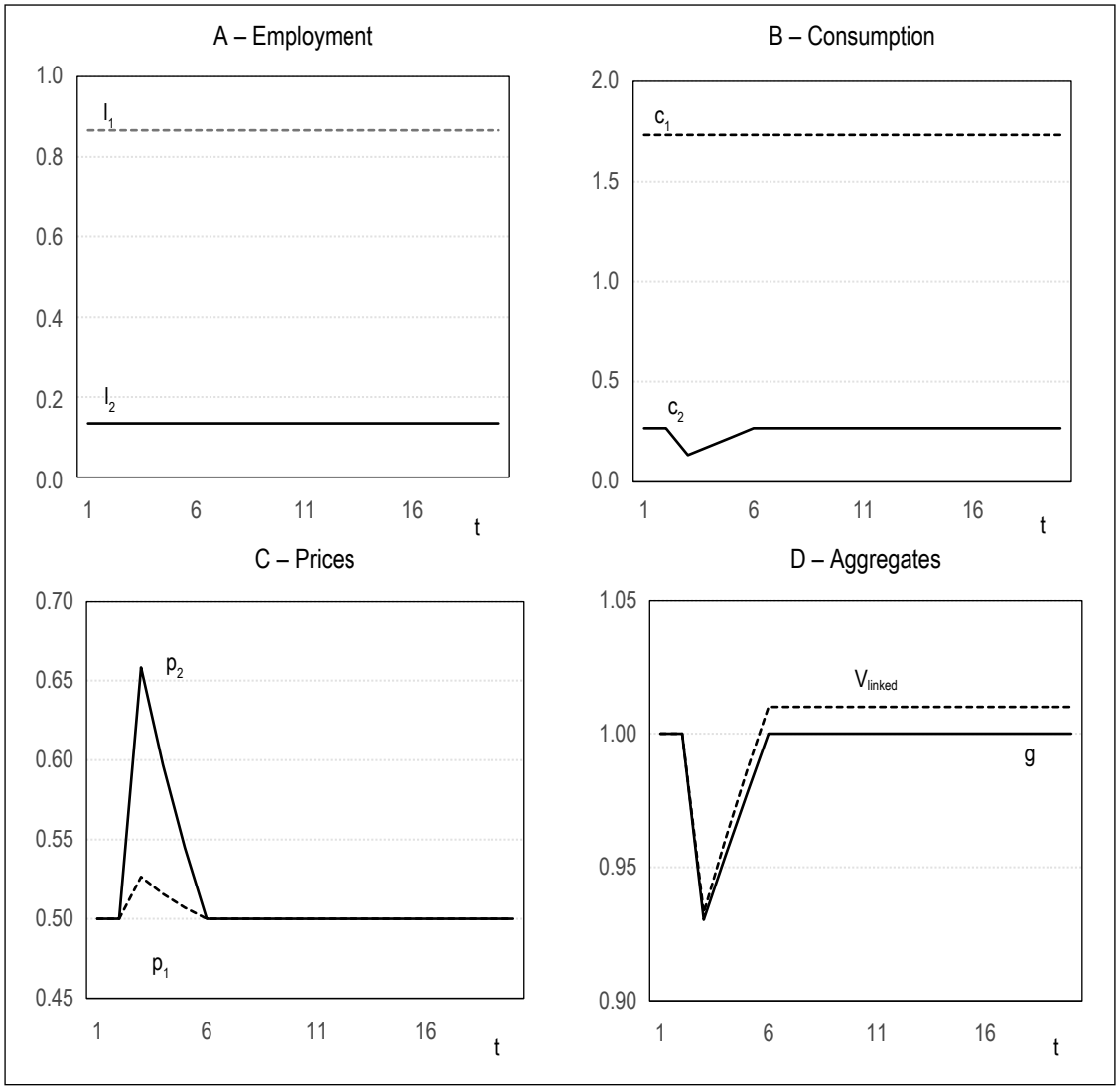
- Completely rigid prices and, therefore, rationing of quantities. The result is forced nominal savings, as has been observed in practice. It can then contribute to price rises at the end of the crisis, among other inflation factors, which could be accounted for by authorising spending of this saving and a gradual return of price adjustments, but here we focus on the question of measurement during the shock phase.

Figure IV shows an initial simulation with a productivity shock in sector 2 that divides it in two between periods 2 and 3, after which it returns linearly to its starting value in three periods. The allocation of labour remains unchanged by assumption (Figure IV-A), with a change in production/consumption that entirely reflects that of productivity (Figure IV-B) and complete price flexibility (Figure IV-C) that makes prices rise temporarily, particularly for the good affected by the productivity shock. The result for chain-linked volume is a 7% drop at the start of the shock, followed by a recovery phase which, at the end of the crisis, leads to new volume slightly more than 1% above its initial level (Figure IV-D), although we returned precisely to the starting point in terms of price and consumption, as the plot of the function g reflects. We are therefore confronted with a path dependence problem despite a return to normal exactly through the same trajectory as the initial drop. This is explained by the choice of time units: between periods 2 and 3, the whole of the downward shock is computed with quantities valued at pre-crisis prices, the increase that follows is valued at crisis prices, which overweight the importance of the return to pre-crisis quantities for good 2.

On the other hand, this problem disappears if we simulate the same shock with totally rigid prices (Figure V) by rationing good 2 on the market with forced saving corresponding to the amount of unmet demand for the good. The fact that price rigidity makes it possible for the volume indicator to completely recover its initial level is mechanical: since the weightings of the quantities are constant, the fact that they recover their starting values leads to recovery of the same aggregate.

Paradoxically, we would have therefore been partially protected from the effects of path dependence by a temporary relaxation of the link between prices and instantaneous relative marginal utilities of the two goods, i.e. the link used in normal times to legitimise aggregation by prices. Can we live with it? Yes, if we remain in the scenario of a perfectly reversible transitory shock with a return to the initial conditions. In this case, we need only consider the volume indicator as a measurement of the decrease in production with respect to the marginal utilities

Figure IV – **Simulation of a sectoral productivity shock, with labour market rigidity and flexible prices**



Reading Note: Productivity in sector 2 changes from 2 to 1 on date 3 and then returns to its original value in three periods. With labour market rigidity, the consumption of good 2 changes in the same way. The supply-demand balance is achieved by a price shock on p_2, as well as a smaller price shock on p_1. The function g is the component of total utility that the volume index of consumption intends to replicate. Assessed with chain-linked volumes, this volume indicator replicates the initial loss in g, but ultimately returns to a level higher than that at the start, while the economy returns to exactly the same point.

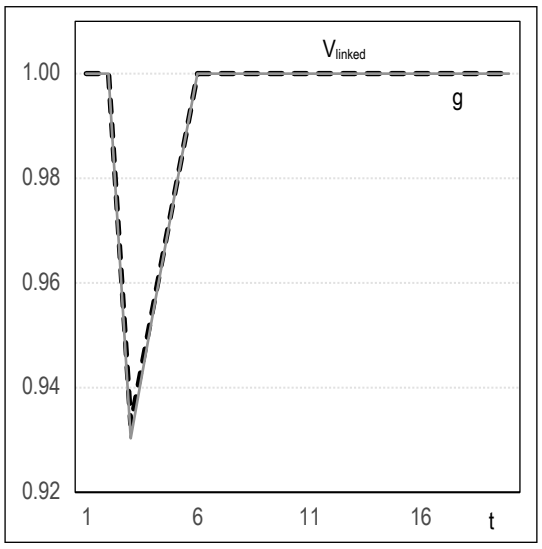
that the various goods and services have in normal times.

This also applies to transitory distortions of preferences. During this period, the supply shocks overlapped preference shocks: there were fewer options for consumption of certain goods and services and less consumer desire, with variable weights of the two types of shocks depending on the goods. Inversely, we also saw the appearance of new types of consumption (PCR tests, masks), which we can consider as obligatory consumption symmetric with consumption prohibitions of some goods, or consequences of consumer preference trends in favour of these goods, with a combination of obligation and desire to protect oneself. The easiest way to neutralise all of this is to view these constraints and preference distortions only as temporary changes, the fact that prices did not overreact allowing the volume index to quickly recover the numbers we have during normal times at the end of the disruption.

3. More Structural Issues on Growth Measurement

However, apart from the fact that relative prices have not been that stable during the period of interest, the problems of constraints on consumption choices and distortions of preferences have no reason to disappear with the end of the crisis. The truth is that both were already present before the crisis: the issue of constrained spending was often mentioned as a possible explanatory factor for the discrepancies between measurement

Figure V – **Simulation of a sectoral productivity shock, with rigid labour market and prices**



Reading Note: Same assumptions as for Figure IV-D but with rigid prices. The volume indicator returns to its initial value at the end of the crisis.

and perceptions of standard of living, and the economic growth in recent decades has clearly been accompanied by significant changes in preferences. These are two subjects for which the usual conceptual framework of volume/price decomposition is poorly equipped and could take new forms in the post-crisis world.

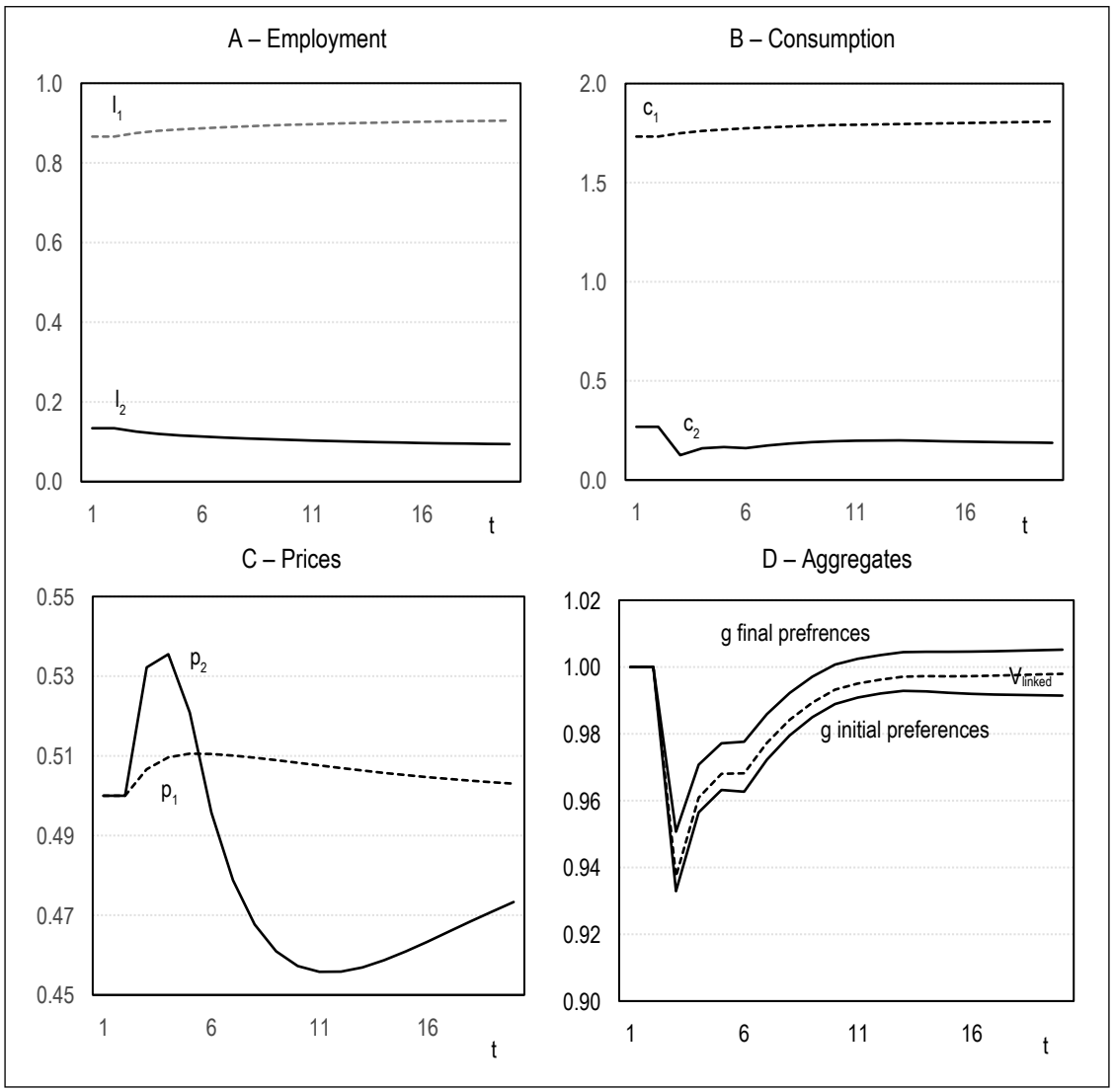
In particular, one expects growth to turn greener and less exposed to the risks of international interdependencies. This kind of shift in the pattern of growth could, of course, manifest itself in a conventional way through price signals; for example, if the goods and services produced locally are more expensive than those usually imported, or if greening involves increasing prices of polluting goods, either spontaneously or through their taxation. If this is the case, it is to be expected that the volume and price components will accurately reflect how household living conditions are impacted. But, particularly regarding greening, part of the shift could be forced by regulations that would combine varying degrees of prohibition on consuming brown goods, or obligations to switch to green goods. And it could also result from changes in preferences between these different types of goods.

Let's take a closer look at this last example in which the problem of path dependence would combine with the loss of a stable reference point for assessing the utility derived from baskets of goods. This is the situation described in Figure VI, which simulates the same productivity shock on the non-essential good 2 but accompanies it with a gradual and lasting change in preferences that accentuates its non-essential character. The simulation takes the form of a drop in the parameter β_1 causing it to drop from −1 to −1.25 between periods 3 and 6, after which it remains at this level. Faced with this long-lasting distortion of preferences, it is evident that it is no longer possible to assume indefinitely rigid prices and a rigid sectoral distribution of labour. We therefore assume gradual decreases in their distance from to current optimum values, at the rate of 10% per period for the labour market, and 25% per period for prices. The labour market thus adjusts very gradually over the 20 simulation periods (Figure VI-A), and the production/consumption of the two goods reflects the combination of this movement as well as, for good 2, the temporary impact of the negative productivity shock (Figure VI-B), this shock temporarily raising the relative price of this good, before the distortion of the pattern of preferences causes it to drop in a lasting way.

How then do the overall initial and final economic situations compare? In terms of utility, and in light of a change in preferences, one possibility is to compare the two states based on final preferences, which is the solution favored by Baqaee & Burstein (2021); at the end of the period, individuals are asked to judge how their situation seems better or worse than before the crisis, with their current preferences. In view of a return to the initial supply conditions, the final state is preferred to the initial state because it is based on the current resources optimised for the preferences of the final period (Figure VI-D). It is the opposite with an assessment based on initial preferences, with utility that emerges lower after the crisis. Between the two, the chain-linked volume indicator gives an intermediate profile. We can see this a convenient pragmatic compromise, and it is in any case difficult to offer much better in current statistical production, but in the end, it is not possible to say to which economic concept this median trajectory corresponds: it is an approximate measure of a reality that looks different depending on the angle of view.

Again, the use of equivalent income is another way to address the issue of preference instability (see Box 2 and the Online Appendix, link at the end of the article), as well as the issue of choice constraints. Regarding the variation of preferences, one virtue of equivalent income is to be comparable between people with different preferences: two people with the same monetary utility in the sense of equivalent income can be considered to have the same standard of living,

Figure VI – **Transient productivity shock accompanied by a persistent negative preference shock for good 2, with partially flexible labour market and prices**



Reading Note: The supply shock decreases productivity π_2 from 2 to 1 in period 3, which then returns to its initial level in period 6. The preference shock consists of causing the coefficient β_2 to drop from −1 to −1.25 in the function $g(q_1,q_2)=\left[\alpha_1(q_1-\beta_1)^\rho+\alpha_2(q_2-\beta_2)^\rho\right]^{1/\rho}$, this drop being gradual from period 3 to period 6. This leads to a distortion of the labour market structure and spending in favour of good 1. The relative price of good 2 loses ground after the increase induced by the initial supply shock. The variation in g can be assessed based on terminal preferences or initial preferences. The chain-linked volume never returns to its initial level. It has an intermediate change between that of g calculated with terminal preferences – which is higher after the shock than before – and that of g calculated with initial preferences.

regardless of their differences in preference and consumption. The comparison between the situations of a person who has changed preferences between two periods is formally and ethically similar to this comparison between two people with different preferences, regardless of whether or not they are examined at the same period (Fleurbaey & Tadenuma, 2014). If an individual changes preferences but keeps the same budget, this approach concludes that her standard of living and economic situation have not changed, even if her consumption pattern has changed. However, the problem remains of choosing the reference price system which is mobilised to quantify these monetary equivalents of utility, with a result that depends on the choice of this reference system: there is no definitive way to escape the relativism implied by preference instability.

4. Questions on Non-Market Services

We will return for conclusions on these post-crisis perspectives, but first we need to look at the non-market case. Not only is there the same general aggregation problem, but there are also problems regarding joint observability of quantities and prices at the level of individual goods and services. We are going to look at both topics.

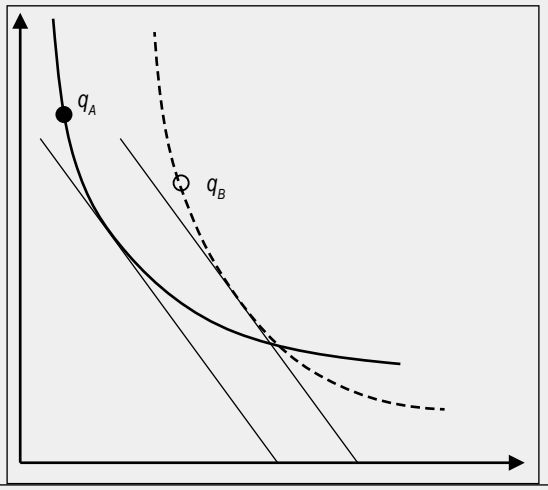
In the market sector, quantities are not always observed, but turnover and value added are, and the monitoring of prices of goods and services allows measuring volumes by difference that we then re-aggregate according to relative prices. For public utilities, temporarily leaving aside the cases of health and education, the main data available are not prices but costs, primarily wages and consumption of fixed capital. When only this data is available, it has to be used both as a measure of price and nominal output. This leads to the assumption that overall productivity does not change, an assumption that is accepted for service activities offering little room for productivity gains but that remains reductive. This assessment principle was maintained during the crisis: the contribution of the labour factor was considered to have dropped as hours worked, without distinguishing between those worked on-site and those that were teleworked, due to the lack of evaluations of the relative productivity of teleworking. The novelty was only to have to mobilise sub-annual information on these hours worked when we usually use information on annual working hours. Normally, the quarterly accounts could quantify the fact that the output of public services decreases during the holidays, as does market output, but to do so in order to immediately correct the series of their seasonal variations would be an

Box 2 – **Equivalent income, variable preferences and non-monetary determinants of well-being**

While it does not provide an unequivocal solution to the problem of non-homothetic preferences, the equivalent income approach offers ways of dealing with changes in preferences (Fleurbaey & Tadenuma, 2014), always conditionally to the choice of a reference price system. It also provides a framework for differential treatment of a pure change in preferences between market goods, without changes in other determinants of well-being, and the case in which those other determinants are changed.

Let us first consider the case of a pure change in preferences represented by Figure B. At given reference prices, it is possible to say that the situation is better in the state q_B than in the state q_A with the different preference systems associated with these two states. On the other hand, the problem remains that of choosing relevant reference prices because a reference price that differs substantially from that shown on the graph could lead to a reverse ranking.

Figure B – **Equivalent incomes and changes in preferences**



In particular, this approach will make it possible to say that the situation of the individual does not change if their income and reference prices do not change: the change in her basket of goods then results only from a change in her tastes, which is relevant as long as the latter does not result from changes in the external environment that affects her well-being elsewhere.

Yet the same does not apply if the individual experiences, for example, deterioration of her health, which shifts her preferences in favour of medical expenses rather than other types of consumption, i.e. changes in one or more components z of the function $U(q,z) = f(g(q),z)$. In this case, the equivalent income approach makes it possible to quantify a monetary equivalent of the shock affecting z, i.e. to quantify how much cash income must be increased for the individual to regain the same level of overall utility U despite the negative shock with z.

This allows constructing generalised standard of living indicators (Boarini *et al.*, 2021) taking into account both monetary and non-monetary determinants of well-being, including the provision of non-market in-kind services, which are another category of elements of z intervening positively on overall well-being.

unnecessary detour that is normal to dispense with.

Ordinarily, however, the calculation goes further in the two important special cases of education and health. For education, the output measurement is the number of students receiving educational services, only modulated based on the level of education, and again based on relative costs: the assumption is that there is more education produced for, and consumed by, a student receiving higher education than by a primary school student, considering the different costs for the two populations. Again, although the provision of these services is unevenly distributed over the year, it is the total annual volume that is directly distributed over four quarters. But this output measurement in volume, based on the number of pupils or students, would have been of no help in assessing the effects of a crisis that did not affect the number of pupils enrolled, at least over the school year in progress. The effect specific to the crisis was therefore added by proceeding in the manner described above, mainly by assessing the hours worked, without distinguishing between hours of on-site teaching and hours of distance learning assumed to have equivalent productivity – information on class closures or numbers of dropouts was also taken into account, but without these two types of additional data having significantly changed the results.

The case of health is the most specific. The default method uses the count data of medical acts, weighted by their fee schedules. Here too, the normal use of these data is annual, but infra annual data could also be used. As the quarterly accounts could not immediately mobilise this information due to transmission delays, they initially made the assumption that the additional volume caused by the epidemic was counterbalanced by putting other care on hold. The more precise data subsequently used for the accounts published in October of the same year showed an additional cost in the first quarter, which was directly interpreted as an increase in volume, including the part of the additional cost corresponding to exceptional bonuses, which were considered as remuneration for additional work and not as a supplement to the price of the service for identical work. However, in the second quarter, deprogramming of care prevailed over management of the epidemic, resulting in a decline in activity (Houriez, 2020).

What can be learned from all of this in view of measuring aggregate output? A number of questions arise. Let us set aside the problem of productivity, excluding education and health. There is an obvious problem in considering it as being trendless but, for the crisis period, having reduced productivity per capita in line with hours worked is an assumption that seems quite acceptable.

With regard to health, a first point is that the health crisis would have revealed a structural underassessment of the value of the service rendered. This is not necessarily specific to health services given that the same essential character and the problem of their under-compensation have also been brought to light for a large number of retail jobs. This is another reason to use with caution the idea that prices and costs are the exact reflection of the social values of goods and services, even in normal times. It is an assumption chosen for its practical nature, not an uncontested law.

This case of healthcare production raises yet another question. By its nature, aggregation made it play a role in cushioning the crisis, and it would have been even more pronounced if an assessment more in keeping with its essential role had been made. We did as if additional intensive care had helped to compensate for the loss of meals in restaurants, an arithmetic that obviously poses a problem given the very different purposes of the two activities: what has been cushioned by the additional efforts in care activities has been the direct negative effect on well-being of the health shock, i.e. a downward shock on one of the factors outside the scope of GDP determining overall well-being. In the terms of the simple modelling discussed above, we were not talking about compensation between movements of opposite signs within the set of goods and services q, but between a component q_i of this vector and a component of vector z. In such a situation, only quantifying the additional production effort with q_i, without counting the negative shock it compensates for gives an unbalanced view of what is happening. This is an aspect of the general problem of so-called "defensive" expenditures, which aim to avoid ill-being rather than generate well-being. How to count them has always been a topic for national accounts, the difficulty being to draw a steady line between what is strictly defensive and what has a net positive value. This question cannot be bypassed in the event of an exogenous shock: there is a problem in giving the same value to an increase in one of the q_i's, under an unchanged z environment and a similar increase of the same q_i that only serves to compensate for a negative shock in the z_j which, among the z, would represent the state of health.

Another way of formulating things is to say that it is difficult to bring such defensive activities into the category of "wealth creation", following a term sometimes used to provide an idea of what GDP intends to measure. Presenting intensive care stay as a form of wealth creation that would have partially counterbalanced the deficit of wealth creation in the market sector is certainly not the best way to categorize them. It is as corrections of the direct effect of z_j on U that the contribution of the healthcare system must be counted, and this only makes sense in an approach that, symmetrically, would negatively count this shock that healthcare systems tried to cushion; here, an approach in terms of equivalent income would potentially be better able to take it into account by trying to quantify the monetary equivalent of this negative shock on z (cf. Box 2). And, once again, this is a problem that crosses the border between public and market services: negative external shocks on well-being can receive market responses too, including in this area of health.

For education, this problem of defensive expenditures is avoided. In this case, the concept of "wealth creation" can be understood in the fullest sense of the accumulation of human capital (Canry, 2020). Here, we need to know by how much the crisis has affected this accumulation process, and how to account for it. The question is more about putting productions dedicated to the satisfaction of current consumption needs and production or transmission of knowledge aimed at preparing for the future on the same levels. This latter form of production would have more a place on a sustainability scoreboard alongside the quantification of what is done or not done in the other dimensions of this sustainability, including the environmental component, as discussed in the Stiglitz report (2009).

Next, when it comes to numbers, the question of the quality of human capital thus accumulated is obviously much more complex than simply counting the teaching hours consumed by students (see, for example, Angrist *et al.*, 2021). In general, an indicator of the "volume" of investment implies quantifying the expected benefits over time. For investments in the market sector, it is assumed that the market is able to reveal investors' expectations regarding return on investment, assuming that these expectations are, on average, reasonable and neglecting the fact that this return for the investor ignores the possibility of negative externalities, another major problem posed by accounts at market prices. In the case of education, it is rather positive externalities that are expected, even more difficult to quantify than individual return on this investment. Add to this the fact that the crisis has revealed even more so than usual that this investment is a co-production whose teaching hours are only an input, as it also partly involves domestic labour, of which home-schooling has abruptly and unequally increased the importance.

To conclude on the case of non-market services, we have emphasised thus far the direct quantification of volumes and the significance of their aggregation with those of other market goods and services. But, during the crisis period, a problem also appeared when moving from volumes to values, symmetrical of those encountered when moving from values to volumes for market goods. Two options were available for the imputation of values during periods of forced activity reduction. The first has been adopted in Europe and is, therefore, shared by all the countries in the European Union: consider that the output of these services in value remained equal, as usual, to their cost of production, including the wages of employees placed in a situation of forced inactivity. The counterpart is a formal increase in unit production costs, thus a price impact and potentially the kind of destabilising effect for the aggregate that we saw on the market sector in the case of a strong price reaction at the heart of the crisis. The other option would have been to consider unchanged unit costs and treat remuneration of unworked hours in the same way as subsidized partial activity in the private sector, i.e. a type of insurance against technical underemployment directly provided by the government, with the same result as the first option in terms of overall impact of the crisis on public finances, but avoiding an artificial gap between real and nominal public productions.

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From all this emerge somewhat mixed messages about the contribution of national accounts in times of crisis and what they tell us about their contributions in normal times. Viewed from a first angle, they emerge strengthened. The crisis has clearly demonstrated the need for these accounts: indicators of the financial situation of the various economic agents, in both flows and stocks, are needed, and these indicators must be linked to each other by a coherent accounting framework. Such a framework inevitably ignores many aspects of what works well or poorly for

societies and the well-being of their members, but the portion of this functioning expressed in terms of monetary flows is large enough to make its monitoring as important as it is.

The headline indicator of national accounts, real GDP, is, however, a complex object, consisting of heterogeneous components the cumulation of which is not always easy to discuss. It was built by successive additions to meet various types of demands, and its practical calculation involves methodological compromises the accumulation of which can sometimes make us lose sight of what we wanted to measure at the outset. The crisis is an opportunity to rethink some of these problems. Does it, therefore, help us to specify more clearly what GDP measures? Once accepted that it does not measure well-being, is there a characterisation that is simple, fair and complete?

Answering this question by presenting it just as a one contribution among others to well-being poses the problem of characterising the relative importance of this contribution – the exact place of g and its weight in relation to z within the function f. What other terms should be used? We have seen that the term "wealth creation" sometimes used did not necessarily adapt well to many aspects of the period. The crisis rather led to favour the expression of "measurement of economic activity". Indeed, this term was appropriate for the context and fits with the way in which matters have been assessed in practice. It is a deviation of activity with respect to the norm that has been evaluated. To a large extent, quantifying this sub-activity has often consisted in just estimating the decrease in hours actually worked, making it akin to an activity indicator in the sense of labour market statistics. We have even seen that it is in these terms that the estimate was directly built for a large part of government activity.

Relevant in times of crisis, this characterisation is nonetheless insufficient in normal times. When comparing GDPs 10 or 20 years apart, it is not levels of activity that are compared, but rather the quantities of goods and services that these levels of activity generate on both dates, to address the question of how productivity has increased between the two dates, the question that, in particular, has been at the centre of the pre-crisis debate on the mismeasurement of growth.

Is real GDP then better characterised as a measurement of output? Yes, of course, but with a large number of difficulties and questions which, taken literally, do not turn out to be much easier to master than that of the measurement of the well-being to which this output contributes. Even the assumption of efficient markets perfectly revealing the relative utilities of goods is not enough to fully protect against inconsistencies in an assessment of volume growth, whether at chained prices or let alone at base year prices. The problem is even bigger when preferences are changing or when the crisis increases awareness of the differences between prices or costs and the social values of what is produced, if we think that it is based more so on the latter that real output must ultimately be assessed.

The question of the limits of the equivalence between monetary values and social values does not just concern remunerated activities. It also encompasses two other traditional limits of national accounts: the question of the production boundary, i.e. that of productions not remunerated at all, and the question of externalities since market values only express the values attributed to things by their direct consumers, not the indirect effects on other consumers, both those of today and those of future generations. This question, of course, will become even more important with the demand for greening for post-crisis growth. If we keep the characterisation of real GDP as a measurement of output, all these topics suggest doing so with all the required caveats, avoiding looking at it as "the" measurement of this output, but only as "a certain way" of measuring (through market prices or costs) "a certain part" (not necessarily stable) of this output. □

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6472317/ES532-33_Blanchet-Fleurbaey_Online-Appendix.pdf

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Agricultural Outsourcing in France: A Statistical Perspective on an Emerging Phenomenon

Geneviève Nguyen, François Purseigle, Julien Brailly and Melvin Marre*

Abstract – The purpose of this article is to provide an overview of the emerging phenomenon of outsourcing in agriculture, which has been happening since the early 2000s. Although very little is known about this practice, it now affects no fewer than six out of ten farmers. Given the methodological difficulties resulting from its covert nature, a mixed approach was developed to characterise this phenomenon, combining statistical analyses of secondary data and other original data from two surveys conducted in 2018 and 2021, with qualitative analyses of surveys of stakeholders in agricultural outsourcing. The results highlight different aspects of the phenomenon, including the outsourcing of multiple tasks and full delegation, which represent a departure from traditional practices. Significant changes on the supply side are also highlighted, among which the rise of agricultural outsourcing enterprises and the arrival of new stakeholders. These results also point to economic puzzling questions and controversial debates that are happening alongside this emerging phenomenon, with major challenges for agriculture as a whole.

JEL classification: Q12, Q13, L24
Keywords: agricultural outsourcing, full delegation, farm work organization, organisational innovation

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Between 2000 and 2016, French agriculture[1] lost a quarter of its workforce, especially farmers, co-farmers and family helpers, who form the basis of the family farm model. The majority of farms still mainly rely on family labour. However, they have decreased in number by 37% (Forget *et al.*, 2019). As a result, a growing number of agricultural holders are working alone and are increasingly calling on external labour (Dupraz & Latruffe, 2015; Courleux *et al.*, 2017; Legagneux & Olivier-Salvagnac, 2017; Chardon *et al.*, 2020). Hiring permanent and fixed-term employees directly is the preferred option to cope with this new way of working. This figure increased by 7 points in 2016, representing 29% of labour supply. However, at the same time, we are seeing growth in the external workforce from ETAs (*entreprises de sous-traitance agricole* – outsourcing enterprises), CUMAs (*coopératives d'utilisation de matériel agricole* – co-operatives for shared use of agricultural machinery) and GEs (*groupements d'employeurs* – employers' alliances). Although this external workforce accounts for just 4% of farm labour supply, the corresponding volume of work (in annual work units or AWUs) almost quadrupled between 2010 and 2016, from 8,000 to 29,760 AWUs. Furthermore, its proportion within the total number of non-family workers increased, to the disadvantage of employees hired directly by the farms themselves (Forget *et al.*, 2019). According to data from the MSA (*Mutualité sociale agricole* – agricultural social security), the number of workers employed by a legal entity other than the farm itself (ETA, temporary employment agency, foreign service providers, GEs, etc.) increased from 76,500 to 227,000 between 2002 and 2016. This marked contrast in the changing patterns of labour supply suggests that the family farm model, with or without employees, is declining, moving towards new ways of organising work based on a sub-contracted workforce.

This change in the organisation of farm work is not without consequences. Disruptions in the agri-food sector since the beginning of the COVID pandemic in 2020, particularly in the fruit and vegetable sector, have highlighted the risks of a shortage of agricultural labour, despite the apparent gains in labour productivity that have been enabled by the modernisation of the sector since the 1960s (OECD, 2020). At the same time, numerous debates on the status of farmers or on supporting agricultural jobs in rural areas are disrupting ongoing negotiations regarding the reform of the Common Agricultural Policy (CAP). How have French farm managers re-structured the work on their farms over the last 20 years? Despite their obvious importance, these issues have received little coverage in the literature, with the exception of rare pieces (Mundler & Laurent, 2005; Harff & Lamarche, 2007; Béguin *et al.*, 2011; Gasselin e*t al.*, 2014; Hostiou, 2016; Forget *et al.*, 2019).

The purpose of this article[2] is to contribute to the understanding of the upheaval in agricultural labour practices, by focusing on one of the little-known, yet emerging forms of production organisation: farm outsourcing, also called custom farming. How important is farm outsourcing? How is it organised? Who are the main stakeholders and what are their motivations? While farmers have historically outsourced certain agricultural work and activities[3] to a third party, such as harvesting or bale wrapping, this phenomenon often has little visibility. The growth of the agricultural outsourcing market, which we believe dates back to the 1990s, is more recent than the rise of outsourcing in the industrial sector, which has been happening since the 1970s (Hébrard, 2001; Chevalier, 2007).

Here, we are suggesting that the growth in outsourcing and fully delegating agricultural work is a marker of change and a shift towards a new model of production organisation, which we will call "delegated agriculture". Our study provides a glimpse into farming strategies and practices that resemble those of the industrial sector (Holcomb & Hitt, 2000; Milberg & Winkler, 2013), while still maintaining some singularities. This model may represent in a new type of agricultural producers and organisation of work. Beyond that, may imply a new way of farming. Beside family farmers who either hire directly or work together, there are farmers who outsource a significant amount of work to a third party for various reasons, as well as a range of stakeholders in various legal forms who take

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1. Here and throughout the article, we are referring to Metropolitan France unless otherwise stated.

*2. The article is part of the continuation of the research conducted in the following projects: The Agrifirme project (2011-14) from the ANR (*Agence nationale de la recherche *– French national research agency) on the emergence of large corporate farms; the REPRO-INNOV project (2015-20) from PSDR4 on innovations in agricultural companies; the Actif'Agri project (2019-20) on the transformation of jobs and activities in agriculture; the H2020 AgriLink project (2017-21) on the re-structuring of farm advice; and CasDar AmTrav'Ovin (2018-21) on organisational innovations in sheep farming. It also draws on various studies initiated by the GERMEA teaching and research chair, dedicated to changes in agricultural enterprise.*

3. Article L. 722-2 of the French Code rural *(rural code) defines agricultural work as work which is part of the plant or animal production cycle, work to improve agricultural land and ancillary work required to conduct the aforementioned work.*

on work for others (Forget *et al.*, 2019; Nguyen *et al.*, 2020). With these new labour relations, the agricultural sector would be re-structured around new professional groups, skills, rules of play and representational spaces, developing ties to other sectors such as services and agricultural machinery. The service offer would also be re-structured in line with these changes. Currently, for six out of ten farmers (Barry & Polvêche, 2021), this practice would be a determining factor in both ensuring agricultural supply and preserving farming employment in some rural areas, with varying levels of intensity and visibility.

The rest of the article is organised into three sections. After having defined outsourcing in agriculture, the first section outlines the methodological approach developed to characterise the emergence of the phenomenon. In the second section, we present several stylised facts to capture emerging aspects of the growth in agricultural outsourcing. In the third section, we return to methodological and theoretical questions, looking in particular at how, while the analysis can be used to provide an outline and assumptions behind the rise of this phenomenon, it also reveals seemingly "economic irrationalities" that upend theoretical frameworks and require further studies.

1. Methodological Approach to Highlight an Emerging Phenomenon with Little Visibility

1.1. Economic and Legal Definition of Agricultural Outsourcing

Using the definition of industrial outsourcing as a starting point,[4] agricultural outsourcing may be defined as a service transaction in which a farmer (the contracting party) entrusts all or some of the operations carried out on his farm, whether technical or managerial, to an external entity (the contractor) who will perform these operations according to specifications established by the contracting party. According to economic theories, the decision to "contract out" or "outsource" can be explained by prohibitive costs associated with the 'make' strategy, thus favoring the 'buy' option. The latter consists in refocusing on the core business and outsourcing to gain a competitive advantage (Mildberg & Winkler, 2013; Baudry, 2013). Outsourcing thus takes the form of an interfirm relationship, a form of intermediate or "hybrid" organisation between the integrated firm and the market (Ménard, 2021). On the one hand, this is characterised by a more or less marked dissociation between the ownership of the assets and their management, and on the other, by a relationship of authority between the contracting party and the contractor. In agriculture, however, such defined outsourcing relationships are not always easy to identify or, at least, they present ambiguities for certain types of arrangements and stakeholders, as we will see later. Nevertheless, we can distinguish between three major types of outsourcing situations, based on the intensity (estimated using the number of outsourced operations) of the relationship: *(i)* "simple outsourcing" when the transaction consists of simply entrusting a third party with a single technical operation or multiple operations[5] (for example, fertilizer application including the actual spreading operation and the transportation of the liquid manure); *(ii)* "full delegation[6] by refocusing" which involves all the work for one or more productions (for example, all cropping operations for a mixed crop-livestock farm); *(iii)* "full delegation by abandonment", which involves all aspects of production and in some cases even the administrative and economic management of the farm. In our view, the latter is the most advanced form of outsourcing, as it implies a complete dissociation between the ownership of farm assets and their management, where the farmer retains his position but no longer controls his farm.

With regard to contracting parties, it should be remembered that farm outsourcing is defined as a commercial activity in legal and fiscal terms and the completion of such activities is regulated. Thus, unlike processing and marketing activities, which the French rural code (Article L. 722-2) defines as an extension of production, outsourcing cannot theoretically be carried out on the side by farms, but only by service companies, such as outsourcing enterprises (ETAs) or temporary employment agencies. In addition, since 2013, the requirement for companies to be certified for phytosanitary services means that farmers can no longer undertake this type of work under their own farm business and requires them to create a trading company.

1.2. Difficulties in Identification

In spite of these frameworks, identifying outsourcing in agriculture remains difficult and represents a real methodological challenge. The

4. See https://www.insee.fr/en/metadonnees/definition/c1670.
5. Since the data do not allow jobs and basic operations to be distinguished, we will refer to "tasks" or "jobs" for the remainder of this article.
6. The different forms of full delegation (by refocusing or abandonment) refer to what is commonly known as the "A-to-Z" by industry professionals.

lack of data in this area is reflected in the very small number of studies available (unlike for outsourcing in industry). A review of the literature from the last 20 years with a specific focus on agricultural outsourcing only reveals approximately thirty international references (including recent works from Zhang *et al.*, 2017; Nye, 2018; Belton *et al.*, 2018) and four French studies (Hébrard, 2001; Chevalier, 2007; Anzalone & Purseigle, 2014; Nguyen *et al.*, 2020).

The statistical data available are fragmented and heterogeneous. The database includes three questions in the latest censuses and structural surveys conducted by the French Ministry of Agriculture, data from Insee,[7] data from the MSA on labour, data on the creation of establishments from the Infogreffe Trade and Companies Register, data on CUMAs from the HCCA (*Haut conseil de la coopération agricole* – High council for agricultural cooperation), and various data from the ETAs and CUMAs.[8] For the same variable, such as working time measured in AWUs,[9] the differences in value and meaning may be substantial, depending on whether the data was collected by public surveys (agricultural census – AC – and *Enquête sur la structure des exploitations agricoles* – Farm structure survey, hereafter FSS) or by state authorities in France and the MSA. Research by Depeyrot *et al.* (2019) stresses how difficult it is to distinguish and evaluate the different categories of agricultural employees (employed by a farm, an employers' alliance, an ETA or a temporary employment agency) and the volume of work provided by each of them. In general, these statistics have hardly been used in recent official reports on key agricultural features, apart from in the most recent report from the *Conseil général de l'alimentation, de l'agriculture et des espaces ruraux* (French general council for food, agriculture and rural areas, see Frécenon *et al.*, 2021), which suggests that agricultural outsourcing is only a minor occurrence.

Another major difficulty is the way in which outsourcing is practised and perceived by stakeholders in the agricultural sector. Contractual arrangements involve a great deal of informal activity, especially when the activity is not carried out within a dedicated company, making it difficult to quantify.

It is also worth noting that some practices come under the guise of outsourcing, for example, in the case of "complete custom services"[10] developed by certain CUMAs acting as employers' alliances GEs. The latter are akin to a situation of simple outsourcing, or sometimes full delegation by refocusing, where the farmer does not carry out the work himself and entrusts it to CUMAs instead. Similarly, farmers do not always consider certain services (e.g. removal of animals, cleaning of buildings, etc.), which are often included in integration contracts between farmers and agricultural cooperatives or food processing industries, to be part of a contracting-out relationship. The same applies to certain jobs (pruning, harvesting, etc.) in viticulture, arboriculture or market gardening, which are carried out by teams of fixed-term workers (posted or not) who are managed entirely by French temporary employment agencies and foreign service providers, for whom the distinction between hiring an external workforce and contracting-out is not obvious.

The legal definition of the scope of the outsourcing activity also poses a problem when collecting field data. While they help to identify this type of activity, the rules governing it can be circumvented. A certain number of operations become informal in nature and tolerances and exemptions are applied in order to carry it out. For example, aside from legitimate stakeholders, i.e. commercial ETAs, farmers are granted some leeway to carry out custom contract up to a value of 30% of their agricultural revenue or €50k. Farmers working as contractors to diversify their activity can thus operate under their own farm business or create a dedicated company. In the same way, the services offered by CUMAs, particularly those called *"chantiers complets"* (complete custom service), are available exclusively to members, as per CUMA regulations. However, an exemption allows such cooperatives to offer these services to non-members for a charge, up to a limit of 20% of their turnover. Finally, while it is difficult to assess the extent to which this occurs, the existence of specific outsourcing schemes, based on

7. Data relating to support activities for crop production (nafr2-01.61Z) and support activities for animal production (nafr2-01.62Z).

*8. The FNEDT (*Fédération nationale des entrepreneurs des territoires *– French national federation for land contractors) is the umbrella trade union organisation that brings together ETAs and forestry companies. It is important to note that not all ETAs are affiliated with the FNEDT, in the same way that not all CUMAs are members of their federal network, the FNCUMA (*Fédération nationale des CUMA *– French national federation of CUMAs), which adds an extra layer of difficulty in obtaining comprehensive data about these stakeholders.*

9. Unit of measurement used for agricultural statistics based on the amount of human labour equivalent to a year of full-time employment for one person.

10. Since 2006, CUMAs have been authorised to develop an employers group business within a certain limit of their salary costs. This limit was lifted in 2016. This allows them to hire an employee on an open-ended contract to operate CUMA equipment and perform work for their members. Picking up basic technical operations grouped together in jobs performed by employees with machines purchased by the CUMA is called a "complete job" (e.g. silage work with harvesting, transport and packing).

organisational and tax optimisation practices, needs to be noted. Generally, for large corporate farms consisting of several productive divisions or a group of farms structured as a holding company, these practices involve creating an ETA to house the resulting, often large fleet of equipment, with a GE alongside to hire the operators. These types of ETA operate almost exclusively on behalf of the entities of the parent company and function as an internal division. However, they are nevertheless accounted for as independent outsourcing enterprises in the statistical system.

The complexity of the scope of agricultural outsourcing and the existence of informal practices thus contribute to the poor statistical visibility of this phenomenon. Figure I shows a diagram of outsourcing relationships in agriculture, including those that are difficult to quantify for the reasons detailed above.

1.3. Mixed Methodology for Highlighting Stylised Facts

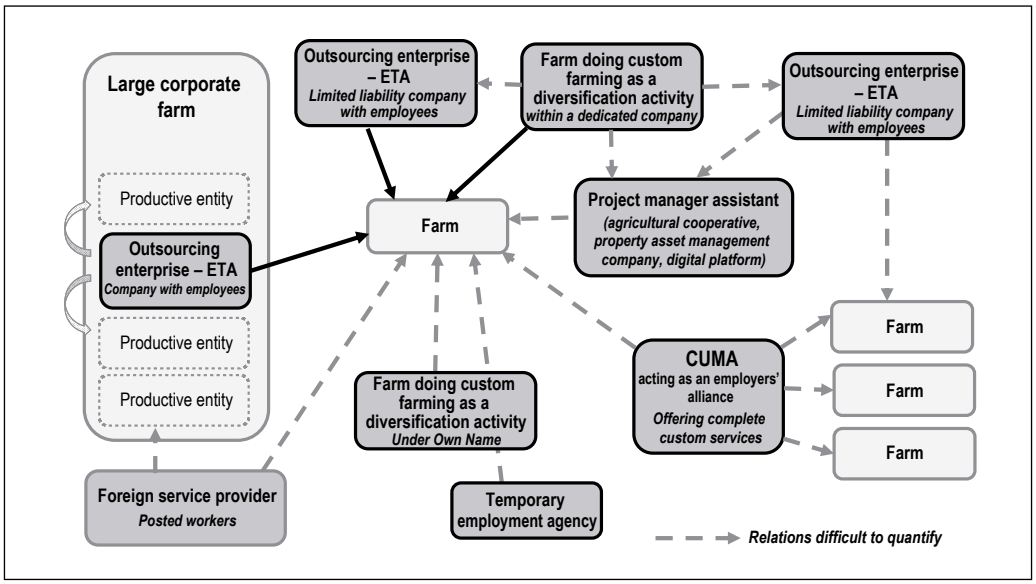
To understand the "emergent" nature of agricultural outsourcing, our approach first aims to identify stylised facts, specifically empirical patterns from which emerging issues may lead to assumptions. In view of the difficulties discussed above, our overall approach was based on a mixed methodology, combining qualitative approaches and statistical analyses.[11] It consists of four parts, a brief description of which is given below.

In the first part, in-depth, semi-structured surveys of key figures in the agricultural sector were conducted between 2012 and 2016. These included members of the *Société des agriculteurs de France* (a French farmers' think-tank), representatives of farmers' unions, representatives from FNEDT and FNCUMA, cooperative leaders and so on, as well as several farmers and service providers. The objective was to identify and characterise new practices and the scope of a new outsourcing market. These key figures were interviewed again in 2021 to gather their views on the progression of the outsourcing market. In particular, the surveys confirmed the advancement of full delegation, previously regarded by Harff & Lamarche (1998, p. 10) as a faint indication of a "profound rift in the idea of the farming profession".

The second part consisted of statistical explorations in an attempt to quantify the growth of outsourcing, and of full delegation in particular, on a national scale. All statistics from the state authorities in France, in addition to data from the various sources cited above, were reviewed. Qualitative surveys for this first part have enabled key indicators to be created. The latter were used to develop a typology of farms according to the criterion for the provision of different types of labour (family, salaried, external) with a top-down and nested classification method.[12] This allows us to isolate farms that make significant use of outsourcing. Quantifying the growth in full delegation in particular (by refocusing or

11. Details of the various ways in which the data was collected and analysed are available from the authors on request.
12. Top-down method as we started with the selected population and gradually removed groups and a nested method as we distinguish between two hierarchical levels (types and sub-types).

Figure I – **Complexity of the farm outsourcing landscape in French agriculture**



Sources: Authors, based on qualitative surveys (see below).

abandonment), on a national scale, represented a major methodological challenge, as farms that had adopted full delegation before 2016 could not be identified directly from the agricultural statistics data. The method of identification and extrapolation used to identify them is detailed in Appendix 1.

In the third part, conducted alongside this statistical identification, in-depth surveys were conducted in two main waves, covering various types of service providers and their customers across several regions. This allowed us to produce monographs of stakeholders and outsourcing arrangements.[13] These were selected to represent the diversity of practices, both conventional and emerging. Respondents were asked about their activities, what motivates them, how outsourcing is organised, and formal and informal contractual arrangements. The first wave, between 2012 and 2018, involved 32 ETAs and 33 of their customers, while the second wave, in 2021, involved 16 ETAs and 3 CUMAs performing complete custom services.

The understanding of the outsourcing practices and arrangements obtained from these qualitative surveys then led to a statistical study in the fourth part to quantify the facts. This is based on two large surveys. The first one was conducted in 2018 (OTEXA 1), in the South-West of France, a region characterised by a diversity of productions and by the high levels of full delegation. Here, data was collected *via* a self-administered questionnaire by farmers located in 12 French administrative departments. The other survey (OTEXA 2), took place in 2021 and again covered the South-West of France, but also included the North-East and West of the country to take other agricultural contexts into account.[14] After cleaning up the response base, 1,267 and 1,591 observations were selected for analysis respectively.[15]

All the data collected was subject to mainly descriptive statistical analyses to highlight the "stylised facts" and to formulate relevant theoretical assumptions ready for testing (the first results from the work carried out up to 2018 are presented in Forget *et al.*, 2019 and Nguyen *et al.*, 2020). In this article, all the results are presented, including the most recent data collected over the 2019 to 2021 period.[16] The aim is to define the "emergent" nature of agricultural outsourcing based on two main "stylised facts": the rise of a new type of farm since the year 2000 with a new demand and innovative outsourcing practices, and the re-structuring of the market on the supply side.

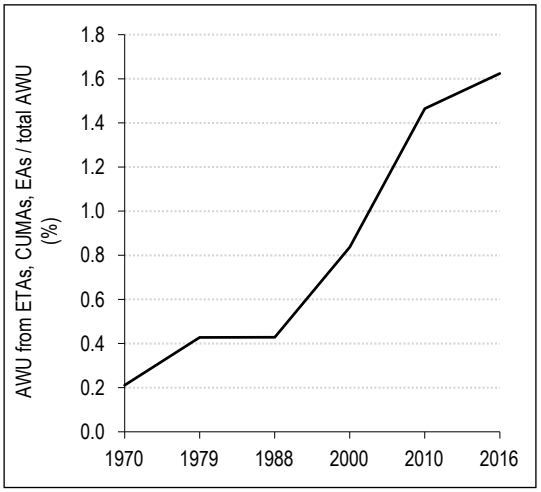
2. The Growth of Outsourcing Since the Early 2000s and Its Scope

2.1. Growing Demand Shaping a New Type of Farms

Between 2005 and 2020, farmers increasingly turned to services provided by ETAs and CUMAs, with the value of services purchased by the sector increasing by 17% from €4.1 billion to €4.8 billion.[17] The share in the volume of work (external labour) provided by ETAs, CUMAs and employers' alliances also increased steadily (Figure II). These developments confirm the trends that were highlighted by Chevalier (2007) between 1979 and 2005. The labour-share approach, however, does not distinguish between what is strictly classed as outsourcing (work carried out by an ETA or by a CUMA within the framework of complete custom services) and

13. Some of these monographs are included in Anzalone & Purseigle, 2014; Purseigle et al.*, 2017; Nguyen* et al.*, 2020.*
14. The OTEXA 2 survey was part of the GERMEA Chair's research activities. The survey sample of farmers were put together from lists of farmers who were members of three French agricultural cooperative groups, Euralis (South-West), Terrena (West) and Vivescia (North-East).
15. The response rates for the OTEXA 1 and OTEXA 2 surveys were 25% and 6% respectively, with original samples of 5,000 and 24,600 farmers respectively. The low response rate for the OTEXA 2 survey could be due to several factors, including a high number of requests being sent to farmers, who also had to complete the Agricultural Census questionnaire in 2021. In addition, we were unable to set up a phone reminder. The characteristics of the populations surveyed were compared to those of the 2010 agricultural census to check that there were no significant biases.
16. Excluding data from the 2020 Agricultural Census not available at the time of writing.
17. Data from the French annual national accounts for agriculture drawn up by INSEE.

Figure II – **Change in the share of the volume of work* provided by ETAs, CUMAs and employers alliances on the total volume of farm work (%)**

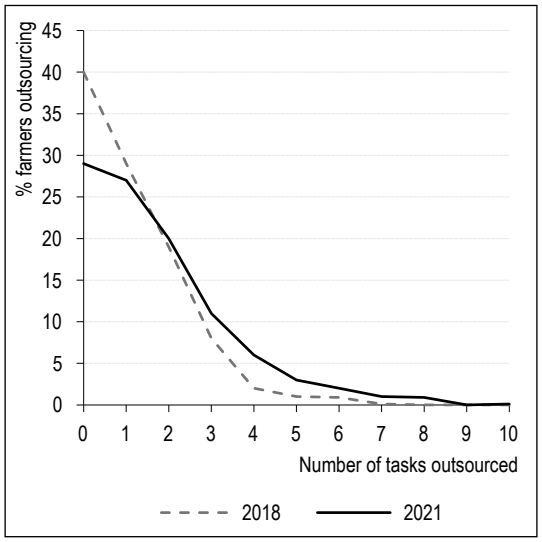


* Measured in annual work units (AWU).
Sources: 2000 and 2010 Agricultural Census and 2016 FSS, authors' calculations.

shared work (an employee hired by a CUMA or an employers' alliance and made available to a farmer); nor does it include contracted hours worked by a neighbouring farmer under his own farm business.

The typology developed in the second part of the study and the data collected in the fourth part were used to define trends. Among farms that contract out at least one task at a national level, we are particularly interested in those that make significant use of the service (see Appendix 1). Changes in these farms confirm the significant increase in outsourcing since 2000, especially over the 2000-2010 period, with an overall increase of 51% (Table 1-A). In 2016, it represented 6.6% of the total number of farms, 5.5% of the standard gross output (SGO) and 4.6% of the total agricultural labour force in the sector (Table 1-B). Compared to the evolution of other forms of work organisation over the past 20 years, outsourcing appears to be in second position in terms of highest growth between 2000 and 2016 (+53%, Table 1-A), behind work-sharing based on the association of several unrelated farms (+79%, see Forget *et al.*, 2019, p. 28) and ahead of the hiring of permanent employees (+23%, *id.*). Moreover, the comparison of the OTEXA 1 and 2 surveys for the South-West of France, which has been particularly affected by this phenomenon, does in fact suggest a relative stabilisation between 2018 and 2021 in terms of the number of farms outsourcing at least one task. However, there is an increase in the number of tasks outsourced by each farm, which could reflect a change in practices and motivations (Figure III). At a national level, a third of the farmers surveyed who made use of the service provision in 2021 contracted out three or more tasks.

Figure III – **Proportion of farmers who outscource according to the number of outsourced tasks in South-West France, 2018 and 2021**



Sources: Data from the OTEXA 1 (2018) and OTEXA 2 (2021) surveys, authors'calculations.

Table 1 – **Change in significant use of farm outsourcing, 2000-2016**

A – Number of farms

	Number of farms			Average annual rate of change (%)			Total change (%)		
	2000	2010	2016	2000 to 2010	2010 to 2016	2000 to 2016	2000 to 2010	2010 to 2016	2000 to 2016
Farms which outsource a significant amount of work, inc.:	16,689	25,159	25,542	4.2	0.3	2.7	51	2	53
Medium and large(1)	*8,810*	*16,139*	*17,889*	*6.2*	*1.7*	*4.5*	*83*	*11*	*103*
Small(1)	*7,879*	*9,020*	*7,653*	*1.4*	*−2.7*	*−0.2*	*14*	*−15*	*−3*
Total number of farms	538,409	419,528	388,705	−2.5	−1.3	−2.0	−22	−7	−28

(1) Because of differences between the logic behind delegating work and the pace of change, we have two separate categories which are based on the SGO. These are small farms (SGO < €25k) and medium and large farms (SGO ≥ €25k). The SGO indicates the productive potential of farms and is used to classify them according to their economic size. It is calculated by applying coefficients to the number of hectares and/or herd sizes. Sources and coverage: 2000 and 2010 Agricultural Census and 2016 FSS, treatment by the authors. The study sample excludes farms in French overseas departments (DOM), very small farms (SGO < €5k) and "other establishments", such as farms managed by agricultural colleges.

B – Share of farms using significantly outsourcing (%)

	Share of total number of farms			Share of total SGO		Share of total AWUs	
	2000	2010	2016	2010	2016	2010	2016
Farms which outsource a significant amount of work, inc.:	3.1	6.0	6.6	5.3	5.5	4.5	4.6
Medium and large	*1.6*	*3.8*	*4.6*	*5.1*	*5.3*	*4.0*	*4.2*
Small	*1.5*	*2.2*	*2.0*	*0.2*	*0.2*	*0.4*	*0.4*

Sources: 2000 and 2010 Agricultural Census, and 2016 FSS, authors' calculations. ➔

Table 1 – *(contd.)*

C – Distribution by type of production (OTEX – *orientation technico-économique*) in 2016 (%)

OTEX		Farms with significant levels of outsourcing	Total number of farms
15-16	Grain	55	28
28-29	Horticulture	0	3
3500	Viticulture	24	15
3900	Arboriculture	1	3
4500	Dairy Cattle	2	9
4600	Beef Cattle	4	13
4700	Mixed Cattle	0	2
4800	Sheep, Goats and Other Herbivores	4	10
5074	Poultry	2	5
6184	Mixed Crops/Mixed Livestock	6	12
Total		100	100

Sources: 2016 FSS, authors' calculations.

2.2. A Diversity of New Outsourcing Practices and Motivations

For a long time, the use of outsourcing in agriculture, in addition to mutual assistance, remained limited to small farms that did not own the necessary equipment or labour. Outsourced operations consisted mainly of grain and forages harvesting, and traditionally involved more or less informal arrangements with nearby farms or with CUMAs. The use of outsourcing can therefore be considered as resulting from an inability to complete a task due to a lack of equipment (combine harvesters, silo fillers, etc.). However, trends observed since 2000 suggest a completely different story (Table 1-A). As a matter of fact, the strong overall growth in the number of farms outsourcing a significant amount of operations between 2000 and 2016 (+53%) mainly stems from medium and large farms. The proportion of these types of farms among farms that outsource is growing (+103%). This is even more remarkable given that the proportion of medium and large farms out of all farms fell by a relative 22% over the same period. It would be hasty to conclude that small farms rely less on the service. By comparing the forces behind outsourcing with the wider forces driving the consolidation of farms, it can be assumed that a certain number of small farms that used to outsource significantly have been integrated into larger structures. Gradually delegating more or even all operations could mean an impending exit from the activity (retirement). In addition, in a context of strong growth in demand from medium and large farms, smaller ones have increasingly been able to turn to more informal arrangements, such as the use of neighbouring farmers who do contract work under their own farm business, or to complete custom services offered by CUMAs.

In addition to the size of the farms, the intensity of outsourcing also depends on the type of production. Graing farms and wine farms are the most concerned, with 55% and 24% respectively resorting to significant levels of outsourcing in 2016, even though these two types of farms only represent 28% and 15% respectively of the total number of holdings (Table 1-C). These results are not surprising in themselves because harvesting, which represents the central operation, is traditionally entrusted to a third party in these types of farms. However, they are more so if we consider their significance – a situation close to full delegation – which indicates that many tasks, other than harvesting, are delegated. The results of the OTEXA 2 survey in 2021 (part 4 of the study) do show that grain farms, which represent 44% of respondents, contract out the spreading of organic manure, sowing, storage and pesticide application to an outsourcing enterprise in 24%, 10%, 6% and 6% of cases, respectively. In addition, the correlation coefficients between outsourced operations, calculated for the variables of the OTEXA 2 survey, indicate a tendency to outsource a combination of operations (for example, sowing, along with organic manure spreading and pesticide application). Respondents to the OTEXA 2 survey are also significantly[18] more likely to delegate tasks when they are not engaged in labelled productions, such as organic farming, which requires strict adherence to a standard guideline. Livestock farms are significantly less represented in this category, with rates ranging from 2% to 6% depending on the type

18. *Student average comparison tests on the OTEXA 2 survey data.*

of livestock (Table 1-C). However, it would be wrong to think that outsourcing does not happen in livestock farming. According to the responses to the two surveys, for some integration contracts in poultry and pig farms, certain operations are often sub-contracted, such as animal removal, prophylaxis or the cleaning of buildings. At the same time, a new range of services (heifer rearing, milking, calving assistance) provided by outsourcing companies is being developed in response to the structural change in some cattle and sheep farms (André, 2019).

Regarding the motivations for making use of outsourcing services, the farmers surveyed often cited a lack of equipment and/or labour, the aim to reduce production costs and improve the technical-economic performance of the production, or strategic objectives[19] (Table 2). These motivations are often interlinked and integrated into agronomic reasoning (when considering the constraints of the production process: optimal work schedule, technical requirements, etc.), economic reasoning (when considering the opportunity cost of scarce resources on the farm, such as the number of work hours and investment capital), or both. According to the service providers and customers interviewed, some farmers have confidence in using a service provider for sowing or phytosanitary treatments for example, in order to access better equipment and thus reduce the cost of inputs. By outsourcing phytosanitary treatments, they also seek to contract out not only investment costs (obtaining the required authorisations, purchase of suitable equipment, training) but also risks to their health, and the management of potential conflicts with neighbours. The socio-economic context in the 1990s was that of a rise in environmental concerns and a CAP reform that searched to promote sustainable agriculture. As a result, it is not overly surprising to see the development of multi-service ETAs offering "precision farming" or "sustainable agriculture" custom services.[20] For others, the shortening windows for certain types of cropping operations, such as sowing and harvesting, due both to the use of high-yield

19. The response options suggested to respondents regarding the reasons for turning to outsourcing are detailed in Appendix 2.
20. For example, "precision farming" services can combine organic and mineral application operations preceded by soil analysis and the use of modulation maps and machines equipped with sensors, while "sustainable farming" services offer, for example, soil-preparation operations without ploughing and direct sowing.

Table 2 – **Characteristics of outsourcing practices for three types of farms**

OTEX in 2021	Main operations outsourced	Main reasons	Main selected service providers	Criteria for selecting service providers	Distance (in Km) from the farm to the providers
Grain farms	Harvesting	Equipment, cost	ETA, other farmers	Equipment, availability, trust	10 to 50
	Spreading of organic manure	Equipment, cost	ETA	Technical expertise, trust, availability	<10
	Sowing	Equipment, time, cost, strategic reasons	ETA, other farmers	Availability, trust, geographical proximity	10 to 50
	Pesticide application	Equipment, time, cost	ETA	Equipment, technical expertise, availability	<10
Dairy farms	Regrouping of animals	Time, equipment	Other farmers, cooperatives	Trust, technical expertise, availability	10 to 50
	Processing	Technical expertise	Other farmers, self-employed providers	Technical expertise, geographical proximity	10 to 50
	Hay baling	Time, equipment	CUMA	Availability, equipment, trust	< 10
	On-call work	Time	CUMA	Equipment, technical expertise	< 10
Wine farms	Harvesting	Equipment, cost	ETA, other farmers, foreign service provider	Technical expertise, trust, equipment	<10
	Pruning	Time, technical expertise	ETA, foreign service provider, self-employed providers	Technical expertise, availability	10 to 50
	Storage	Strategic reasons, time	Cooperative, ETA	Technical expertise, trust, price	<10
	Pesticide application	Equipment, time	ETA	Technical expertise, trust	<10

Notes: The response options suggested for the reasons behind outsourcing and the criteria for selecting the service provider are detailed in Appendix 2.
Sources: Data from the OTEXA 2 survey (2021).

seeds and increasing climate uncertainty, cause farmers to turn to outsourcing enterprises to ensure that the work is carried out on time. Finally, according to the 2021 OTEXA 2 survey, the ownership of farm equipment does not prevent farmers to outsource. Among other things, they may outsource in order to complete several cropping operations at the same time on multiple plots of land that are far away from each other (as frequently occurs on large grain farms).

2.3. A Little Less Farming, a Little More Managing: Are we Moving Towards a New Type Farmer?

Outsourcing of agricultural operations such as sowing, which can be considered to be part of a farmer's identity, seems to us to be a major indicator of profound changes that are not only characterising the practices of outsourcing but also the farming profession. Similarly, the development of full delegation would, in our view, be the other marker of profound changes in outsourcing practices and, more generally, in the organisation of labour on farms. As highlighted by Harff & Lamarche (2007) and later by Anzalone & Purseigle (2014), this practice remained "off the record" for a long period of time and was often mistaken with the farm being run by a manager hired as a permanent employee. The type of full delegation that we are interested in here is a dissociation between ownership and asset management ranging from almost-complete (full delegation by refocusing) to complete (full delegation by abandonment), based on contractual relationships of varying levels of formality between a farmer as a contracting party and a service provider, listed as an external labour force.

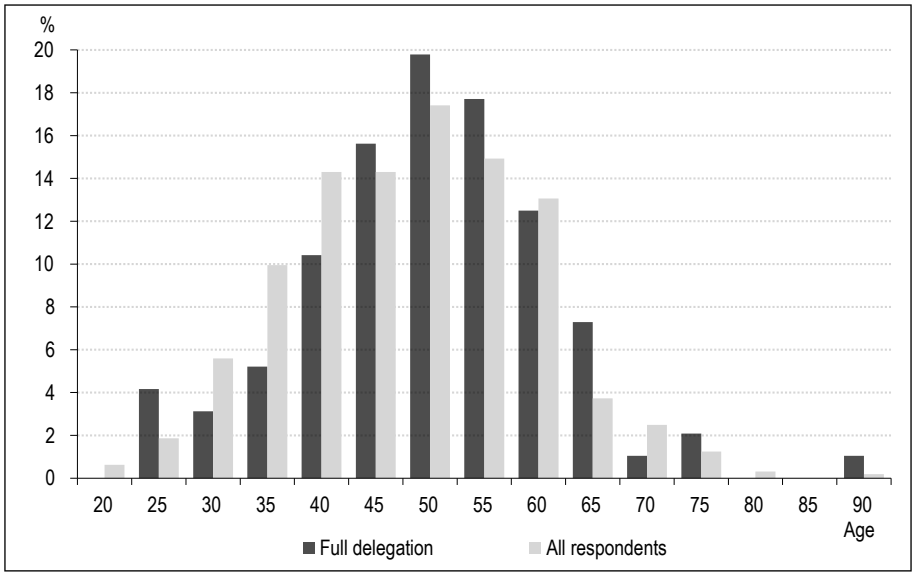
We have been able to identify and characterise three major types of full delegation arrangements according to the stakeholders's characteristics and the governance of the organisation. The first, and oldest, is based on a more or less informal relationship, which has sometimes existed for several generations, between the farmer as a contracting party (very often on behalf of an owner's family who does not always reside on the premises) and a trusted, neighbouring farmer who carries out the service under his own farm business. The second links the farmer as a contracting party to an outsourcing enterprise, an ETA, through a formalised contract. The third, seen from 2010 onwards in France, engages a third stakeholder as a kind of project manager assistant, who mediates the contractual relationship between the farmer as a contracting party and a pool of ETAs, and organises the operations (Nguyen *et al.*, 2020). Although it is not possible to differentiate between them, the statistics from the AC and FSS can be used to approach the extent of full delegation based on the latter two types of arrangements, thanks to an explicit question in the questionnaire regarding the management of all farming work. Note that it is very difficult to quantify the first type, which leads to the extent of this practice being underestimated.

The statistical classification using data from the 2010 AC and 2016 FSS (see part 2 and Appendix 1) describes a growing practice: although "off-the-record" in the early 2000s, it has since been adopted by at least 7% of farms across all types of production. Grain farms are the most involved (12.5% in 2016) with an increase of 2.7% between 2010 and 2016.[21] Going back to our definition of full delegation, the type practised by grain farms can reasonably be described as "abandonment", because it involves all of the cropping operations. However, livestock farms also stand out, using full delegation[22] at a level of about 6% regardless of the type of livestock. For these farms, full delegation can be classed as "refocusing", because it involves delegating all cropping operations to free up time for breeding, processing or marketing. Again, the marked rise in full delegation is mainly due to medium and large farms (+28%), half of which are managed by agricultural holders with multiple jobs, while the number of fully delegated small farms fell by 21%. Thus, in 2016, no less than 26,500 farms were involved in this practice, with at least 500,000 hectares of arable land entrusted to service providers. The map of the phenomenon (see Forget *et al.*, 2019, p. 40) draws an agricultural France that is divided into two, with an area extending to the south-west/west/north-east regions on the one side, where the fully delegated farming rate can reach 18% (whether it is mostly "abandoned" for grain farms or "refocused" for wine or livestock farms). On the other side is an area covering the central/central-east/south-east regions where full delegation is at relatively low levels.

On the basis of the 2021 OTEXA 2 survey, we can characterise the population of the farmers concerned and their motivations more precisely. Out of the 1,591 responses to the

21. The figures for full delegation cited in this paragraph are taken from Nguyen et al.*, 2020, p. 59–62.*
22. It should be noted that the statistical data on full delegation in the AC and FSS is based exclusively on farming work.

Figure IV – **Distribution by age group of farmers who outsource all farming operations (full delegation) (%)**



Sources: Data from the OTEXA 2 survey (2021), authors'calculations.

online questionnaire, 97 respondents (6%) use this practice, one point below the national figure from the FSS. The distribution by age group (in the sample surveyed) of the sub-population of farmers who delegate fully (Figure IV) shows that this phenomenon appears across all age groups, but more specifically in three of them: those aged 25, those around the average age of 50[23] and retirement-age farmers, at 65.

For this sub-population as a whole, the main reasons are time constraints (23%), strategic objectives (19%), access to specific farm equipment (12%) and reduction of production costs (12%). An examination of the characteristics of this population in the three main areas most affected by full delegation reveals significant regional differences for certain variables, such as the average acreage of the farms concerned, age, number of non-family employees, the main reasons behind delegation and the service providers selected (Table 3). This information, supplemented by in-depth surveys of farmers (see parts 1 and 3), can be used to distinguish and characterise three main types of farmer, while referring to different practices and regional presence:

- Profile 1: farmers who are fairly young, in the under-50 age group, with farming as the main job and mainly wanting to refocus on their core business and on production (breeding, wine production, other industrial and specialised crops), tasks (processing, marketing) or related

23. A Student test was conducted to compare the average age of the sub-population of farmers who delegate fully and that of the sub-population who do not. The result means that the H0 assumption that there is no difference between the two averages cannot be rejected.

Table 3 – **Characteristics of farms affected by full delegation in three areas**

Areas		South-West	West	North-East
French administrative departments		Pyrénées Atlantiques, Landes, Haute-Garonne, Gers	Indre et Loire, Vienne, Mayenne, Loire-Atlantique	Aube, Marne, Seine-et-Marne
Average farm size (ha)		138	57	121
Average age of farm managers		50	46	47
Average number of non-family employees		6	3	2
Main reasons (number of responses)		Strategic reasons (27), equipment (16), time (16), cost (16)	Time (43), strategic reasons (11), equipment (11)	Strategic reasons (26), time (14), equipment (11), human resources (11)
Selected service provider (number of responses)	ETA	81	56	51
	Other farmers	6	15	43
	CUMA		26	
	Cooperatives	5		
	Other	5		3

Sources and coverage: OTEXA 2 survey data (2021), population of respondents with full delegation. Authors'calculations.

activities (methanisation, agritourism) which generate high added value. Instead of recruiting, they tend to delegate all cropping operations, preferably to an ETA, for cost reasons, especially when the service provider also offers other services, such as the purchase of inputs or the marketing of crops. This profile of farmer can be found at the head of livestock farms in the western region or at the head of grain and mixed croppinh/livestock farms in the central-east and north-east regions.

- Profile 2: farmers managing medium to large farms, in the over-50 age group, who are retired (or nearing retirement), cannot find a buyer or who do not want to lease their farms due to the leasing contract status, which they deem to be too restrictive. They thus prefer to delegate the management of the farm to an ETA while waiting for a hypothetical takeover or a future sale. This advanced form of delegation is common in cereal areas, particularly those characterised by a low level of tenant farming and by issues with farm succession, such as the South-West.

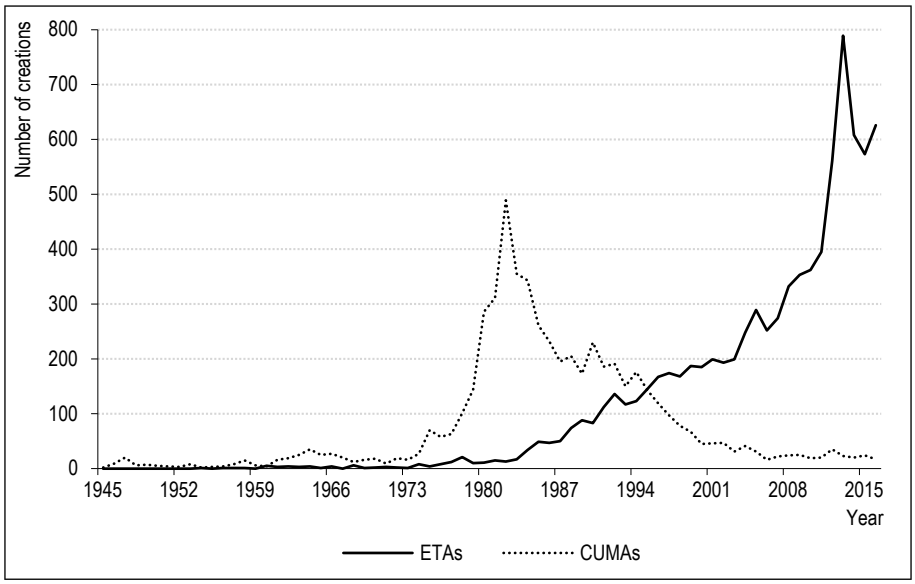
- Profile 3: farmers with multiple jobs, across all age groups, who are short of time and who, just like the first profile, prefer to outsource rather than hire a manager, not only for cost reasons, which include the wage and other transaction costs (finding employees, work supervision and managing possible conflicts), but also to avoid having to invest in equipment. We believe that this profile can be found in all regions, suggesting that "abandonment" (profiles 2 and 3) is the most prevalent and widespread logic behind full delegation.

2.4. An Increasingly Substantial New Offer in a Market Under Construction

Quantifying the offer is much more difficult than quantifying demand, in particular because of the previously discussed issues regarding the legal scope of the activity and the lack of data on the volume of activity for certain categories of service providers (cf. Figure I). However, on the basis of the MSA data and data from the Infogreffe register, we can see that the 1990s are characterised by a marked increase in both the number of AWUs from ETAs, CUMAs and employers' alliances (cf. Figure II) and the growth in the number of ETAs created (Figure V).

Behind this growth in the offer are significant changes that require, in order to understand them properly, a reminder that as a sector, agriculture has long been marked by collective activity embodied in farmers' organisations, such as cooperatives, which were designed to be an extension of farms. What the farmers were unable to do because of lack of resources was taken care of by the farmers' organisations. Traditionally, when farms lacked adequate capacity in terms of equipment and sufficient labour, they turned to CUMAs. Figure V clearly shows the central role of the CUMAs, the rise of which, as seen from the forces behind their creation, corresponds to the laborious modernisation of agriculture between 1960 and 1980, following the creation of the CAP. The ensuing period sees an inversion in the creation curves of CUMAs and ETAs, marking a major divide in the logic behind a collective and commercial service. Recognised

Figure V – **Comparative growth in the number of ETAs and CUMAs created from 1945 to 2016**



Sources: Infogreffe, authors'calculations.

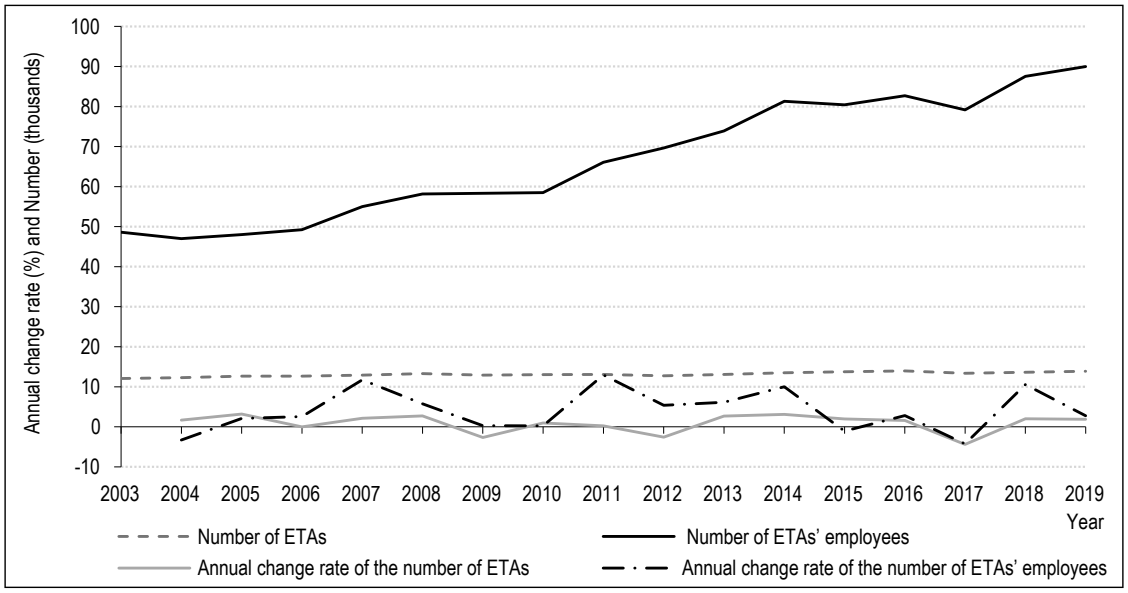
by the profession in 1930, the activity of the ETAs remained relatively "off-the-record" until 1980. Since then, they have undergone a remarkable level of development, particularly since 2003. Without understanding all the determining factors at this point, the rapid growth in the number of ETAs could be linked to the implementation of new tax measures at the time, which prompted farmers to create service companies providing farming support. It could also be an unexpected effect of the various CAP reforms that took place from the 2000s onwards. These included decoupled payments which resulted in some retired farmers preferring to delegate the management of the farm in its entirety rather than lease it out in order to keep the subsidies, as well as the tightening of agri-environmental policies which encourage farmers to call on ETAs to carry out spreading and spraying work. According to data from the MSA and FNEDT, there were 13,893 ETAs in 2019, with a total of 89,960 employees for approximately 34,000 full-time equivalents (FTEs).

With regard to the growth of the ETA workforce, it seems more reasonable to assume that the ETAs that were created and remained in operation became more consolidated, rather than simply growing in number. The strong momentum of creation observed between 2006 and 2013 is not reflected in the number of ETAs in business, which remained relatively stable between 2010 and 2019 (+6%), but rather in the number of employees, which more than doubled over the same period (+53%). This was also a time where the number of businesses being created seems to have stalled (Figure VI). It would also be hasty to conclude that ETAs have replaced CUMAs, or even farmers providing services under their own farm business, who represent the other major stakeholder in outsourcing. The same farmer may approach an ETA, a CUMA and then a neighbour in turn, or all three at the same time depending on the operation to be outsourced. Far from excluding each other, the ways in which outsourcing is arranged are shaped around these new combinations. With regard to CUMAs, the number of new establishments decreased significantly between 1980 and the early 2000s, but then more or less stabilised. This relative stability[24] is seen not only in the number of CUMAs in general, but also in the number of CUMAs acting as employers' alliances – GEs, whose activities with salaried workers (measured here in FTEs) have enabled some of them to develop a complete custom service since 2006 (Figure VII). In 2019, the MSA reported 1,615 CUMAs acting as GEs, representing 14% of all active CUMAs, with 4,700 employees for approximately 2,200 FTEs, almost 20 times less than the ETAs.

Finally, according to data from the 2010 AC and the 2016 FSS (Table 4), there are 14,690 and 11,872 farms respectively that offer services as a way to diversify their agricultural activity (under their own farm business or through a legal entity that is separate to the farm). However, given the decline in the total number of farms, this drop is only relative. The provision of services as a

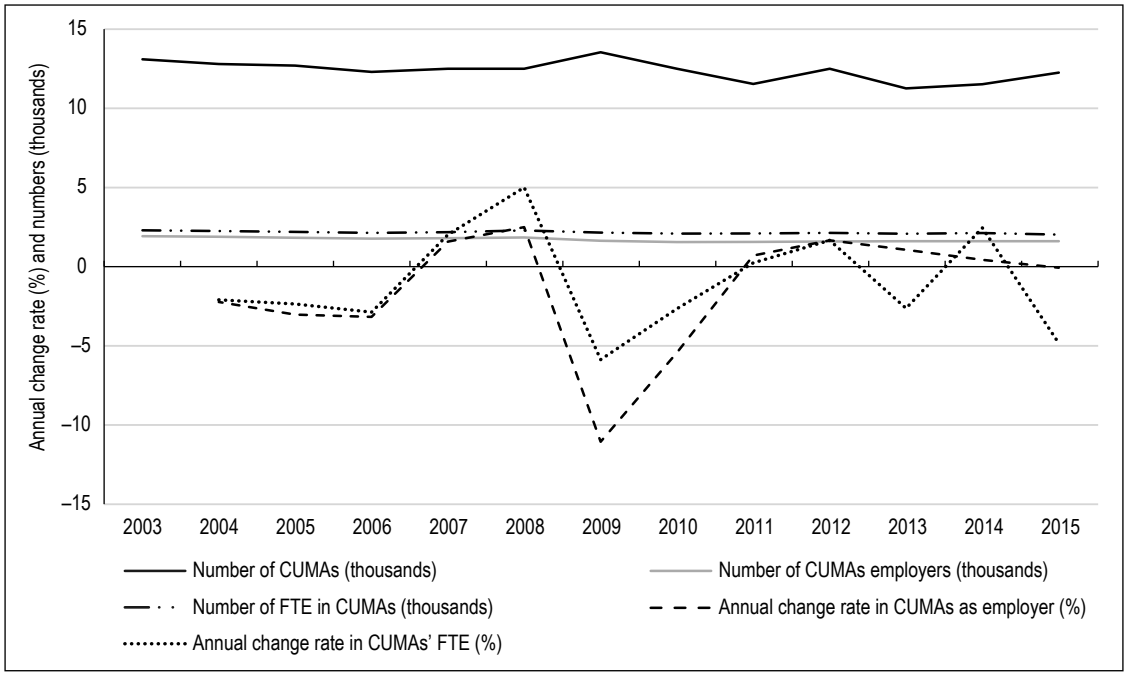
24. The drop seen in 2009 is linked to efforts undertaken by the HCCA to identify inactive CUMAs and remove them from the data files. Furthermore, apart from the 2019 data, detailed data on CUMAs from 2015 onwards are not available as a result of a change in status in 2016.

Figure VI – **Change in the number of ETAs and their employees from 2003 to 2019**



Sources: MSA and FNEDT, authors'calculations.

Figure VII – **Change in the number of CUMAs and their employees from 2003 to 2015**



Sources: MSA and FNEDT, authors'calculations.

Table 4 – **Relative number of farms performing custom farming as a diversification activity in 2010 and 2016**

	Number of farms (*N1*)		Total number of ETAs	*N1*/ Total farms	Proportion under own farm business (%)	Proportion under an ETA business (%)	Proportion of ETAs run as a diversification activity (%)
	under own farm business (*N11*)	under an ETA business (*N12*)	(*N2*)		(*N11*/*N1*)	(*N12*/*N1*)	(*N12*/*N2*)
2010	11,913	2,777	13,055	3.0	81.1	18.9	21.3
2016	8,698	3,174	13,978	2.8	73.3	26.7	22.7

Sources: 2010 AC and 2016 FSS, authors'calculations.

means of diversification, also known as "custom farm work", tends to remain stable over time. Within this population, farms that do this under their own farm business (within the limits of what is theoretically permitted) remain in the vast majority. In this sense, less than one third create a dedicated legal entity and the ETAs thus created represent approximately one fifth of all ETAs (Table 4). Alongside the ETAs that include a diversification activity, many others have evolved so that providing services has superseded production activities on the farm. The OTEXA 1 survey conducted in the South-West in 2018 (see part 4 of the study), an area where this form of outsourcing is particularly prevalent, can be used to better characterise this category of stakeholders: 31% of respondents developed their contract work, mainly motivated by the need to pay off increasingly expensive agricultural equipment that remains relatively unused throughout the year.[25] For some, this activity goes back several generations, from the first threshing work in the post-war period to the "buying fever" of the 1970s and 80s, fuelled by the modernisation policy for the sector. The service-provider farmers surveyed work for a dozen local customers on average (minimum of 1, maximum of 40), who themselves are farmers and have multiple jobs, covering an average of 150 hectares (minimum of 2, maximum of 2,000). With regard to this last point, note that 40% of the service-provider farmers intend to develop their provision of service activities in the future, mainly seeking to increase the cultivated area. This activity generates a turnover of between €10k and €50k for 31% of these farmers and €50k or more for 30% of them. 54% have created a dedicated outsourcing enterprise – ETA. This is because the law requires the creation of an ETA when the turnover exceeds the threshold of 30% of the agricultural revenue or €50k. However, tax optimisation is occasionally the reason behind creating an ETA. In this case, the ETA is responsible for equipment and possibly the hired labour, and then invoices the farm for the associated service. It is interesting

25. A combine harvester costs between €200k and €400k and is only used for three weeks a year. According to the farmers surveyed, specific equipment would only be used at 50% of its capacity without outsourcing.

Table 5 – **Distribution of farms performing custom farming according to their size (in hectares) in 2010**

Farms doing custom farming as a diversification activity	Number	Percentage by class of size				
		[0, 20[	]20, 50]	]50, 100]	]100, 200]	[200, +]
Under own farm business	11,913	12.3	10.9	23.3	35.5	18.0
Under an ETA business	2,777	13.1	11.8	21.7	32.1	21.3

Sources: 2010 AC and 2016 FSS, authors'calculations.

to note that in France, outsourcing as a diversification activity mainly involves medium to large farms with a holding above the French average of 65 hectares (Table 5). In some cases, ETA activity may overtake the farming activity itself and become the main activity. The farmer then becomes the manager of an outsourcing enterprise, rather than a simple farm manager operating custom services under his own farm business. However, the two legal entities (farm and ETA) remain inextricably linked at both the functional and the financial level, as it is the same person making the decisions.

In the last 20 years, ETAs, whether as a primary activity or secondary diversification activity, have thus made substantial gains. However, they have not completely eclipsed other service provision stakeholders, particularly farmers who offer custom services under their own farm business. This coexistence of stakeholders supplying custom services reflects the changing demand. According to the 2021 OTEXA 2 survey (part 4 of the study), over 60% of farmers are CUMA members. However, the vast majority of them either make use of ETAs or neighbouring farmers, depending on their needs. Having to manage shared equipment in the CUMA with limited windows of time to complete jobs is likely to increase transaction costs and effectively limit the use of shared work arrangements. As a result, farmers prefer having contracts with an ETA or a neighbouring farmer. This is particularly the case with harvesting, sowing and pesticide application, which nowadays require a great deal of reactivity (cf. Table 3). This shift from a collective logic organised by farmers' organisations to one of a commercial service run mainly by private stakeholders, in our view, marks a major tipping point in the organisation of agricultural labour and the beginning of the creation of a genuine agricultural outsourcing market. However, the data shows that, in this changing environment, "traditional" collective stakeholders, such as CUMAs, cooperatives traditionally specialised in storage and marketing, and CETA (*Centre d'études et de techniques agricoles* – Centers for studies and agricultural techniques) can also adapt by seizing the opportunities offered both by the emerging market and by legislation. They can do so by building new alliances and coming up with new services, which are sometimes necessary for their survival (Nguyen *et al.*, 2020).

Alongside the supply and demand stakeholders, the creation of a outsourcing market is also playing out at a territorial level, where there is an uneven distribution in the main types of stakeholders (ETAs, CUMAs, farmers performing custom farming under their own farm business, agricultural cooperatives, project manager assistant) (see Nguyen *et al.*, 2020). The areas of influence of each of the stakeholders can be understood according to the geographical distribution of the main productions and the particular needs associated with them (cf. Table 3). ETAs have a greater presence in areas where grains and mixed crops are produced (north, central-west and south-east regions) for harvesting operations, organic manure spreading, sowing and phytosanitary treatments. Meanwhile, CUMA employers have a greater presence for jobs such as hay baling in livestock-farming areas (west, central and south-west regions). In comparison to the ETAs, according to the data of the 2010 AC and the 2016 FSS, farmers performing custom farming under their own farm business have a strong presence in central-northern and north-eastern farming areas, while they are relatively absent from others. Would the barriers to entering the market in the south-west and southern France be greater for farmers doing custom farming than for ETAs? According to the in-depth qualitative surveys conducted in part 3 of the study, several factors could explain the presence of a large number of different types of providers in the North, such as the presence of high value-added crops (e.g. beet) or the size and topography of plots of land that allow for better labour productivity. Conversely, the relative lower profitability of outsourcing activity in the South and South-West would lead to greater competition and the selection of stakeholders on the supply side who are able to optimise the cost of jobs and quickly pay off equipment costs. The difference in the rates charged for fully delegated jobs between the North (typically an average of €500/ha) and the South (average of €350/ha), while the profitability threshold

is estimated to be approximately €450, would indicate differences in the conditions in which the activity is carried out and encourage consideration not of a single outsourcing market, but of several. Moreover, the tension in certain markets would be equally significant, as this would have resulted in a real headlong rush among certain stakeholders, in terms of growing in order to occupy the market by investing an increasing amount in equipment, by recruiting and then by increasing the number of contracts at any cost. The testimonies collected in the in-depth surveys (part 3) are clearly not statistically representative, but they nevertheless echo the assumption made earlier on regarding the mechanism behind the growth of ETAs, which would be more a question of consolidating rather than multiplying companies.

3. Questions Surrounding a Singular Phenomenon

3.1. How to Understand and Explain a Little-Known Economic and Social Phenomenon?

While the vast majority of farmers are concerned, outsourcing remains a little-known and little-studied practice. Its covert nature as an emerging phenomenon is accentuated by the difficulty of defining, measuring and naming it. However, as our study suggests, the little data that is available does seemingly outline a large-scale phenomenon that is shaping a new outlook in agricultural production. The research objective of shedding light on an important emerging phenomenon first brought us to an identification and characterisation exercise, using multiple perspectives (individual and market practices; regional and national scale) and measurement methods (descriptive statistics, inferential statistics, discourse analysis and monographs) in order to minimise blind spots and other risks of bias. However, the methodological limitations with which we were quickly confronted (variable geometry in the legal definition, heterogeneity of data between sources, significance of informal and unspoken practices, evolving driving forces) suggest that the phenomenon is still underestimated and that its edges remain blurred. For example, it is now difficult, if not impossible, to discern the amount of labour supplied or the cultivated area worked by a large number of outsourcing stakeholders. Our analysis of stakeholders on the supply side was thus limited to farmers performing custom farming as a diversification activity and to ETAs and CUMAs developing complete jobs. However, temporary employment agencies, foreign service providers or companies outside the agricultural social protection scheme (MSA) are playing an increasingly important role in certain sectors such as viticulture and arboriculture. Depeyrot *et al.* (2019) in particular make the connection between a slowdown in the momentum of ETAs in recent years (cf. Figure I) and the development of posted work. This limit does have implications with regard to debates surrounding the consequences of outsourcing on agricultural performance and employment in the sector.

Moreover, the considerable variety in the situations observed raises the question of the theoretical definition of outsourcing, an economic organisational category that is proving to be very broad, perhaps even too broad to describe a changeable situation with any level of precision. We distinguished between three contexts for outsourcing: "simple outsourcing", "full delegation by refocusing" and "full delegation by abandonment", with the assumption that they correspond to different degrees of dissociation between the ownership and management of assets. This classification can be questioned in the light of that developed by Ménard (2021) to explore the richness of hybrid forms. As it leads the farmer, as the contracting party, to transfer more decision-making rights to the contractor, does full delegation not rely on coordination described as "oblique quasi-integration", a special form of industrial outsourcing in which the contractor acquires a hybrid status of "contractor-supplier" with greater autonomy in decision-making and responsibility in carrying out work (Baudry, 2013)? It should be noted that in some cases of full delegation by abandonment, some contractors go as far as to take capital shares in the delegated farm, partly absorbing the latter (Purseigle *et al.*, 2017). Moreover, even a simple outsourcing, limited to an elementary operation (sowing, pesticide application), may hide genuine alliances due to the specific nature of the assets involved (machinery, skill). Thus, classifying in order to better characterise and understand the existence of different forms of outsourcing remains a theoretical challenge and invites further study, not only of the contractual terms (formal and informal) of the contracting-out relationship, but also of the practical organisation of operations (agronomic and regulatory constraints, fragmentation and topography of land plots, types of equipment, etc.).

3.2. Outsourcing in Agriculture, a Specific Phenomenon?

Our approach to agricultural outsourcing has also led us to review the economic theories on contracting-out, developed with reference to the industrial sector alone. In doing so, two traits that are unique to agricultural outsourcing caught our attention in particular.

The first refers to the definition of the contractual arrangement behind the service transaction: in an agricultural contracting-out relationship, who is ultimately the principal and who is the agent? Both the customer and the provider are farmers/agricultural producers, each holding some of the assets necessary for the production process, with the former owning the land and the latter owning the equipment and the labour. Both stakeholders would therefore be the principal and the agent, leading to situations with high transaction costs and complicated governance. This question is all the more crucial given that the relationship involves specific assets, such as equipment which features expensive precision technology and requires special skills to operate, or the expertise inherent in quality-driven production (Gandonou *et al.*, 2006; De Oliviera & Zylbersztajn, 2018). It also arises in the case of full delegation because of the level of dissociation between the ownership and management of assets. In spite of this, farmers are increasingly outsourcing operations involving specific assets, and full delegation is advancing at an unprecedented rate in France. How can this be explained? From a theoretical point of view, one assumption in particular deserves to be explored. Contracting-out relationships, like any form of hybrid organisation, are likely to evolve and co-exist within the same sector or even the same company (Ménard, 2021). Simple outsourcing can thus shift to a more strategic type of contracting-out that builds alliances, the existence of which would be facilitated by relational contracts based on *ex ante* promises (better yields through the use of better equipment or better technical expertise and organisation of tasks) or informal incentive schemes, based on trust, mutual understanding and reputation (Baker *et al*., 2002; Holcomb & Hitt, 2007; Ruzzier, 2012). Conversely, full delegation, which is complex to organise due to high transaction costs, could evolve towards a decentralised method of coordination thanks to the intervention of an independent third party, the project manager assistant, whose main role is to coordinate the outsourcing arrangement and manage any conflicts between the farm holder and the ETAs.

The second unique trait involves barriers that should theoretically prevent certain stakeholders from entering the market (Allen & Lueck, 2004). These barriers are significant in certain agricultural regions, for example those where the topography is unfavourable or land plots are small, etc., or where the profitability of the activity is not guaranteed due to the fixed costs of the equipment and particularly high variable production costs. However, many farmers are still keen to turn to contract work and increase the number of contracts that they do to pay off an ever larger and more costly fleet of equipment. Some speak of irrational economic behaviour, arguing that the problem lies with the relationship of farmers and their equipment, and citing cases where farmers even sell land to finance an unprofitable business. Should this behaviour be placed within a broader framework of redefining the scope of an agricultural productive organisation, considering the close links between farming and service provision, even if both are contained within legally autonomous entities? Does it come from the irrationality of an emerging market that is still selecting its stakeholders? These theoretical differences, which are only a few examples of the singularities noted in our study, encourage further research on the global performance of different outsourcing arrangements on different scales.

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Are we standing on the threshold of a "delegated" or "service-based" agriculture? While our study suggests major changes in outsourcing practices and, with them, a profound break in the way farm holders organise labour on their farms, their quantification remains limited due to the current lack of statistical data available to understand them in their complexity. Answering this question would require observing panels of farmers and building robust time series for all the central variables discussed in this article. The 2020 Agriculture Census (AC) has introduced new questions abour outsourcing activity, and should help to better characterise the different types of farmers who outsource and those of the farmers who contract custom work. Even though we do not have all the results from the AC at the time of writing, some partial data show a relative stabilisation in the use of outsourcing at a high level and even its development in some regions (for example, Normandy or the Île-de-France region).

Even with these limits in mind, outsourcing seems to be common practice for a large majority of farmers, regardless of the size and specialisation of their farms. The number of those who outsource significant levels of operations has more than doubled in 20 years, and some no longer hesitate in delegating full management of their farm. From outsourcing due to a lack of capacity or resources, farmers seem to have shifted towards strategic outsourcing in order to optimise the allocation of resources, refocus operations or manage an estate. At the same time, an increasing number of farmers, caught up in a race for equipment and perhaps also to expand, are making custom farming into a diversification activity. Some of these have then shifted into a new business, that of contractors or service providers. The boundary between the agricultural sector and the service sector is thus becoming quite porous. Are we witnessing the tertiarisation of agricultural production? Faced with increasing demands and their members' inability to find buyers or to meet new production challenges, farmers' organisations such as agricultural cooperatives, CUMAs or CETAs are adapting and are quick to follow suit. In addition, new French or foreign "land management" agencies[26] are emerging and challenging the order of a professional sector that until now seemed to remain distinct, while some farmers themselves, especially those most attached to the family farm model, are making important contributions to the development of this phenomenon.

These developments, the stakes of which are high for professionals in the sector and for society as a whole, have been a major subject of debate, as evidenced in recent years by the growing number of articles in the professional press[27] and forums. At a time when a third of farmers are set to retire without a buyer and when the influx of young farmers into the sector is a rare occurrence, for some, outsourcing represents the only solution to help those who remain to better organise the work on the farm, to support those who are setting up or to allow others to gradually enter the profession through salaried employment within service organisations (ETAs, CUMA employers, etc.). In so doing, it would help to maintain certain farms, as well as the productive capacity and employment in some rural areas. However, for others, outsourcing should be regulated (Grimonprez, 2018) as it would sound the death knell for family farms and would endorse the takeover of agricultural and food production by ETAs and companies in the industrial sector (agri-food, agri-supply and agricultural machinery), with possible consequences regarding access to farmland, food security and the agro-ecological transition of regions.

This phenomenon therefore puts professional organisations and the legislator in a difficult position, between the desire to recognise a situation that is out of their control and the desire to regulate it in order to preserve the status of farm managers. In France, the debates at the National Assembly surrounding the proposed law on emergency measures to ensure the regulation of access to agricultural land through corporate structures (French Law No. 2021-1756 of 23/12/2021)[28] and the opinion presented on behalf of the Committee on Economic Affairs regarding the draft finance law for 2022 (Sempastous, 2021) testify to this. This does not only represent a difficulty for France, as the next CAP reform will call on EU member states to define "the active farmer" who is likely benefit from subsidies from Europe (Chatellier & Guyomard, 2021). Faced with these concerns, knowledge about agricultural outsourcing remains fragmented and some aspects are still not widely understood. Being in a position to provide support with this emerging phenomenon requires taking an interest in it, especially as it also affects other regions in the world. □

26. For example: Agriland, Cabinet d'agronomie provençale, Linkinfarm, Terrea, etc.
27. Noël, 2016; Aumailley, 2019; Poudevigne, 2020; Heloury, 2021; Marcotte, 2021.
28. Journal officiel de la République française, 24 December 2021.

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APPENDIX 1

MEASURE OF THE DEGREE OF "FULL DELEGATION" OF FARM WORK BEFORE 2016 WITH DATA FROM THE SSP (FRENCH STATISTICAL SERVICE) AND EXTRAPOLATION

At the time of the Agricultural Census in 2010, the question regarding the use of full delegation of farm work was only addressed in the former Midi-Pyrénées region. An initial statistical exploration was conducted within the framework of the ANR Agrifirme project to evaluate the phenomenon of full delegation of field crop work in France in 2010, based on a characterisation of the farms concerned in the Midi-Pyrénées region. The statistical analysis made it possible to identify several variables, allowing farms in the Midi-Pyrénées region that fully delegate their farming work to be isolated.

In order to extrapolate to a national level, three of these variables, available at the national level, were used: the number of days worked by an ETA (JETA), the surface area in hectares used for grain, oilseed and protein crops (SCOPha), and the number of annual work units (AWU).

For each of these variables, thresholds above which full delegation was statistically very likely were calculated by distinguishing the farms according to their standard gross output (SGO). Medium and large farms (SGO≥€25k) were separated from small farms (€5k<SGO<€25k), with these two groups having different reasons for delegating work. The variables and thresholds used were as follows:

	Medium and Large farms	Small Farms
	JETA/SCOPha ≥ 0.27	JETA/SCOPha ≥ 0.35
Or	JETA/SCOPha ≥ 0.18 & AWUeta% ≥ 5%	JETA/SCOPha ≥ 0.25 & AWUeta% ≥ 4%
Or	AWUeta% ≥ 15%	AWUeta% ≥ 10%

Assuming that, in other regions, units that are structurally similar to these variables would use these providers in the same way, we extrapolated the number of farms that specialise in field crops and use full delegation to the rest of France.

The analysis was then extended to all productions during a second statistical study conducted within the framework of the Actif'Agri[(i)].working group. This made it possible to validate, *a posteriori*, along with the 2016 FSS data, the numbers derived from the extrapolation conducted using the 2010 AC data on field crops. Furthermore, in 2016, the FSS questionnaire included, for the first time, a country-wide question on the use of full delegation.

In addition, to gain an idea of the development of full delegation between 2010 and 2016, we applied the extrapolation method previously described for the AC to the 2016 FSS data[(ii)].

The statistical study carried out within the framework of Actif' Agri also consisted of creating two indicators to isolate the population of farms characterised by the significant use of outsourcing. These indicators are: the volume of work taken on by ETAs in relation to the volume of permanent work, and the number of working days completed by ETAs in relation to the SGO, exceeding a threshold close to that calculated for farms using full delegation (by refocusing or by abandonment):

	Medium and Large	Small
ETA work volume/permanent work volume	> 0.09	> 0.065
Working days of ETAs/SGO (In Thousands of Euro)	> 0.23	> 0.32

For medium and large farms with permanent AWUs (i.e. 229 working days of 7 hours per day according to agricultural statistics), an ETA work rate threshold of 0.09 represents 21 days. In addition, for the second criterion, a threshold of 0.23, for a 100 ha grain farm, for example, translates into 23 working days for an ETA, where 1 ha of grain crops is equivalent to a SGO of €1,000.

*(i) Between 2017 and 2019, the Actif'Agri working group united researchers under the leadership of the CEP (*Centre d'études et de prospective – *centre for studies and outlook) at the French Ministry of Agriculture to analyse changes in agricultural activities and jobs. Our participation in this group allowed us to access the individual data from the 2016 FSS and the support of CEP statisticians.*

(ii) It should be noted that the result of the full delegation estimate for 2016, using the extrapolation method, gives a figure of 8,986 field crop farms as being concerned. This constitutes a slight underestimation of the phenomenon compared to the figure derived directly from the question asked in the 2016 FSS, which is 11,036.

APPENDIX 2

RESPONSE OPTIONS TO QUESTIONS FROM THE OTEXA 1 AND 2 SURVEYS ON THE REASONS BEHIND OUTSOURCING WORK AND THE CRITERIA FOR SELECTING A SERVICE PROVIDER

A – Reasons behind the use of outsourcing

Question asked: For the tasks that you reported to have outsourced for your XXXX production, what were the main reasons behind you making that choice? (multiple answers possible)

Response options:

- Cost: cost of a hired employee, improved profitability of the contracted worker and better technical-economic performance of the job (reduction in the use of inputs, constraints on the work schedule)
- Equipment: lack of suitable equipment, does not have the acreage to make the equipment cost effective
- Strategic reasons: turning focus to another area of production or other activities (food processing, marketing)
- Human resources: no/shortage of labour for the proposed work, availability of workers, difficulties accessing OFII contracts, ease in terms of work organisation
- Technological reasons: access to new technologies such as remote sensors, GPS mapping, etc.
- Technical expertise: lack of technical skills, use of a new technique
- Time: lack of labour, lack of time due to other agricultural and non-agricultural activities, saving time compared to hiring
- Health/disputes
- Lack of interest in the task

B – Criteria for selecting a service provider

Question asked: For the tasks that you reported to have outsourced for your XXXX production, what were the most important criteria in selecting this service provider? (multiple answers possible)

Response options:

- Geographical proximity
- The price
- Their discretion
- Their technical skills
- Their equipment
- The type of contract offered
- Their reputation
- Their efficiency
- Their additional services (advice, marketing, purchase of inputs)
- Trust
- Other, please specify…

Informal Learning at Work and the Securing of Professional Mobility

Olivier Baguelin* and Anne Fretel**

Abstract – In addition to job training, some work activities or organisational contexts may be more or less favourable to the development of skills through informal learning (IL). What is its influence on the probability of employment for workers in external mobility? This issue is addressed using data from the Céreq's *Dispositif d'enquête sur les formations et itinéraires des salariés* (DEFIS, a survey on employee training and career path). With respect to a basic model of human capital accumulation, some of the results are unexpected; in particular, workers who left jobs that were *a priori* the most favourable to IL (cognitive processes, autonomy and professional exchanges) appear to derive no benefit from it; the most favourable situations combine only cogntive processes and autonomy, without professional exchanges. One explanation would be that while the positions most conducive to IL contribute to the development of skills, professional exchanges include an employee evaluation dimension, the outcome of which is not always favourable. In this case, external mobility could correspond to a negative evaluation likely to undermine workers' self-confidence and their careers.

JEL classification: J2, J3, J6
Keywords: training, work activity, organisation, probability of employment

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In the context of a flexible labour market, training appears to be a key component in securing workers' career paths, in particular by promising to make it easier to return to work after external mobility (loss of job or resignation). In the French case, research has shown that on-the-job training helps to secure external mobility (Blasco *et al.*, 2012). The effect of training during a period of unemployment is less clear: it would not reduce the duration of unemployment (or only reduce it very little) but would increase the duration of subsequent employment (Crépon *et al.,* 2012). The training period would therefore have potential for securing career paths when it takes place before mobility. Having received training also has an impact on other dimensions, such as the level of pay or the quality of the job found (Aubert *et al.*, 2009), which help to make the career path more secure. Some authors note, however, that the benefits are largely reaped by the employer (Goux & Maurin, 2000; Lê, 2013). One possible interpretation is that the latter uses training above all as a lever for developing the specific human capital of its employees and invests in those it wishes to retain (Lainé, 2002). This would help to explain why access to on-the-job training is very uneven depending on age, level of initial training, occupational group or type of contract (Céreq, 2014). Training therefore does not necessarily appear to be a resource for those workers who, from a public policy perspective, appear to need it most: those in the secondary segment of the labour market defined by their overexposure to external mobility (Picart, 2017).

However, the acquisition of skills is not exclusively the result of formal training (as defined in labour law): other, more everyday forms of learning, such as hands-on learning, direct transmission of know-how or receiving instructions, also contribute to it. While the role of such 'informal' learning (IL) is now widely recognised in the development of skills (Fournier *et al.*, 2017a), few quantitative studies have attempted to measure its effects on career paths. This is what is proposed here by focusing on workers experiencing external mobility after resignation, contract termination or redundancy; the aim is to quantify the role of IL in securing the career paths of workers facing labour market selectivity.

One difficulty in this respect is that, unlike diplomas, formal training or certified achievements, informal learning is by nature difficult to objectify, posing a statistical problem of measurement and implying a certain theoretical indeterminacy as to its effects, as we shall see further on. To understand them, we rely here on a typology developed by Fournier *et al.* (2017b), which characterises work situations according to whether they are more or less conducive to IL. Drawing on the lessons of vocational didactics and on the basis of data from Céreq's *Dispositif d'enquête sur les formations et itinéraires des salariés* (DEFIS, a survey on employee training and career path), these authors propose the concept of work dynamics, which combines organisational contexts and job activity to describe the extent to which a work situation facilitates IL or not (see Appendix 1). A statistical classification leads them to distinguish groups of organisational contexts and work activities that are more or less favourable to IL (the variables used for the classification are detailed in Appendix 1, Table A1). This results in the distinction of three classes of organisational contexts: those that facilitate dialogue and the sharing of information, the transmission of skills, professional development, the decompartmentalisation of work, reflection on practice and value the collective are considered favourable, those that only combine the first three characteristics are considered partially favourable and those with none of them are considered unfavourable. In terms of work activities, four classes are distinguished: job conducive to IL facilitate cognitive processes, exchanges and autonomy, activities not conducive to IL facilitate none of these aspects, and two intermediate categories are also considered, one combining cognitive processes and exchanges, the other cognitive processes and autonomy. Finally, Fournier *et al.* (2017b) distinguish twelve working dynamics ranging, in terms of IL, from the most (conducive activity in an IL-friendly context) to the least (non-conducive activity in an IL-unfriendly context).

These categories are mobilised as they are, and the same DEFIS data are used here. The particularity of this investigation is to focus on external mobility.[1] The aim is to document the effect of having previously held a work position conducive to informal learning (IL) on the subsequent return to work of externally mobile workers. More precisely, we analyse the situation, between early 2014 and mid-2015, of employees under the age of 60 who were employed at the

1. The typology proposed by Fournier et al. *(2017b) is based on all employees (in a company with ten or more employees), whether or not they left their job of end 2013; it is therefore little influenced by the case of externally mobile workers, who represent less than 20% of all the workers surveyed.*

end of 2013 in a company with ten or more employees and who left their job following a resignation, contract termination or redundancy (retirements are excluded from the scope of the analysis), depending on whether they were in an organisational context that was more or less favourable and in an activity that was more or less conducive to IL at the end of 2013. This focus on externally mobile workers responds to the specificities of the issue of job security in France, where access to continuous full-time employment (primary segment) often involves repeated confrontation with the selectivity of the labour market.[2]

The rest of the article is organised as follows: The first section presents the literature on the role of IL in business and its possible influence on the security of professional mobility. The second section presents the data, the study sample and first descriptive results. The third section is devoted to the econometric analysis of the short and medium term effects of the passage through a more or less favourable work dynamic for a representative sample of workers who experienced external mobility between the beginning of 2014 and mid-2015. This section first presents the results of a quasi-saturated regression analysis and produces a series of apparent and sometimes unexpected effects; it then examines more specifically the effect of taking into account the circumstances of external mobility, on the one hand, and stages of training or certification of skills following the initial employment on the other. Finally, an analysis using instrumental variables is proposed to assess the risk of endogeneity of assignment to the various IL situations. The analysis concludes with an overall interpretation of how the different work situations distinguished by Fournier *et al.* (2017b) influence the access to employment of workers in external mobility.

1. Informal Learning, a Possible Factor in Securing Career Paths?

The concept of informal learning (IL) is broad, ranging from the acquisition of skills through practice (in an occupational or non-occupational setting) to skills acquired on the job through observation of other workers, receiving instructions, supervision or feedback from a boss or co-worker (see OECD, 2010, pp. 24–29). This is a form of skill development distinct from training where workers suspend their production activity, for a defined period and under defined conditions, to take on the role of learner, typically in a dedicated room.

1.1. Informal Learning and Skill Development

From Adam Smith's pin factory to the learning by doing of endogenous growth theories, the concept is present, albeit often implicitly, in the economic literature where IL basically has the status of a positive externality. The empirical study of the influence of IL at individual level, however, is poorly developed. Heckman *et al.* (2002) investigate the implications of the fact that, unlike training actions, IL does not suspend production activity and therefore appears to intervene without cost to the employer. De Grip (2015) insists on the scope of the hypothesis: insofar as the time spent learning on the job is much greater than that spent in training actions, IL would be, in his view, preponderant in the development of skills.

Little is known about the transferability of skills acquired through IL or their contribution to satisfactory occupational mobility. The empirical literature on the payoffs of experience or seniority is of little use because it does not take into account the fact that different jobs have very different potentials for IL. However, work situations involving IL are likely to contribute more than others to equipping the worker for the demands of the labour market. Arellano-Bover & Saltiel (2021) make a decisive contribution in this respect by showing empirically that the beneficial effect on wages stemming from experience are strongest in companies that are particularly favourable to IL.

From a more psychological perspective, IL can stimulate a sense of competence and provide the worker with self-confidence to facilitate access to employment. Van der Heijden *et al.* (2009) propose in this perspective a study of the comparative influence of formal and informal learning on the perception that workers have of their employability (quality of expertise, anticipation and efficiency, adaptability, sense of community, management of constraints). They find some statistical independence between markers of formal or informal learning and conversely very clear associations between the different circumstances favourable to IL. A regression analysis documents the determining factors for access to the different IL-favourable situations, including gender, age, education level, marital status, job seniority and workload. Statistically significant linkages are rare. The analysis consisting of regressing each of the five employability

2. According to Picart (2017), among people employed for at least one week in 2012 (just over 32 million people), 21% belonged to the secondary segment, i.e. faced constraints related to how the labour market works (unemployment or underemployment).

dimensions considered on the characteristics of the worker, those of the organisational context and the various learning opportunities (including formal learning) leads mainly to the following conclusions: formal learning of the job-specific adaptation type is positively associated with most of the employability dimensions; the presence of interactions with superiors only shows a significant association with the sense of community and the management of constraints; the learning content of the job does not show a statistically significant link with any employability dimension except with the feeling of expertise, and this link is paradoxically negative, all things being equal.

One reason to be interested in IL is the hope that it is a less discriminating method of skills development than training. Ferreira *et al.* (2018) are specifically interested, in the differences in IL involvement between employees on temporary contracts (secondary segment) and others. Based on OECD data, they observe, all things being equal, a more intense involvement on the part of the former. The interpretation favoured by Ferreira *et al.* (2018) is that these secondary segment employees would see IL as an investment in accessing stable employment.

1.2. Informal Learning and Occupational Mobility

There are several theoretical reflections that address the way in which IL can influence career paths in the job market. Rosen (1972) proposes a job market model in which the various positions have varied learning potential. In contrast to the idea of IL as an externality, the market becomes dual: both work and learning opportunities are traded. This framework provides the basis for a theory of occupational mobility in which a worker can accept a low-paid job at the beginning of their working life, provided it is conducive to learning, in the hope of moving on to higher-paid jobs. Sicherman & Galor (1990) develop a similar argument for understanding patterns of internal (no change of employer) or external occupational mobility; in analysing these patterns they emphasise the opposition between (company) specific and general knowledge. Their highly Beckerian assumption is that the knowledge acquired informally is often specific and therefore more useful in the context of internal rather than external mobility. In such a model, therefore, there would be little to expect from IL-friendly work situations with regard to the future of externally mobile workers. Nevertheless, Acemoglu & Pischke (1999) contest the practical significance of the distinction between specific and general knowledge: empirical analysis suggests that they are complementary in the development of skills.

Perhaps a more serious impediment to the valuing of IL in the case of external mobility is the informational imperfection inherent in the labour market. De Grip (2015) notes that skills acquired informally are likely to be less visible to potential employers than those resulting from a training action. This risk justifies the existence of public policy schemes explicitly designed to certify skills acquired on the job, such as the VAE (*Valorisation des acquis de l'expérience*, accreditation of prior experiential learning – APEL) in France; competence should be accompanied by signals to reduce exposure to unemployment (cf. Spence, 1973). Yet, analysing wage progression, Arellano-Bover & Saltiel (2021) find clear evidence of the transferability of skills acquired informally for Italy and Brazil.

2. Data, Study Sample and Initial Descriptive Approach

The Céreq's DEFIS data on which we rely combines a survey of a sample of companies (employer section) with a panel of employees (employee section) monitored over five years (2015-2019). The sample of companies includes 3,400 companies with at least ten employees, which are representative for the private sector (excluding agriculture). The employees surveyed are those employed in the sample companies at the end of 2013. The employer section describes the context in which these individuals were working at the end of 2013: characteristics of the company, work organisation, human resources management, continuing vocational training, manager's profile. The employee section is aimed at documenting workers' trajectory: individual characteristics, training wishes, constraints and needs, on the job learning, relations within the company, information circulating on training opportunities, jobs and professional changes, training undergone and past trajectory.

Of the 15,000 or so people who were employed in one of the companies with at least ten employees surveyed at the end of 2013,[3] some 3,200 had left their initial employer by 2015. Here, we are interested in the prospects of these workers in external mobility. In 2015, 49% were employed (salaried or self-employed), 27% were unemployed and 13% were retired or in early

3. Sample representing approximately 12 million non-agricultural private sector employees at the end of 2013.

retirement. The latter, as well as employees over the age of 59, are excluded from the analysis. In 2016, a considerable proportion of the sample of externally mobile workers could not be re-interviewed: about 2,000 individuals remained, with the shares of actively employed, unemployed and (pre-)retired workers stood at 55%, 20% and 16% respectively.

2.1. Workers in External Occupational Mobility

In order to analyse the effect of work situations that are more or less favourable to IL in terms of the becoming of a working-age population, we have chosen to exclude individuals who were retired or aged over 59 in 2015. This is a compromise to ensure that a reasonable number of observations are kept, while avoiding the labour market participation issues specific to workers approaching retirement age. This brings the study sample down to 2,761 non-retired mobile individuals representing just over 2.3 million individuals in 2015 and 1,646 observations representing 2.1 million individuals in 2016 (Table 1).

How were these externally mobile workers distributed between the different work situation identified by Fournier *et al.* (2017b)? Table 2 answers this question and compares the distribution of the study sample with that of all employees. At the end of 2013, workers on the verge of external mobility were less often in a context favourable to IL and their activity was itself less often conducive to IL. When the

Table 1 – **Labour market situation of individuals under 60 in 2015 who were no longer employed by their end-2013 employer (%)**

	2015		2016	
	Unweighted	Weighted	Unweighted	Weighted
Employment	56	54	65	65
Unemployment	32	34	24	28
Study/training	8	7	6	4
Other inactivity	4	5	5	3
Total	100	100	100	100
Number	2,761	2.3 million	1,646	2.1 million

Notes: The weighting applied for 2016 corrects for attrition.
Reading Note: At the time of the first survey wave in 2015, 54% of workers who had left their employer of end- 2013 were employed.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

Table 2 – **Distribution by work dynamics in 2013: all employees surveyed (north-west values)/ externally mobile workers under 60 in 2015 and 2016 (south-east values); weighted data**

Organisational context	Job Activity…				Total
	Conducive to IL	Partially conducive		Not conducive	
		Exchanges without autonomy	Autonomy without exchanges		
Favourable to IL	9	11	12	7	39
2015	4	12	8	8	33
2016	3	13	8	8	32
Partially favourable	6	11	11	17	45
2015	4	15	7	23	49
2016	3	11	8	25	47
Unfavourable	2	2	4	8	16
2015	1	3	3	11	18
2016	1	4	3	13	21
Total	17	24	27	32	
2015	9	30	19	42	100
2016	8	28	19	45	

Notes: The analysis of the differences in distribution between all the employees surveyed on the one hand and the sub-samples of mobile workers on the other involves two-sided tests of homogeneity on the unweighted distributions; the differences are all significant (at the 5% level) except those measured for the following context x activity configurations: favourable x exchanges without autonomy, favourable x non-conducive, unfavourable x conducive. The weighting applied for 2016 corrects for attrition. As for unweighted data, the difference obtained for the partially favourable x exchanges without autonomy configuration is only significant at the 10% level.
Reading Note: 9% of employees had a work activity that was conducive to informal learning within a context that was itself favourable; this was the case for only 4% of the externally mobile workers surveyed in 2015 (*N*=2,761) and 3% of the externally mobile workers surveyed in 2016 (*N*=1,646).
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

activity was only partially conducive, it was more often because of lack of autonomy than because of lack of exchanges. In greater detail, the clearest differences concern: *(a)* activity not conducive to IL in a partially favourable context (in 2015: 23% of external mobility cases compared to 17% for all employees); *(b)* partly conducive activity due to lack of autonomy in a partly favourable context (in 2015: 15% of external mobility cases compared to 11% of all employees, Table 2).

2.2. Employment Rates in the Short and Medium Term

For externally mobile workers, did the work situations most favourable to IL lead to better employment opportunities later on? This is not what Tables 3 and 4 suggest. These describe the fate of the study sample in mid-2015 and mid-2016 in terms of employment rate according to the work dynamics (see Appendix 1) at the end of 2013.

In the short term (mid-2015), workers enjoying the employment rate of those in the most favourable work context and activity is not significantly different from the average. The lowest employment rate (28%) was indeed for groups in unfavourable organisational contexts, but their activity was partially conducive to IL. Conversely, workers facing the least favourable dynamics at the end of 2013 fared significantly better (at the 5% threshold) than the average, with an employment rate that was 8 points higher (62%, see Table 3). Only workers with autonomy in an organisationnal context only partially favourable to IL did better.

Table 3 – **Short term employment rate (mid-2015) among externally mobile workers under 60, by work dynamics at the end of 2013; weighted data**

Organisational context		Job Activity…				Total
		Conducive to IL	Partially conducive		Not conducive	
			Exchanges without autonomy	Autonomy without exchanges		
Favourable	Employment rate (%)	51	40	60	54	50
	(N)	*(127)*	*(301)*	*(254)*	*(251)*	*(933)*
Partially favourable	Employment rate (%)	69	55	65	53	57
	(N)	*(120)*	*(344)*	*(235)*	*(610)*	*(1,309)*
Unfavourable	Employment rate (%)	42	28	57	62	54
	(N)	*(47)*	*(84)*	*(105)*	*(283)*	*(519)*
Total	Employment rate (%)	58	46	61	56	54
	(N)	*(294)*	*(729)*	*(594)*	*(1,144)*	*(2,761)*

Reading Note: 54% of non-retired individuals under 60 who, in 2015, are no longer employed by their December 2013 employer are in employment in 2015 this applies to 51% of those who, in December 2013, were in an activity conducive to informal learning in a context that was favourable to such learning. Homogeneity tests were performed to compare the employment rate of each work dynamic to the overall employment rate.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

Table 4 – **Medium term employment rate (mid-2016) among externally mobile workers under 60, by work dynamics at the end of 2013; weighted data**

Organisational context		Job Activity				Total
		Conducive to IL	Partially conducive		Not conducive	
			Exchanges without autonomy	Autonomy without exchanges		
Favourable	Employment rate (%)	65	68	70	52	65
	(N)	*(91)*	*(176)*	*(164)*	*(133)*	*(564)*
Partially favourable	Employment rate (%)	42	76	81	56	64
	(N)	*(62)*	*(193)*	*(154)*	*(361)*	*(770)*
Unfavourable	Employment rate (%)	31	75	76	64	66
	(N)	*(30)*	*(55)*	*(71)*	*(156)*	*(312)*
Total	Employment rate (%)	50	72	75	58	65
	(N)	*(183)*	*(424)*	*(389)*	*(650)*	*(1,646)*

Reading Note: 65% of workers who, in 2015, were no longer employed by their December 2013 employer were employed in 2016; this applies to 65% of those who, in December 2013, were employed in an activity conducive to informal learning in a context that was favourable to informal learning.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

Table 4 describes the medium-term (mid-2016) situation. The first finding that helps to qualify the short-term impression is that a job activity not conducive to IL no longer appears to be associated with particularly high employment rates, whether or not the organisational context is favourable to IL. However, the lowest employment rates are still associated with IL-conducive activities: only 50% compared to 65% overall. This is mainly due to less IL-friendly contexts (employment rates of 42% or even 31%, Table 4). When broken down by work situation more or less conducive to IL, the highest employment rate (81%) is obtained for individuals who were engaged in an activity offering autonomy but lacking exchanges, and this in a context only partially favourable to IL. In a given context, partially IL-conducive activities are always associated with higher employment rates; among them, autonomous activities are associated with the highest employment rates. Work dynamics that seemed promising in terms of short-term employment (conducive activity in a partially favourable context, cf. Table 3) are associated in the medium term with the lowest employment rates (42%). Conversely, work activities with professional exchange but little autonomy associated with low employment rates in the short term appear among the most advantageous in the medium term (72%).

Thus, whether in the short or medium term, there is no simple association between work dynamics and the securing of external mobility: the most promising situations in terms of IL do not seem to provide any particular advantage, and sometimes they even seem to represent a handicap. This paradoxical result may, however, reflect strong compositional effects involving the usual determinants of individual employment probabilities. This is what we are now trying to clarify.

3. Econometric Analysis

The analysis consists in comparing the access to employment of individuals assigned to an IL-friendly work situation with that of other workers.This comparison would be unbiased if the assignment to IL-friendly positions was independent of the *ex ante* employment probability. This assumption is obviously doubtful: certain factors facilitating access to employment are probably involved in the assignment to an IL-friendly position as well. Workers participating in the tightest labour markets and/or presenting *ex ante* the least assets in the face of the selectivity of these markets may be over-represented in the best work dynamics: if access to formal training is selective precisely on the basis of criteria facilitating access to employment, perhaps the best work dynamics are, on the contrary, counter-selective. Assignment of these work dynamics could, for example, especially concern workers whom their employer considers needing to be tested. This would explain the previous paradox.

Another element that could bias the comparison is the focus on externally mobile workers. Being externally mobile is likely to have a different meaning depending on whether one is leaving a more or less IL-friendly position. For example, workers in positions that are not IL-friendly may be more likely to be searching for another job: this would determine both a greater propensity for external mobility and, where the case occurs, a faster return to employment. The bias is due to the fact that we are comparing workers with no job-seeking activity because they are assigned to a work situation that is IL-friendly with workers assigned to a position that is not IL-friendly and who are seeking another job.

In order to clarify the meaning of the descriptive results (cf. Tables 3 and 4), it is therefore first necessary to neutralise these potential composition effects. These can be identified by observed characteristics: it is therefore possible to neutralise these differences in characteristics that are known to be discriminating on the labour market; this is what is now being done using a regression analysis based on a quasi-saturated linear probability model (see Box and Online Appendix C1 – link at the end of the article).

This approach has two main advantages: it is non-parametric and the estimated coefficients are directly interpretable. It also allows for transparent consideration of sampling weights so that the proposed estimates are representative for the population of workers considered by the DEFIS data.

3.1. Apparent Effect of Work Dynamics for Externally Mobile Workers

What happens when effects of diploma-age-gender composition effects are neutralised? In terms of probability of employment and compared to the baseline, the least favourable situation for IL (non-conducive activity in an unfavourable context) does not result in any statistically significant disadvantage (Figure I; the results of the estimations are detailed in Tables A3-1 and A3-2 in Appendix 3). At the other end, whether in the short or medium term,

Box – **A quasi-saturated linear probability model**

The estimated equations are in the form:

$y_i^{2013+t} = \sum_{j=1}^{12} \rho_j \nu\left(sit_i^{2013} = j\right) + \sum_{k=1}^{6}\sum_{l=1}^{5}\sum_{m=1}^{2} \beta_{klm} \nu\left(dip_i = k\right) \nu\left(age_i = l\right) \nu\left(sex_i = m\right) + \varepsilon_i$, where:

y_i^{2013+t} the activity status of the individual i in $2013+t, t \in \{2;3\}$;

$\nu\left(sit_i^{2013} = j\right)$ an indicator that their working dynamics at the end of 2013 were of the type $j \in \{1,\ldots,12\}$.

The conditioning variables include the diploma (dip, with six possible values: no diploma or BEPC, CAP-BEP, baccalaureate, baccalaureate+2, baccalaureate+3/+4, baccalaureate+5/*Grandes écoles*), gender and age (with five possible values: under 25, 25-29, 30-39, 40-49, 50-59).

The differences are measured in relation to a baseline situation corresponding to the case of an externally mobile worker who, in 2013, had a job that was not conducive to IL in an organisational context that was partially favourable. These differences are calculated over two time horizons: the short term (activity status mid-2015) and the medium term (activity status mid-2016).

The models are estimated using weighted data. Although the differences in baseline probability between weighted and unweighted data indicate some under-sampling of individuals with a low risk of non-employment, the results obtained are qualitatively consistent (see Table A3-2 in Appendix 3).

Note that this quasi-saturated regression analysis is similar to propensity score matching (this point is highlighted in Online Appendix C1).

the best work dynamics (activity conducive to IL in a favourable context) brings no statistically significant advantage. For IL-conducive activities, the organisational context seems to make a difference. The absence of overlapping between the confidence intervals (see Figure I) shows that these differences are significant – this direct comparison amounts to a test of equality between estimated coefficients.

Contrary to what might be expected, although some of the estimates are imprecise, working in an IL-conducive job in an unfavourable IL context reduces the probability of employment: −18 percentage points in the short term (see Table A3-1) and −30 percentage points in the medium term (see Table A3-2). A work activity that is not IL-conducive in a context that is at least partly IL-friendly is better than an IL-friendly activity in an unfavourable context. The only case of an activity conducive to IL that provides a significant advantage for the external mobility worker corresponds, in the short-term, to contexts that are only partly IL-friendly; however, the benefit is not stable in the medium term (see Figure I).

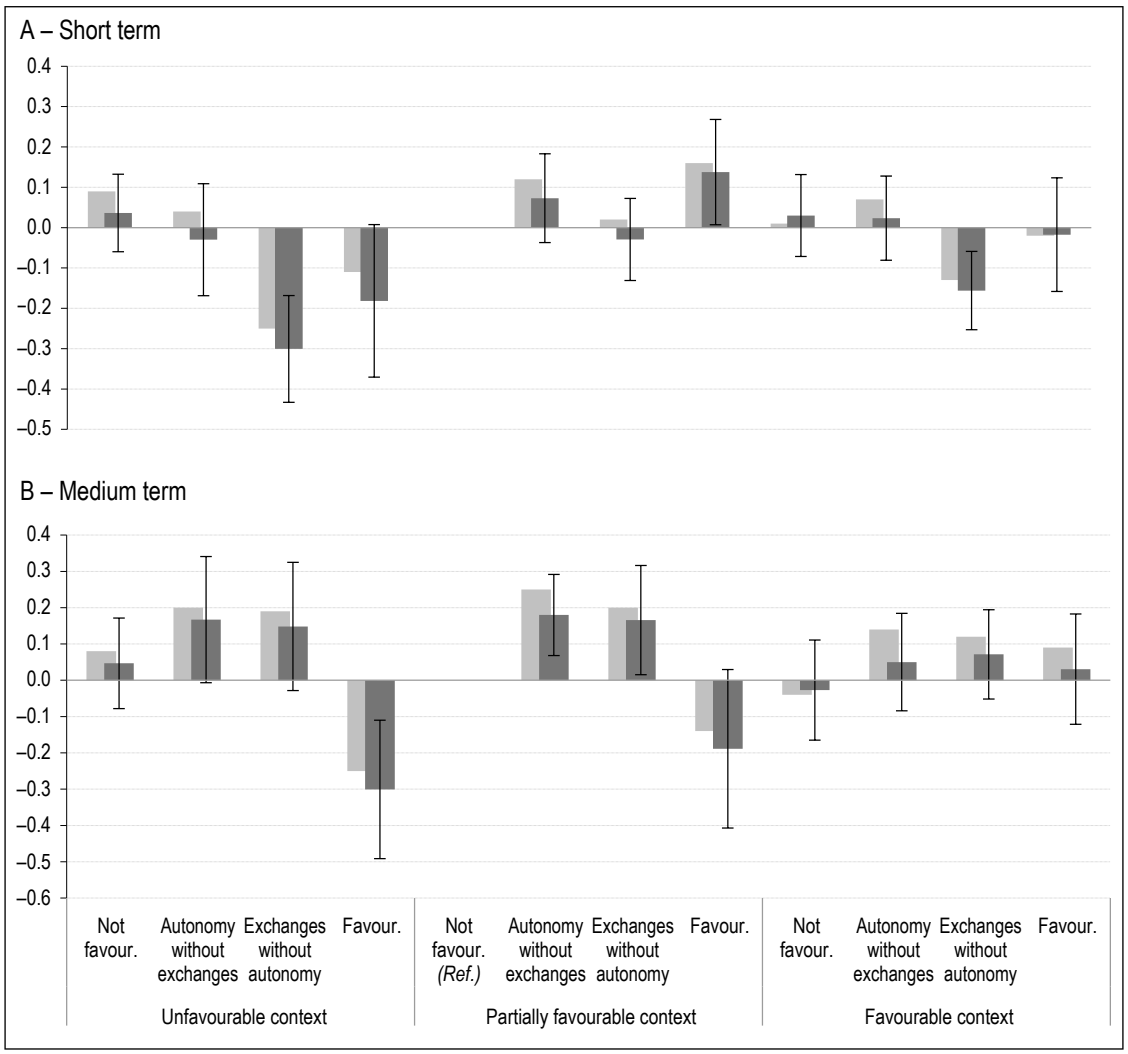
In the short term, the apparent effect of activities that are partially conducive to IL (autonomy without exchanges or exchanges without autonomy) is mixed (see Figure I and Table A3-1 in Appendix 3): situations of exchanges without autonomy may involve a very marked handicap (in a context that is favourable or unfavourable to IL), which is not the case for situations of autonomy without exchanges. In the medium term, however, the probability of employment is much higher in both cases (although imprecisely measured, see Figure I and Table A3-2).

Taking into account the chosen (rather than endured) character of mobility brings a first perspective[4] on the previous results. For a given combination of conditioning variables, workers leaving an activity conducive to IL in a context that is only partially favourable are much more likely than the baseline to initiate their mobility (see Table A3-1). In the short term, this mobility is indeed accompanied by an exceptionally high and often full-time employment probability for an IL-friendly activity (see Table A3-2).

Considering other outcomes (full-time employment, permanent employment, unemployment) provides useful supplements to the analysis (see Tables A3-1 and A3-2). In particular, the lesser probability of access to employment frequently associated with IL-conducive activities does not seem to be offset by better quality of employment (full-time or permanent); the two aspects tend to go hand in hand. In the short term, for example, the lower probability of employment from situations combining cognitive processes and exchanges without autonomy in unfavourable contexts is coupled with a significantly lower probability of full-time employment and especially of permanent employment.

4. *We will come back to this point later.*

Figure I – **Apparent effect on the probability of employment of work situations more or less favourable to informal learning. Quasi-saturated linear probability model, OLS estimates on weighted data***



* Gross differences are reprensented in light grey.
Notes: Confidence intervals at the 90% level, robust (heteroscedasticity). The weighting applied for 2016 corrects for attrition.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

Overall, even if statistical significance is not always achieved, situations of autonomy without exchanges appear to be associated with the most satisfactory results: mobility more often chosen from organisational contexts that are partially favourable to IL, better probabilities of employment (both in the short and medium term), sometimes of better quality.

Compared to the baseline (activity not conducive to IL in a partially favourable context), the positive (respectively, negative) gross differences in employment rate overestimate (resp. underestimate) the apparent positive (resp. negative) effect of the work situations concerned. This means that a selection on observable variables takes place, implying an over-representation of diploma-age-gender characteristics favourable to access to employment in situations other than the baseline. The selection effect on observable variables appears particularly strong in situations of autonomy without exchanges: in the short and medium term, in a context favourable to IL, more than half of the employment rate advantage associated with these situations is that they relate to individuals with diploma-age-gender characteristics that in themselves are favourable to access to employment. Considering the case of IL-conducive activities helps to answer the question of their possible counter-selectivity. Compared to the baseline, there is an over-representation of individual characteristics favourable to employment. The initial paradox is therefore not removed.

One hypothesis is that IL is difficult to value in the labour market because it is not "visible" to employers, as opposed to formal training or

skills certification. It is therefore interesting to consider the relationship between work dynamics and possible training or certification steps, which may have taken place between early 2014 and mid-2015, after the departure from the initial company. Table A3-1 in Appendix shows that, for a given combination of conditioning variables, working in an activity conducive to IL is associated with a more frequent passage through "transitional" training[5] than the baseline: the effect is very strong in an unfavourable context, less so as it becomes more favourable.[6] The training undertaken between early 2014 and mid-2015 therefore appears to have no added value in terms of access to employment. In an organisational context partially favourable to IL, situations of exchange without autonomy are also associated with a significantly more frequent passage through transitional training, but this time it seems to pay off in the medium term as regards employment. As for situations of autonomy without exchanges, they are more often associated with chosen mobility in organisational contexts that are partially favourable to IL, with more passages through transitional training in favourable contexts and with more certification in partially favourable contexts. And this time, the training or certification stage seems to have added value, especially in the medium term.

At this point, however, we can question the scope of our conditioning variables (even with a quasi-saturated specification). To examine the sensitivity of the apparent effects estimated above, additional conditioning are introduced describing the social origin of the employees and the characteristics of their initial company; this removes the non-parametric character of the quasi-saturated approach but allows the addition of conditioning variables without abusing the number of parameters to be considered. This analysis, presented in the Online Appendix C1-4, shows that the consideration of these additional dimensions only marginally alters the apparent effects measured previously. The only exception is the medium term effect of the passage through an unfavourable context for IL and a work activity that provides opportunities for exchange but without autonomy. The social origins favourable to access to employment are over-represented and constitute the bulk of the advantage that this work dynamics seemed to bring in the medium term. This is the only clear challenge to the apparent effect measured from the initial quasi-saturated model.

All in all, the regression analysis does not call into question the general impression gained from Table 3 and 4. In particular, IL-friendly activities do not appear to confer any lasting benefits on externally mobile workers. Exchange situations without autonomy appear to be penalising in the short term without significant influence in the medium term. Finally, autonomous situations without exchanges provide a very clear advantage in the medium term.

3.2. The Dominant Role of Work Activity

Figure I suggests that the bulk of the variation in apparent effects is due to work activities rather than organisational contexts. The results of adjustments using the same specifications as above, but considering in isolated fashion the influence of the type of context and that of the type of work activity, confirm the predominant role of the work activity (see Appendix 3, Table A3-4). The influence of the organisational context is never statistically significant, regardless of the outcome variable (employment or unemployment) or the time scale (short or medium term). On the contrary, there are several significant links between the more or less IL-friendly type of activity and the risk of non-employment or unemployment, particularly in the medium term. This could indicate that it is less the general structuring of collective work than the work activity itself that favours the development of skills. As introducing only one of the two dimensions allows for more precise estimates, the rest of the analysis is conducted at the work activity level only.

The results thus raise unexpected questions about the influence of IL situations. How can engaging in an activity that facilitates cognitive processes, exchanges and autonomy provide no employment advantage? The comparison of the apparent effect of autonomy without exchanges or exchanges without autonomy adds to the perplexity: how can the combination of autonomy and exchanges be detrimental when each aspect taken separately seems (at least in the medium term) to have a positive effect on access to employment? An analysis of the circumstances of mobility and the possibility that the individuals may have gone through training or a skills certification stage may help to explain this.

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5. That is, completed in mid-2015.

6. If we take the fact of being in training in mid-2015 as an outcome variable (results not reported), it turns out, however, that engaging in an activity conducive to IL confers no advantage (within a context that is unfavourable to IL) or even represents a significant handicap (in a context that is at least partially favourable): compared to a basic probability of being in training or returning to school in mid-2015 of 15%, activities conducive to IL are associated with an 8 percentage point drop in a context that is only partially favourable, and even a 12 percentage point drop in a favourable context.

3.3. Circumstances of Mobility, Transitional Training and Certification of Skills

The aim here is to look again at the possible effect of other dimensions likely to influence the probability of subsequent employment: the chosen (rather than involuntary) nature of external mobility; and having gone through transitional training or a certification process (accreditation of prior experiential learning or APEL) between the beginning of 2014 and mid-2015. As the results presented in Table A3-1 (first three columns) suggest, these dimensions are likely to be endogenous, i.e. they are themselves influenced by the variable of interest (i.e. whether the work activity is more or less conducive to IL). The interaction between the apparent effects of the work activity and each of these dimensions is studied to take this into account.

3.3.1. Chosen or Involuntary External Mobility

Two variables are available to describe the circumstances of mobility. One describes the reason for leaving the initial job: resignation (26% of cases), redundancy (15%), contract termination (31%) or "other reasons" (28%). The other indicates whether the mobility was chosen by the worker (59% of cases) or involuntary. However, the two variables are closely related: 96% of resignations were voluntary, 86% of redundancies were involuntary, 56% of contract terminations were involuntary and 36% were for "other reasons". The apparent effect of work activities that are more or less conducive to IL is therefore studied by simply distinguishing between the chosen and unchosen nature of the initial job termination.

As expected, the fact that mobility is chosen by the worker leads in the short term to a significantly higher probability of employment, in the order of 20 percentage points (Figure II). The advantage, however, is hardly significant for workers in situations of exchange without autonomy. In addition, given the choice of mobility, there is no significant benefit in either the short or medium term from working in an IL-conducive (rather than non-IL-conducive) activity. As far as involuntary mobility is concerned, activities conducive to IL even prove to be a handicap compared with those that are not: the probability of employment with given conditioning variables would be reduced by about 20 percentage points in the short or medium term.

3.3.2. Transitional Training or Certification

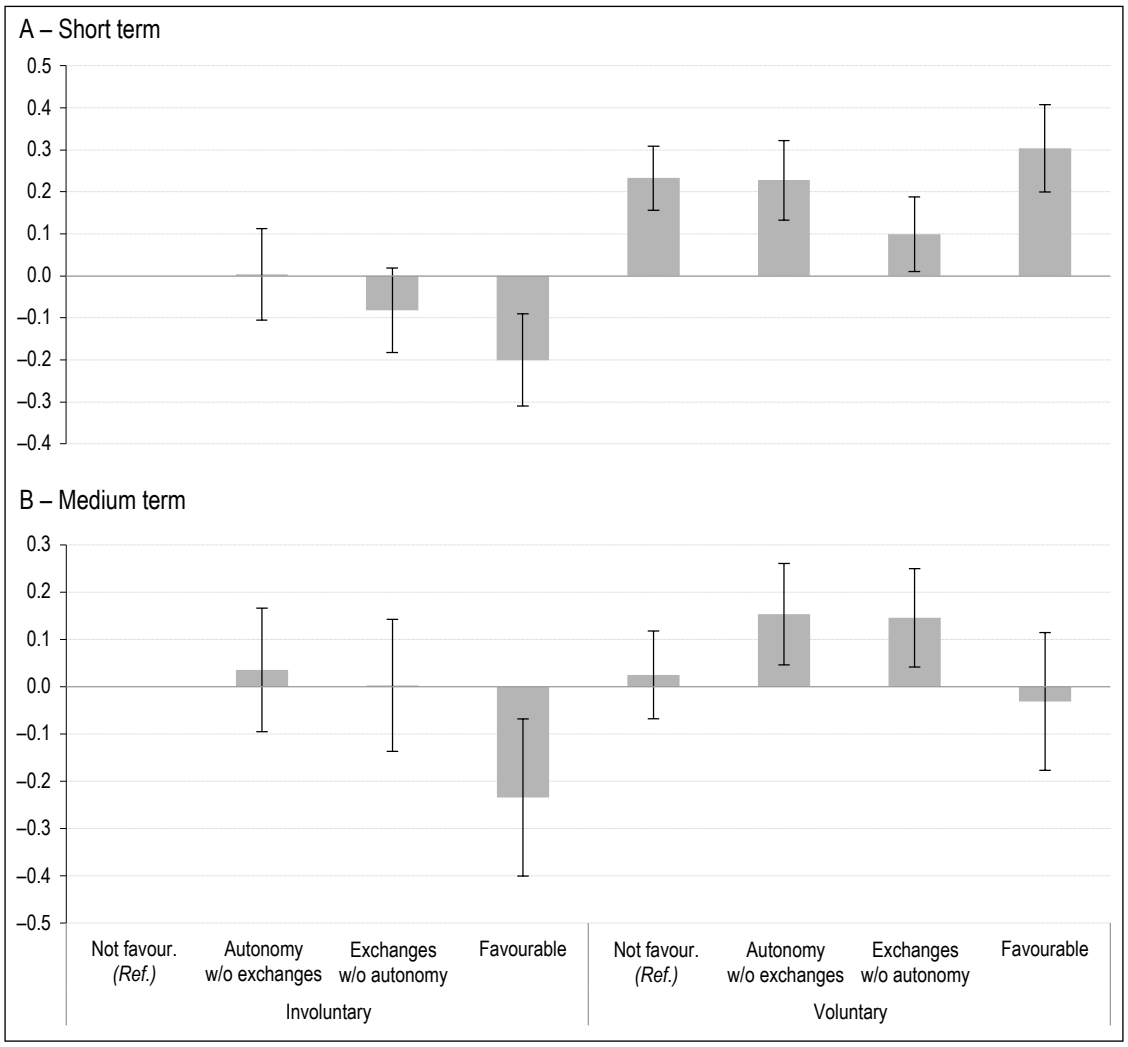
Does the apparent effect of more or less IL-conducive work activities vary depending on whether or not workers underwent training between early 2014 and mid-2015? In the short term, there is no significant difference in the probability of employment for those who went through training (Figure III). For the others, we observe a lower probability of employment associated with the initial situations of exchanges without autonomy compared to the non-conducive situations. In the medium term, having undergone training results in a virtual levelling of the probabilities of employment depending on the initial work situation. In the absence of training, situations of autonomy without exchange or exchange without autonomy seem to be favourable, but paradoxically this is not the case for the activities considered to be the most conducive to IL. This examination of the apparent effect of work situations with or without training confirms the general impression of a "premium", in terms of probability of employment, for situations of autonomy without exchanges.

What about taking into account a skills certification process such as the accreditation of prior experiential learning (APEL[7])? From the perspective of signal theory (Spence, 1973), this should improve the outcome of IL-favourable situations by making visible the skills acquired outside of training. Is this the case? The answer is quite different depending on whether one considers the short or the medium term (Figure IV).

In the short term, one of the most advantageous situations in terms of probability of employment is paradoxically the pursuit of a non-IL-conducive activity without recourse to APEL. The use of APEL appears to significantly reduce the chances of access to employment, particularly for those who had engaged in IL-conducive activity. The impression is radically different in the medium term for jobs are partially conducive to IL. This time, it is in the presence of APEL that we observe a (significant) increase in access to employment, particularly for exchange situations without autonomy, as APEL seems to offset the lower probability of employment (cf. Table A3-4 in Appendix 3). One possible interpretation of the differences observed between the short and medium term is that the APEL process takes time and only has a tangible impact in the medium term. There remains, however, another paradoxical case: that of work activities conducive to

7. The APEL system allows any person to obtain a full diploma or degree thanks to their professional experience, whether this experience was acquired through salaried, non-salaried or voluntary activities. APEL applies to all diplomas and degrees for professional purposes offered by the various certifying bodies (ministries, professional branches) as long as the certificates in question are registered in a National directory of professional certifications.

Figure II – **Apparent effect on the probability of employment of work activities more or less conducive to informal learning according to the voluntary or involuntary nature of external mobility. Linear probability model, OLS estimates on weighted data**



Notes: The measures of apparent effect proposed here are obtained by adjusting for the individual characteristics of the worker (59 indicators), their social origin (24 indicators) and the characteristics of their initial company (47 indicators). The baseline here is involuntary mobility from a non-IL conducive activity. The confidence intervals depicted are at the 90% level, and are robust (heteroscedasticity). The weighting applied for 2016 corrects for attrition.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

IL, which do not seem to be associated with any gain in terms of the probability of employment in either the short or medium term.

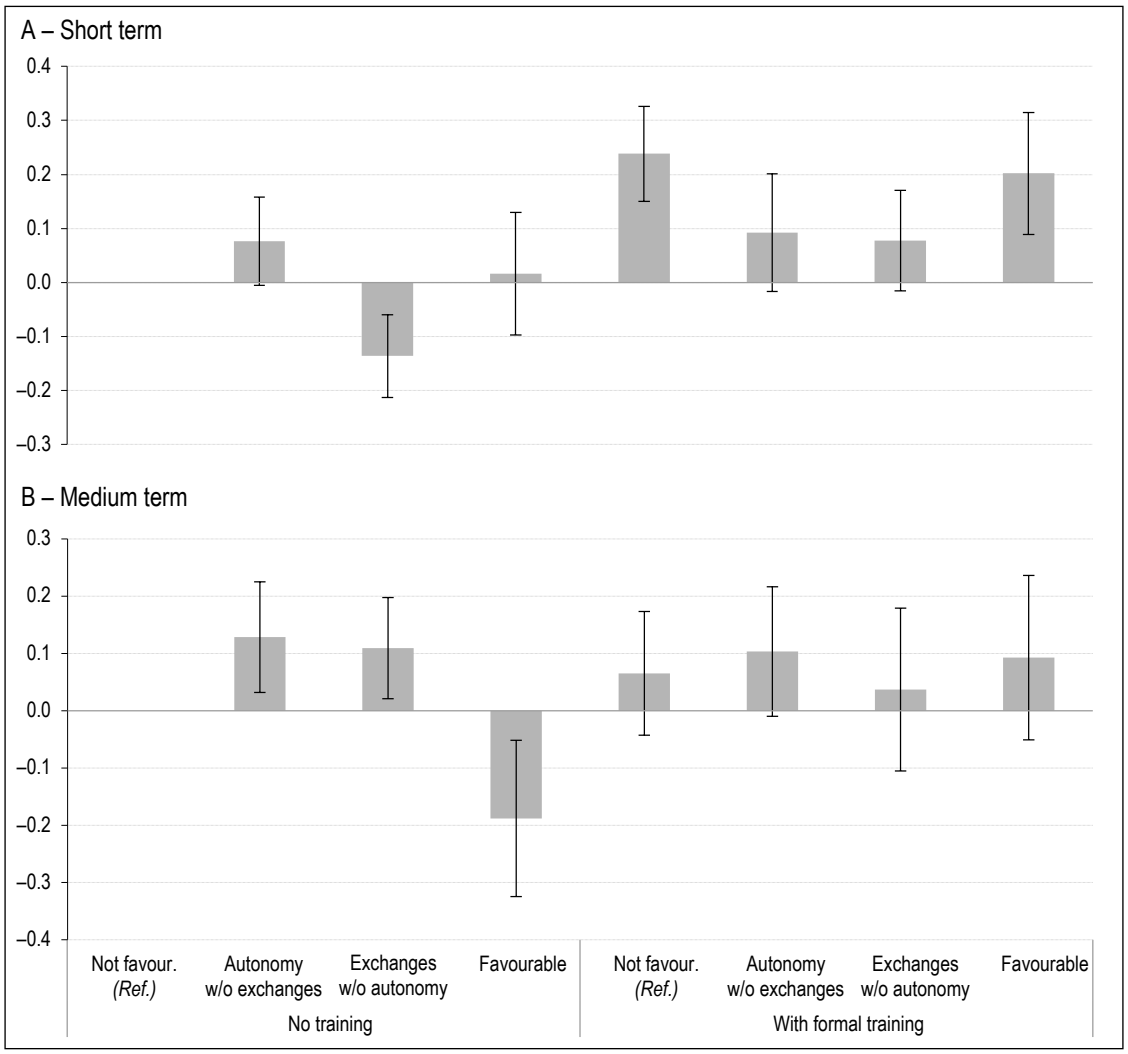
3.4. Analysis by Instrumental Variables

While the analysis of the role of the circumstances of external mobility puts the results obtained above into perspective, it does not allow us to appreciate the causal significance of the regression analysis. The results obtained may still be due to compositional effects, but this time in dimensions omitted until now. There are variables whose importance is not considered and others that simply remain unobserved in the DEFIS; workers assigned to the different work dynamics can be selected according to criteria that are not captured by the conditioning variables introduced.

This risk is examined using a complementary instrumental variable analysis for a sample of externally mobile workers who at the end of 2013 were in a company where at least one other surveyed employee remained with the same employer (see Online Appendix C4). This approach makes it possible to diagnose the endogenous nature of the assignment of externally mobile workers to a work activity that is more or less conducive to IL.

The tests conducted do not reject the hypothesis of exogeneity of the assignment: the assumption of conditional independence is not rejected and the OLS estimation provides coefficients that

Figure III – **Apparent effect on the probability of employment of work activities more or less conducive to informal learning depending on completion of transitional training. Linear probability model, OLS estimates on weighted data**



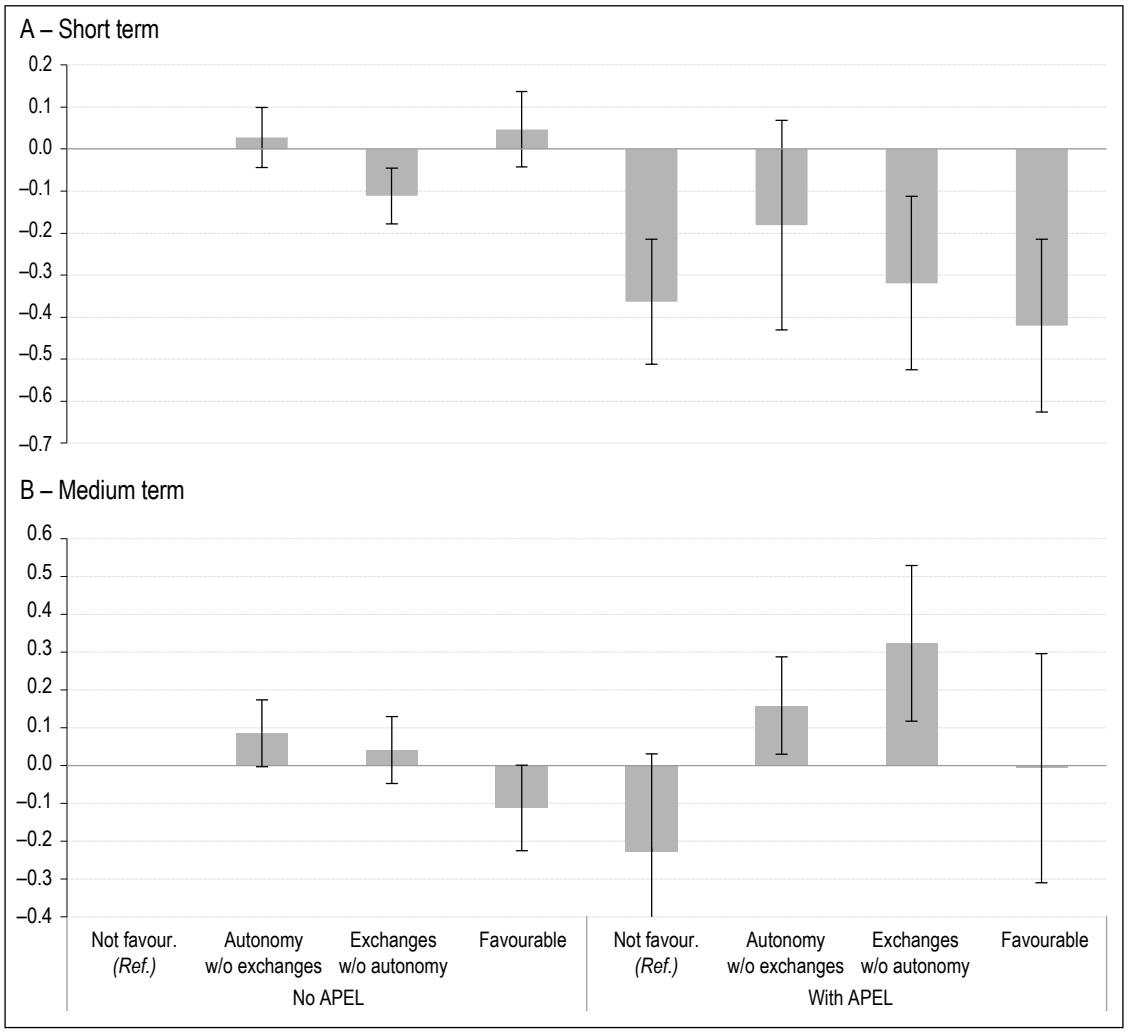
Notes: cf. Figure II.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

admit a causal interpretation. Only the assignment to the activities most conducive to IL (cognitive processes + exchanges + autonomy) remains somewhat ambiguous: there are tenuous indications that it may be counter-selective in an omitted dimension; in other words, it would over-represent workers who have *ex ante* fewer assets in the face of labour market demands. Ultimately, only work activities combining cognitive processes and autonomy without exchanges appear to have a potential for securing career paths for mobile workers, a potential that is fairly strong in the medium term, albeit measured in an imprecise manner.

* *
*

In this study, the probability of employment of externally mobile individuals was estimated based on the learning potential of their initial work situation. In both the short and medium term, the organisational context does not seem to play a decisive role. The statistically significant relationships are more likely to be found in the work activity and appear to be counter-intuitive. The only advantageous situation corresponds to a work activity combining cognitive processes and autonomy without exchanges; the activities most conducive to IL, which combine the three aspects, do not provide any advantage in terms of access to employment. The significance of this outcome is questioned by attempting to neutralise the comparison biases that may occur. Regression analysis shows that, in terms of observed characteristics, the assignment to activities conducive to IL is not particularly

Figure IV – **Apparent effect of work activity on the probability of employment of externally mobile individuals according to their use of skills certification (APEL). OLS estimates on weighted data**



Notes: cf. Figure II.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector, excluding retirees and early retirees.

counter-selective, i.e. reserved for profiles that are less well-endowed in terms of labour market requirements. The risk remains that workers assigned to the most IL-friendly jobs will differ from others in an omitted (unobserved) dimension that negatively influences access to employment. An instrumental variable approach makes it possible, under the same conditioning variables, to conclude that assignment to activities that are partially conducive to IL is exogenous: the comparison with workers assigned to a non-conducive activity would therefore not be biased. Activities combining cognitive processes and autonomy statistically significantly reduce the risk of unemployment in the medium term for externally mobile people.

This result raises the question of how a work activity that adds an IL element (professional exchanges) can be less beneficial. One explanation could be as follows. While the conducive activities allow for the development of skills, they also facilitate the evaluation of the worker: autonomous situations have a testing dimension, professional exchanges have a control dimension. In the case of external mobility, one might imagine that the experience of a situation combining autonomy and exchanges represented a test whose outcome may have proved unfavourable to the worker, particularly in the case of involuntary mobility. The return on the extra skills would then, in the medium term, be inhibited by a disappointing test outcome. The possibility that the assignment to these situations is counter-selective (in a dimension omitted from the list of selected conditioning variables) is consistent with this interpretation: testing would occur in the case of workers who are *ex ante* less well-prepared for the demands of the labour market. Activities combining cognitive processes and exchanges without

autonomy would be those of workers exempt from testing. Only work activities combining cognitive processes and autonomy without exchanges would offer an opportunity for skills development without evaluative intent on the part of the employer, perhaps revealing more confidence in the employee's qualities.

A look back at the study by Fournier *et al.* (2017a) feeds into this interpretation when considering variable by variable what contrasts activities offering cognitive processes and autonomy without exchanges to others (Fournier *et al.*, 2017c, p. 6). 72% of workers in such an activity state that their work is only sometimes or never controlled (50% for all workers), 9% state that they are assigned numerical targets (46% for all workers) and 40% state that they are evaluated (69% among workers in an activity combining cognitive processes, exchanges and autonomy and 72% in an activity with cognitive processes and exchanges without autonomy). Professional exchanges are therefore often associated in practice with a control dimension of the work activity. The advantage associated, for externally mobile workers, with activities combining cognitive processes and autonomy without exchanges could thus be due to the enabling environment of these work situations. This would translate into an increased ability to initiate mobility or certification of prior learning (in organisational contexts that are partially favourable to IL) or to undertake transitional training (in contexts that are favourable to IL). Conversely, in the context of external mobility, a situation combining autonomy and exchanges would more often refer to a trial period whose outcome may have been disappointing. Mobility would then concern workers with a diminished perception of their competence, which would make them vulnerable on the labour market. This ambivalence of professional exchanges would be consistent with certain results of van der Heijden *et al.* (2009), who observe in particular the absence of a statistical association between the intensity of exchanges with the hierarchy and the main dimensions of the feeling of employability (quality of expertise, anticipation, efficiency and adaptability). It could also refer to a learning condition readily invoked by professional didactics (Mayen & Gagneur, 2017): the right to make mistakes. □

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6472321/ES532-33_Baguelin-Fretel_Annexe-en-ligne_Online-Appendix.pdf

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APPENDIX 1

THE FOURNIER, LAMBERT AND MARION-VERNOUX TYPOLOGY

Fournier *et al.* (2017b, 2017c) conduct two separate factor-based multiple correspondence analyses (MCA): one, based on the DEFIS company component, to describe the variety of organisational contexts; the second, based on the employee component, to describe the variety of work activities. Typologies are then obtained from hierarchical bottom-up classifications and aggregation around moving centres, giving three organisational context classes and four work activity classes. The concept of work dynamics put forward by Fournier *et al.* (2017b) allows for all combinations of activity × context categories.

The MCA conducted on company data uses twelve active variables to generate a space of more or less favourable contexts for IL, and the MCA on employee data uses nineteen active variables (Table A1).

The structure of the space generated from company-level data can be described in six main axes that Fournier *et al.* interpret as management factors: decompartmentalising work, creating links between the different jobs, broadening the scope of action (main correlates: variables 1 and 2); encouraging dialogue and information sharing in the work and on training (variable 3); encouraging reflection on practice in the light of contingencies or events encountered (variables 4, 5 and 6); encouraging the ability to pass on and explain one's professional competence (variables 7, 8 and 9); encouraging individual commitment through management practices that value the collective (variables 10 and 11); providing prospects for development, mobility (variable 12). Contexts that are favourable to IL involve all six of the identified factors; contexts that are partially favourable involve only three of the six factors (dialogue and sharing of information, transmission of skills and development prospects); unfavourable contexts involve none.

The structure of the space generated by the variables at employee level is described in three main axes: the work is a place of exchange and discussion of know-how and professional practices (main correlates: variables 1 to 6); the work situation calls for and activates cognitive processes (variables 7, 8, 10 to 13); the work allows autonomy and initiative (variables 14 to 18). This results in four classes: activities conducive to IL that involve all three dimensions (cognitive processes, exchanges and autonomy); activities that combine cognitive processes and exchanges but without autonomy; activities that combine cognitive processes and autonomy but without exchanges; and non-conducive activities that do not involve any of the three dimensions.

Table A1 – **MCA Variables**

Context	Activity
(1) The company uses autonomous work groups	(1) Works in a team
(2) It allows employees to control their own work	(2) Holds several job positions
(3) It has analysed the qualification or skill needs of staff	(3) Attends meetings
(4) It has formalised methods for solving problems	(4) Has been taught by a colleague how to do the job
(5) It has an approach to standardising work processes and methods	(5) Has taught to colleagues
(6) It attaches importance to novelty, innovation or has benefited from the research tax credit	(6) Has to go to trade fairs, conferences, meetings
(7) It takes on apprentices	(7) Non-repetitive actions
(8) It formally identifies employees as trainers or tutors	(8) Uses a computer
(9) It organises on-the-job training or training by task rotation	(9) Uses a machine or device
(10) It attaches importance to reputation, tradition and the brand	(10) Has to follow quality procedures
(11) It implements a wage incentive policy based on collective performance	(11) Contact with the public
(12) It provides training to encourage mobility, provides information on training and discusses the issues of mobility, changes in work content and skills enhancement during interviews	(12) Work involves reading, writing
	(13) Speaks a foreign language
	(14) Work is occasionally or never controlled
	(15) Possibility of deciding on hours
	(16) Possibility of measuring results of work, has numerical targets
	(17) Possibility of changing targets
	(18) Is evaluated
	(19) Executive engineer

APPENDIX 2

DESCRIPTIVE STATISTICS FOR SHORT AND MEDIUM TERM SAMPLES

Table A2-1 – **Individual characteristics of externally mobile workers**

	Unweighted frequencies (%)		Equality of proportions test
	2015	2016	
Gender			
Male	58.3	58.3	n.s.
Female	41.7	41.7	n.s.
Age			
<20	6.6	5.8	n.s.
20-24	23.5	21.7	n.s.
25-29	16.7	16.0	n.s.
30-34	12.2	11.4	n.s.
35-39	9.7	10.1	n.s.
40-44	10.3	11.4	n.s.
45-49	8.7	10.2	0.1
50-54	6.9	7.6	n.s.
55-59	5.5	5.7	n.s.
Level of education			
No qualification (or primary school certificate)	6.7	6.6	n.s.
Certificate of general education, *Brevet des collèges*), BEPC (secondary school leaving certificate)	4.0	4.1	n.s.
CAP vocational qualification, BEP or diploma of this level	21.8	20.2	n.s.
General or technological baccalaureate	9.6	9.4	n.s.
Professional baccalaureate or diploma of this level	11.2	10.3	n.s.
Baccalaureate+2 (DEUG, BTS, DUT)	16.0	15.7	n.s.
Baccalaureate+3 (general or professional diploma)	9.6	10.3	n.s.
Baccalaureate+4 (Maitrise, Master 1)	5.5	5.9	n.s.
Baccalaureate+5 (DESS, DEA. Master 2)	11.2	12.5	n.s.
Grande école, engineering school, doctorate	4.4	4.9	n.s.
Father's socio-professional group (at the individual's 16th birthday)			
Self-employed	14.4	13.9	n.s.
Executive or middle management	26.4	27.8	n.s.
White-collar worker	20.7	19.1	n.s.
Blue-collar worker	27.2	28.4	n.s.
Unemployed or retired	11.3	10.8	n.s.
Mother's socio-professional group (at the individual's 16th birthday)			
Self-employed	6.1	6.2	n.s.
Executive or middle management	13.0	13.1	n.s.
White-collar worker	35.5	35.0	n.s.
Blue-collar worker	11.5	12.0	n.s.
Unemployed or retired	33.8	33.8	n.s.
Sample size	2,761	1,646	

Notes: n.s. for non-significant differences at the 1% level.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees.

Table A2-2 – **Characteristics of employers in 2013**

	Unweighted frequencies (%)		Equality of proportions test
	2015	2016	
Total workforce of the employer/company at the end of 2013			
10 to 19 employees	12.9	13.5	n.s.
20 to 49 employees	19. 6	19.0	n.s.
50 to 249 employees	22.8	22.8	n.s.
250 to 499 employees	7.4	7.2	n.s.
500 to 999 employees	7.9	8.3	n.s.
1000 to 1999 employees	8.0	8.5	n.s.
2000+ employees	21.4	20.7	n.s.
Sector used in the sample draw (15 classes)			
C3 - Manufacture of electrical, electronic and IT equipment and machinery	1.8	2.4	n.s.
C4 - Manufacture of transport equipment	1.3	1.1	n.s.
C5 - Manufacture of other industrial products	7.1	7.3	n.s.
CR - Manufacture of food, beverages and tobacco products, coking and refining	3.7	3.7	n.s.
DE - Mining and quarrying, energy, water, waste management and remediation industries	1.0	0.9	n.s.
FZ - Construction	6.6	6.1	n.s.
GZ - Motor vehicle and motorcycle trade and repair industry	22.4	21.2	n.s.
HZ - Transport and storage	5.3	5.4	n.s.
IZ - Hospitality	7.9	7.0	n.s.
JZ - Information and communication services	5.5	6.0	n.s.
KZ - Financial and insurance activities	2.1	1.9	n.s.
LZ - Property activities	0.9	1.0	n.s.
MN - Specialist scientific and technical activities and administrative and support service activities	25.9	27.9	n.s.
OQ - Public administration, education, human health and social work	5.9	5.3	n.s.
RU - Other service activities	2.7	2.6	n.s.
Reason for discontinuation of the employment contract at the end of 2013			
Resignation	26.7	26.7	n.s.
Contract termination	31.0	30.2	n.s.
Redundancy	14.6	14.8	n.s.
Other employment contract terminations	16.3	17.0	n.s.
Other cases	9.7	9.6	n.s.
Do not know	1.6	1.6	n.s.
Sample size	2,761	1,646	

Notes: n.s. for non-significant difference at the 1% level.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees.

The equality of proportions tests show that the short and medium term samples are essentially similar so that the differences in effects measured in the short and medium term do indeed have economic significance.

APPENDIX 3

DETAILED RESULTS OF OLS ESTIMATES

Table A3-1 – **Apparent effect of work situations more or less favourable to informal learning on various short term outcomes. Short term sample (*N*=2,761) quasi-saturated linear probability model, OLS estimates, weighted data**

	Voluntary mobility	Training or certification stage (between 2014 and mid-2015)		Short term activity status (2015)	
		Training	APEL	Employment	Unemployment
Baseline probability#	0.378 ***	0.213	0.050	0.418 ***	0.399 ***
	(0.127)	(0.112)	(0.043)	(0.151)	(0.135)
Context unfavourable to informal learning					
Non-conducive activity	0.009	−0.020	−0.012	0.036	−0.012
	(0.064)	(0.050)	(0.023)	(0.058)	(0.052)
Autonomy w/o exchanges	−0.109	0.098	0.015	−0.030	−0.023
	(0.086)	(0.079)	(0.030)	(0.084)	(0.077)
Exchanges w/o autonomy	−0.009	0.085	−0.029	−0.300 ***	0.302 ***
	(0.093)	(0.089)	(0.031)	(0.080)	(0.086)
Conducive activity	0.077	0.229 *	0.016	−0.182	0.132
	(0.106)	(0.118)	(0.029)	(0.115)	(0.114)
Context partially favourable to informal learning					
Non-conducive activity	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Autonomy w/o exchanges	0.162 ***	0.111	0.123 **	0.073	−0.057
	(0.052)	(0.070)	(0.056)	(0.067)	(0.061)
Exchanges w/o autonomy	−0.123 **	0.131 **	0.049	−0.029	0.006
	(0.060)	(0.057)	(0.035)	(0.062)	(0.055)
Conducive activity	0.221 ***	0.117 *	0.007	0.138 *	−0.048
	(0.059)	(0.067)	(0.041)	(0.079)	(0.069)
Context favourable to informal learning					
Non-conducive activity	0.008	−0.043	−0.001	0.030	0.004
	(0.061)	(0.052)	(0.020)	(0.062)	(0.060)
Autonomy w/o exchanges	−0.027	0.111 *	0.026	0.024	−0.041
	(0.063)	(0.060)	(0.025)	(0.063)	(0.060)
Exchanges w/o autonomy	0.047	0.096 *	0.047 *	−0.156 ***	0.129 **
	(0.055)	(0.053)	(0.026)	(0.059)	(0.055)
Conducive activity	0.004	0.039	0.049	−0.017	0.053
	(0.071)	(0.069)	(0.043)	(0.086)	(0.075)
Conditioning variables	Gender × age × education (× 59)				
R^2	0.14	0.12	0.10	0.13	0.15
R^2 adjusted	0.12	0.10	0.08	0.10	0.13

Notes: The baseline is a male under 25 years of age with a BEPC or lower. The standard deviations in brackets are robust (heteroscedasticity). The weighting applied for 2016 corrects for attrition.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector.

Table A3-2 – **Apparent effect of work situations more or less favourable to informal learning – Variants, robustness checks and medium term. Quasi-saturated linear probability model, OLS estimates, weighted data (unless otherwise indicated)**

	Employment status in the short term (2015 – *N*=2,761)			Unweighted data (2015)	Medium term activity status (2016 – *N*=1,646)	
	Employment	Full-time	Permanent	Employment	Employment	Unemployment
Baseline probability	0.418 ***	0.300 *	0.183	0.314 ***	0.734 ***	0.227
	(0.151)	(0.158)	(0.165)	(0.081)	(0.139)	(0.138)
Context unfavourable to informal learning						
Non-conducive activity	0.036	−0.007	0.064	−0.007	0.047	−0.036
	(0.058)	(0.058)	(0.059)	(0.035)	(0.076)	(0.071)
Autonomy w/o exchanges	−0.030	0.021	0.020	0.044	0.167	−0.179 **
	(0.084)	(0.080)	(0.081)	(0.051)	(0.106)	(0.075)
Exchanges w/o autonomy	−0.300 ***	−0.213 ***	−0.209 ***	−0.098 *	0.148	−0.157 *
	(0.080)	(0.069)	(0.064)	(0.058)	(0.107)	(0.094)
Conducive activity	−0.182	−0.063	0.000	−0.134 *	−0.301 ***	0.172
	(0.115)	(0.123)	(0.123)	(0.075)	(0.116)	(0.166)
Context partially favourable to informal learning						
Non-conducive activity	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Autonomy w/o exchanges	0.073	0.161 **	0.108 **	0.078 **	0.180 ***	−0.173 ***
	(0.067)	(0.065)	(0.062)	(0.038)	(0.068)	(0.058)
Exchanges w/o autonomy	−0.029	0.024	−0.010	0.011	0.166 *	−0.157 *
	(0.062)	(0.061)	(0.054)	(0.033)	(0.091)	(0.089)
Conducive activity	0.138 *	0.196 **	0.048	−0.001	−0.189	0.208
	(0.079)	(0.085)	(0.072)	(0.050)	(0.133)	(0.132)
Context favourable to informal learning						
Non-conducive activity	0.030	0.058	0.023	−0.011	−0.027	0.024
	(0.062)	(0.061)	(0.051)	(0.037)	(0.084)	(0.079)
Autonomy w/o exchanges	0.024	0.018	0.060	0.082 **	0.050	−0.142 **
	(0.063)	(0.064)	(0.062)	(0.038)	(0.082)	(0.065)
Exchanges w/o autonomy	−0.156 ***	−0.079	−0.058	−0.066 *	0.071	−0.017
	(0.059)	(0.052)	(0.052)	(0.035)	(0.075)	(0.070)
Conducive activity	−0.017	−0.016	−0.059	0.065	0.031	0.057
	(0.086)	(0.079)	(0.070)	(0.048)	(0.092)	(0.086)
Conditioning variables	Gender × age × education (× 59)					
R^2	0.13	0.12	0.13	0.075	0.17	0.19
R^2 adjusted	0.10	0.10	0.11	0.051	0.13	0.16

Notes: The standard deviations in brackets are robust (heteroscedasticity). The weighting applied for 2016 corrects for attrition.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector.

Table A3-3 – **Apparent effect of work situations more or less favourable to informal learning – robustness to the addition of supplementary conditioning variables. Short term sample (*N*=2,761). Linear probability model, OLS estimates, weighted data**

	Voluntary mobility	Training or certification stage (2014-2015)		Short term activity status (2015)	
		Training	APEL	Employment	Unemployment
Baseline probability	0.546 ***	0.104	0.020	0.250	0.558 ***
	(0.152)	(0.133)	(0.068)	(0.158)	(0.160)
Context unfavourable to informal learning					
Non-conducive activity	−0.019	0.007	0.016	0.046	−0.039
	(0.055)	(0.049)	(0.025)	(0.055)	(0.049)
Autonomy w/o exchanges	−0.123	0.111	0.033	−0.016	−0.053
	(0.079)	(0.074)	(0.034)	(0.086)	(0.076)
Exchanges w/o autonomy	0.008	0.097	0.002	−0.264 ***	0.256 ***
	(0.085)	(0.077)	(0.028)	(0.074)	(0.085)
Conducive activity	0.057	0.236 *	0.022	−0.158	0.097
	(0.112)	(0.125)	(0.041)	(0.125)	(0.113)
Context partially favourable to informal learning					
Non-conducive activity	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Autonomy w/o exchanges	0.200 ***	0.099	0.130 **	0.076	−0.062
	(0.052)	(0.065)	(0.053)	(0.065)	(0.059)
Exchanges w/o autonomy	−0.100 *	0.108 **	0.058 *	−0.032	−0.002
	(0.054)	(0.054)	(0.035)	(0.059)	(0.054)
Conducive activity	0.214 ***	0.137 **	0.043	0.106	−0.041
	(0.062)	(0.065)	(0.035)	(0.082)	(0.072)
Context favourable to informal learning					
Non-conducive activity	−0.038	−0.003	0.026	0.043	−0.017
	(0.058)	(0.051)	(0.024)	(0.060)	(0.057)
Autonomy w/o exchanges	0.019	0.113 **	0.027 **	0.011	−0.044
	(0.062)	(0.057)	(0.027)	(0.064)	(0.059)
Exchanges w/o autonomy	0.042	0.133	0.061	−0.142 **	0.114 **
	(0.052)	(0.055)	(0.045)	(0.056)	(0.055)
Conducive activity	0.058	0.058	0.070	0.034	0.013
	(0.071)	(0.070)	(0.111)	(0.075)	(0.068)
Conditioning variables	Gender × age × education (× 59) + social origin (× 24) + size × sector (× 47)				
R^2	0.24	0.20	0.17	0.19	0.22
R^2 adjusted	0.20	0.15	0.13	0.15	0.18

Notes: The standard deviations in brackets are robust (heteroscedasticity). The weighting applied for 2016 corrects for attrition.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector.

Table A3-4 – **Apparent effects of work situations more or less favourable to informal learning – Separating context and activity dimensions. Linear probability model, OLS estimates, weighted data**

Activity status …		Short Term (2015)		Medium Term (2016)	
		Employment	Unemployment	Employment	Unemployment
Adjustment for organisational context type					
Baseline probability#		0.271	0.560 ***	0.692 ***	0.382 **
		(0.165)	(0.162)	(0.197)	(0.184)
Context	Unfavourable	−0.049	0.036	−0.005	−0.002
		(0.043)	(0.039)	(0.050)	(0.045)
	Partially favourable	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Favourable to IL	−0.044	0.042	−0.046	0.051
		(0.036)	(0.035)	(0.042)	(0.040)
	R^2	0.174	0.203	0.261	0.280
	R^2 adjusted	0.132	0.163	0.197	0.217
Adjustment for type of work activity					
Baseline probability#		0.233	0.578 ***	0.716 ***	0.340
		(0.157)	(0.159)	(0.190)	(0.179)
Activity	Not conducive	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Autonomy w/o exchanges	0.019	−0.044	0.103 **	−0.135 ***
		(0.045)	(0.041)	(0.051)	(0.043)
	Exchanges w/o autonomy	−0.116 ***	0.079 **	0.068	−0.051
		(0.041)	(0.038)	(0.053)	(0.050)
	Conducive to IL	0.028	0.009	−0.102	0.139 **
		(0.055)	(0.048)	(0.069)	(0.068)
	R^2	0.183	0.209	0.270	0.296
	R^2 adjusted	0.141	0.169	0.206	0.235
Conditioning variables		Gender × age × education (59 indicators) + social origin (24 indicators) + size × company sector (47 indicators)			
N		2,761	2,761	1,646	1,646

Notes: The baseline is a male under 25 years of age with a BEPC or lower, whose two parents were inactive (at the time of his 16th birthday) and employed at the end of 2013 by a company with 10 to 19 employees in the motorcycle/automobile trade and repair sector. The standard deviations in brackets are robust (heteroscedasticity) (White's standard deviations). The weighting applied for 2016 corrects for attrition.
Sources and coverage: CNEFP-Céreq, DEFIS 2015 and 2016; former employees of a company with ten or more employees in the private non-agricultural sector.

A New Nomenclature for French Statistics: The Household PCS

Thomas Amossé* and Joanie Cayouette-Remblière**

Abstract – The Household PCS (PCS being a French nomenclature of socio-professional categories) enables the social position of a household to be analysed by the cross-referenced situation of the main adults in the household rather than on the basis of the profession of a single individual (reference person, dominant position, etc.). This new nomenclature reflects the multiplicity of resources (economic, educational, etc.) in the form of a hierarchical and modular grid, specifically distinguishing households according to social homogamy and mono- or bi-activity. Compared to approaches that categorise households on the basis of a single individual, it enables social phenomena to be described at household level and is accompanied by an explanatory gain in statistical models. It is made available in official statistics sources from 2022 onwards and is likely to be implemented retrospectively. After describing the Household PCS and its groups, the article illustrates its empirical contribution from three themes (place of residence and housing conditions, standard of living and wealth, educational trajectories of children). Finally, it presents the profound changes in family and professional categories that transformed the household structure between 1982 and 2019.

JEL Classification: C18, C38, D10, I24, R20
Keywords: PCS, socio-professional category, household, nomenclature, statistics

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In many areas of social sciences research, being able to define and analyse the social position not of an individual but of a household is a key issue. This is notably the case in order to understand the situation of children or adolescents according to their social background, for example in terms of health, development, educational choices or educational outcomes and, more broadly, when dealing with family events (relationship, marriage, birth, separation), place of residence, housing conditions or economic situations (standard of living and wealth, consumption and savings, etc.).[1] The household, whether in the sense of a family and parental unit, a living unit or a fiscal home, is a crucible where the first relationships between individuals are built, where basic socialisation develops, and where decisions are made (between spouses, between parents and children). It is the place of arrangements, negotiations, sometimes tensions, in the determination of both personal and family orientations. In this respect, the analysis of individual professional developments (cessation or resumption of work, change in position or working hours, continuation of training, etc.) would benefit from integrating the household dimension,[2] as well as the analysis of time uses, particularly the distribution of domestic tasks between spouses, lifestyles (sociability, holidays, cultural practices) or health behaviours.[3] The social mobility analysis, which has more often than not been conducted individually based on the father's profession, and more rarely on the mother's (or her qualifications), completes the spectrum of themes for which a definition of social position of the parental couple would enable the renewal of knowledge.

Surprisingly, the official statistical response to this challenge has remained relatively limited: the definition of household reference person was certainly clarified during the 2000s (Saint Pol *et al.*, 2004), but it continues to leave their possible spouse, most often a woman,[4] in the shade. To quote Baudelot & Establet (2005), if households have a class, it still only walks on one leg (male) [*si les ménages ont une classe, elle ne marche toujours que sur une jambe (masculine)*]. In the academic community, no definition of the social position of households that accounts for several adults is imposed, unlike, for example, the EGP classification – for Erikson, Goldthorpe, Portocarero (Erikson *et al.*, 1979) – that was imposed on individual social stratification. In Anglo-Saxon literature, after a heated debate in British sociology in the early 1980s about the relevance and manner in which the situation of women is taken into account in analyses of social stratification and mobility (see Vallet, 2001 for an abstract of this controversy), use of the "dominant position" has spread, although it does not always have the strongest explanatory power (Thaning & Hällsten, 2020).[5] In France, while statisticians and social scientists have made several attempts to combine the work situations of individuals in the household – in the form of a categorical nomenclature (Baudelot & Establet, 2005; Villac, 1983), a continuous index (Lebart *et al.*, 1977; Rocher, 2016) or modular method of construction according to the objects (Cayouette-Remblière & Ichou, 2019) – none have resulted in a widely followed use.

Three main uses co-exist in France today for understanding the socio-professional position of households from individual PCS: reducing the household to the position of one individual (the reference person or dominant position); jointly using the individual socio-professional categories of men and women who comprise the household in econometric models; or systematically cross-referencing them. In the latter case, what is statistically gained in explanatory power is lost in parsimony and legibility of the results, and the cross-referencing constructed often differs between research. The construction of a nomenclature of household social positions therefore responds at least as much to descriptive issues as to analytical ambition: beyond work on particular social or family situations (couples, single-parent families, etc.), or the estimation of models where social position only has a role as a control variable, the aim is to provide a stable, limited, organised and exhaustive categorisation of social household configurations, enabling comparisons and cumulative work.

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1. All of these subjects have recently been studied from the perspective of the social position of households in quantitative work in social sciences (e.g. Berthomier & Octobre, 2018; Brinbaum et al.*, 2018; Cayouette-Remblière & Moulin, 2019; Gaini* et al.*, 2020; van Zanten, 2009).*

2. In economics, an analysis in terms of the labour supply of households, and not just the individuals that comprise them, could help to reform the non-unified scope of work focusing on women's labour supply (Briard, 2017).

3. Goffette (2016) highlights, for example, that tobacco consumption is partly determined at household level.

4. The reference person is now most often defined by the economic contribution to household resources – so the main contributor of resources defines the reference person – or, in the absence of that information, by age (this is particularly the case in the population census). Given the persistent differences in income and age between women and men within couples, these definitions remain indirectly androcentric.

5. For a recent literature review of international debates around the dominance approach, see Cayouette-Remblière & Ichou (2019, pp. 388–390). Incidentally, applying it to the French situation requires prioritising a nomenclature that does not take this approach (Desrosières & Thévenot, 2002).

This article presents such a categorisation. It was produced by a working group[6] composed of researchers specialising in social stratification, statisticians and users of official statistics within the framework of the reform of the nomenclature of professions and socio-professional categories (PCS) undertaken in 2018 (Amossé *et al.*, 2019). Synthetically taking into account the cross-referenced situation of the main adults in the household, both readable and standardised, the Household PCS is made available in a wide range of official statistics sources from 2022 onwards and can be implemented retrospectively. As with the nomenclature of PCS for analyses conducted at individual level, it enables a statistical basis to be given to analyses of classes conducted at household level using various theoretical frameworks.

1. A Social Position Taking Into Account Household Composition

1.1. Overview

The Household PCS is a new nomenclature that combines information on the composition of the household and on the socio-professional situation of its members. Classifying all households into 7 groups and 16 sub-groups, it refers in its headings to the most aggregated level of the individual PCS (Table 1). More specifically, it combines this information for the two main adults in the household (usually the reference person and their spouse). At sub-group level, it distinguishes households with only one economically active (or retired)[7] adult from those with a couple of economically active people, who themselves are distinguished according to the criterion of social homogamy.

This nomenclature was developed using a hierarchical ascending classification constructed around the 48 household configurations obtained by cross-referencing the socio-professional groups[8] of the two potential adults in the household (Table 2), based on the analysis of different forms of resources available to them (standard of living, qualifications, social background, employment situation, occupancy status and size of the dwelling, geographical situation). These analyses were carried out based on two sources (the INSEE 2013 Survey on tax and social income – ERSF – and the DEPP[9] 2007 panel of second-degree students) that cover two populations (all households and all parents) and have confirmed the stability of the groupings ultimately retained. In order to promote the legibility and use of the nomenclature, and reading of the empirical results, it was decided not to take into account the gender of the two potential spouses and thus to retain a symmetric and nested nomenclature, following the classification tree study (for details on construction of the nomenclature, see Online Appendix C1 – link at the end of the article).

1.2. Group Portraits

Composed of couples of executives who are strictly (I-A) or partly (I-B) socially homogamous, the households of group I accumulate the resources of bi-activity and the highest socio-professional positions. In every other case,[10] the man is an engineer or company manager (CS 37 and 38), the positions occupied by women being more varied (between middle management or administrative executive and company sales representative, CS 46 or 37, and teacher or higher scientific profession, CS 34). Among couples that are not strictly homogamous (I-B), men's position is higher than women's in 70% of cases. Predominantly executive households are distinguished both by their high level of economic resources (68% in the top quintile of standard of living) and educational resources (79% of couples have at least one spouse with an undergraduate university degree or higher) – these values are even higher in the sub-group I-A, which is also the most concentrated in the Paris urban area.

Essentially composed of socially heterogamous executives or those with no spouse and homogamous couples of people in the middle-management category, group II is below group I in terms of economic resources (41%

6. This is one of the sub-groups of the CNIS (the French National council for statistical information) working group on the reform of the 2020 PCS. Named the "Aggregates" sub-group and coordinated by the authors of this article, it was composed (in alphabetical order) of: Sarah Abdelnour (Université Paris 10), Michel Amar (formerly INSEE), Thomas Amossé (Cnam), Milan Bouchet-Valat (Ined), Fanny Bugeja (Université Paris 10), Joanie Cayouette-Remblière (Ined), Jean Flamand (France Stratégie), Céline Goffette (Ensae), Pauline Grégoire-Marchand (France Stratégie), Julien Gros (CNRS), Julie Landour (CEET), Pierre Mercklé (Université de Grenoble Alpes), Monique Meron (formerly INSEE), Christophe Michel (Dares), Olivier Monso (DEPP), Tiaray Razafindranovona (INSEE), Louis-André Vallet (CNRS) and Loup Wolff (Deps).

7. With income related to their (past) professional activity, retirees are considered in the same way as the economically active in the Household PCS. Thereafter, unless otherwise stated, the concept of economically active people will thus include retirees in the text, as opposed to other economically inactive and unemployed people who have never worked.

8. Online Appendix C1 explains why prototypes developed from socio-professional groups were preferred to those based on socio-professional categories.

9. The statistical services of the ministry of Education.

10. The numerical data indicated in this section refers to analyses carried out based on the 2019 Employment survey for family and socio-professional configurations and, for the description in terms of resources, based on the 2013 Tax and Social Incomes survey used to draft the nomenclature (see Online Appendix C2). These analyses were carried out on ordinary households with no retirees or economically inactive people aged 60 and over, which gives a more faithful picture of working households and parental couples (used for analyses in terms of social background, for example).

Table 1 – **The 7 groups and 16 sub-groups of the Household PCS**

	Ordinary households		Ordinary households with no retirees or economically inactive people aged 60 years and over	
	Number of people (thousands)	Proportion (%)	Number of people (thousands)	Proportion (%)
I. Predominantly executive households	2,550	8.7	1,787	10.5
I-A Executive with executive	1,117	3.8	829	4.9
I-B Executive with middle-management profession	1,433	4.9	957	5.7
II. Predominantly middle-management (or executive) households	5,198	17.8	3,290	19.4
II-A Executive with white or blue-collar worker	1,124	3.9	600	3.5
II-B Executive with economically inactive* or no spouse	2,224	7.6	1,505	8.9
II-C Middle-management or executive profession with self-employed small business owner	722	2.5	435	2.6
II-D Middle-management profession with middle-management profession	1,128	3.9	750	4.4
III. Predominantly white-collar (or middle-management) households	6,315	21.7	3,793	22.4
III-A Middle-management profession with white- or blue-collar worker	2,563	8.8	1,507	8.9
III-B Middle-management profession with economically inactive* or no spouse	3,012	10.3	1,859	11.0
III-C White-collar worker with white-collar worker	740	2.5	426	2.5
IV. Predominantly self-employed small business owner households	2,487	8.5	1,137	6.7
IV-A Self-employed small business owner living with another self-employed/economically inactive adult or lives alone	1,625	5.6	687	4.1
IV-B Self-employed small business owner with white- or blue-collar worker	862	3.0	450	2.7
V. Predominantly blue-collar worker households	3,099	10.6	1,615	9.5
V-A Blue-collar worker with white-collar worker	2,288	7.8	1,264	7.5
V-B Blue-collar worker with blue-collar worker	811	2.8	351	2.1
VI. Households with a white- or blue-collar worker	7,603	26.1	4,086	24.1
VI-A White-collar worker with economically inactive* or no spouse	4,264	14.6	2,273	13.4
VI-B Blue-collar worker with economically inactive* or no spouse	3,340	11.5	1,813	10.7
VII. Economically inactive households*	1,922	6.6	1,249	7.4
VII-A Economically inactive with economically inactive or no spouse	1,922	6.6	1,249	7.4

Notes: *"economically inactive" excludes retirees; the wording "executive" refers to the group of executives and higher intellectual professions and, where possible to distinguish them, to the category of company managers of companies with more than ten people. All the headings of the socio-professional groups and categories cited in the article refer to the headings chosen during the updating of the 2020 PCS, as specified in the nomenclature presentation guide.
Sources and coverage: INSEE, *enquête Emploi* (Labour Force Survey) 2019; ordinary households (France, excluding Mayotte).

Table 2 – **The structural matrix of the Household PCS**

Adult 1 / Adult 2	Executive and company manager	Middle-management profession	Self-employed small business owner	White-collar worker	Blue-collar worker	Economically inactive or missing status	No adult 1
Executive and company manager	I-A	I-B	II-C	II-A	II-A	II-B	II-B
Middle-management profession	I-B	II-D	II-C	III-A	III-A	III-B	III-B
Self-employed small business owner	II-C	II-C	IV-A	IV-B	IV-B	IV-A	IV-A
White-collar worker	II-A	III-A	IV-B	III-C	V-A	VI-A	VI-A
Blue-collar worker	II-A	III-A	IV-B	V-A	V-B	VI-B	VI-B
Economically inactive or missing status	II-B	III-B	IV-A	VI-A	VI-B	VII-A	VII-A
No adult 2	II-B	III-B	IV-A	VI-A	VI-B	VII-A	

Notes: Unemployed workers who have already worked and retirees are classified according to their last job. The concepts of adult 1 and adult 2 may refer to the reference persons and their potential spouse, or to parents 1 and 2 (most often father and mother).

of households in the last standard of living quintile) and educational resources (54% with at least one adult who has an undergraduate university degree or higher). However, the hierarchy between sub-groups changes depending on the type of resources. For example, executives with an economically inactive spouse or no spouse (II-B) have, on average, a higher standard of living and higher qualifications than households in other sub-groups, but a lower property wealth. Among couples in middle-management professions (II-D), which comprise one third and one quarter of men and women in primary education professions or similar (CS 42) and middle-management health or social work professions (CS 43), a high proportion (43%) include at least one civil servant. Sub-groups are also differentiated by the degree of asymmetry of positions occupied by women and men. Three sub-groups appear relatively symmetrical: by construction, socially homogamous middle-management professions (II-D), executives or middle-management professions with self-employed (II-C), whose modal situation is the man who is an artisan or trader (CS 21 or 22) and the woman who is in a middle-management administrative profession or a company sales representative (CS 46), and executives with an economically inactive spouse or no spouse (II-B), where the proportions of executive women and men without a spouse are close (42%[11] and 45% respectively). In contrast, female social hypergamy dominates among heterogamous executives (II-A), a sub-group composed of 71% male executives in a couple with a white- or blue-collar worker.

Group III, comprising heterogamous middle-management professions, with either one of the spouses economically inactive or no spouse and homogamous white-collar workers, complements the vast array of households ranging from mid-positions to the highest positions in society. It is one level below the previous groups in terms of economic resources (in the third and fourth standard of living quintiles) and academic resources (less often holding an undergraduate university degree or higher, but almost always having qualifications). Unlike the equivalent sub-group for executives (II-A), that of middle-management professions with a white- or blue-collar worker (III-A) is almost as much composed of hypogamous men – from middle-management professions (especially technicians or supervisors) whose spouse is white-collar or, more rarely, blue-collar – as hypogamous women (for example, a middle-management health or social professional whose spouse is a blue-collar worker or, more rarely, a white-collar worker). The sub-group of middle-management professions with an economically inactive or no spouse (III-B) is more female (52% female with no spouse, compared to 38% male with no spouse). Relatively less frequent in the total population, the sub-group of homogamous white-collar workers (III-C) has greater resources than those in groups V and VI, where other white-collar workers are classified. Thanks to the bi-activity and the fact that homogamous white-collar workers are recruited in the most qualified categories of white-collar workers, these white-collar workers should not be confused with working classes: more than two thirds are in the third standard of living quintile; 43% of households in this sub-group include at least one civil servant; finally, 26% of households have at least one person with higher education qualifications.

Group IV, predominantly self-employed/small business owner households, includes farmers, artisans or traders, unless they are in a couple with an executive spouse or a spouse in a middle-management profession (sub-group II-C). This group occupies a pivotal position, with resources close to those of the working class households in groups V, VI and VII, but a level of wealth that brings them closer to groups I and II. The households in this group are the most evenly distributed in all standard of living quintiles (yet with slight over-representation in the first quintile). They also overwhelmingly own their home, which, more than in other groups, is large and located far away from large urban areas. The group is characterised by high social reproduction (one of the adults has a self-employed/small business owner parent in nearly one in two households, which is twice the average). It has two sub-groups: the first (IV-A) is a group of household configurations counting male (40%) or female (20%) self-employed with no spouse, or homogamous (26%) or self-employed with an economically inactive spouse (14%) – who share the fact of being less financially well-off (44% belong to the first standard of living quintile) and more often than not without qualifications (16%), but relatively well-off with regard to property wealth (32% own a large home). A little more than one male farmer in two is in this sub-group, compared to 40% of male artisans. In the second sub-group (IV-B), composed of self-employed in couple with a

11. In fact, the II-B sub-group concentrates a significant proportion of female executives: it concerns 40% of female executives in the fields of information, art or entertainment (CS 35) and 36% of female teachers or those who exercise a higher scientific profession (CS 34).

white- or blue-collar worker, being in a couple outside the self-employed sector enables them to combine greater professional stability, a dual income and a relatively high level of wealth.

Couples with a dominant blue-collar worker (group V) constitute the fraction of working-class households where resources (economic but also educational, social, etc.), although low, can be pooled between spouses. Their bi-activity provides them with a standard of living close to the median (between the second and fourth quintiles) and spouses often have a qualification (second degree vocational qualifications – CAP, BEP –, or the baccalaureate). They often reside outside of large urban areas, and about half own or have a mortgage on their homes, and their places of residence allow them to access ownership without compromising on the size of the home. The slightly better off V-A sub-group most often reproduces a "classic" gender configuration, with a white-collar female and blue-collar male (more often than not with qualifications). With fewer qualifications and more often settled in rural communes, couples in the V-B sub-group bring together more low-skilled blue-collar workers (CS 67 and 68).

With socio-professional categories identical to those of group V, group VI of households with one white- or blue-collar worker and the spouse economically inactive or no spouse, which represents nearly one in four households in France, is mainly characterised by situations of singledom and single parenthood. It is composed of 37% single men, 48% single women and 12% male white- or blue-collar workers with an economically inactive spouse.[12] These households are predominantly between the first and second standard of living quintiles and have fewer resources (qualifications, social background, and housing) than those of the previous groups. White-collar workers with an economically inactive spouse or no spouse (VI-A) – women in three quarters of cases – are the largest sub-group numerically; they are primarily civil servants working in administration, health service officers or health assistants (CS 52), and employees of direct services to private individuals (CS 56). Comprising 1 in 10 households, 40% of blue-collar workers and 1 in 4 economically inactive women, the sub-group of blue-collar workers with an economically inactive or no spouse (VI-B) concentrates the low-skilled fraction of the working world.

Yet it is the last group – that of households composed solely of economically inactive people (group VII) – that comprises the majority of inactive people (47% inactive women and 75% inactive men belong to this group). Depending solely on resources from social welfare or private solidarity, these households, although few, form a separate group. They are made up of 37% single men, 57% single women, and only 6% couples. Heavily concentrated in the first standard of living quintile (71%), they rarely have qualifications (69% have, at most, a secondary education certificate – BEPC) and make up the group with the least favourable social background.

1.3. Availability and Principles of Nomenclature Construction

Together, these 7 groups and 16 sub-groups enable the socio-professional structure of households in France to be described in a new way. Referring to the historical categories and groups of the individual socio-professional nomenclature and summarising, as it does, several dimensions of social characteristics, the Household PCS was designed to be easily appropriable by researchers and statisticians. For descriptive and explanatory purposes, it will be progressively made available in all sources of official statistics in France from 2022 onwards.

Its construction principle (cf. Table 2 and a presentation in algorithmic form in Online Appendix C3) allows for retrospective implementation back to 1982. Implementation only requires entering the individual socio-professional group[13] of the two main adults in the household and specifying the definition of the household to be used: "housing" (as in the census), "living unit" (or "fiscal home", which tends to become the norm in official statistics), or even "family" or "parental couple" (for example, in surveys regarding children,[14] or in the analysis of social mobility). The choice of the two main adults in the household is, in

12. Female white- or blue-collar workers with an economically inactive spouse represent only 3% of the group.

13. This is usually the first position of the 'CSTOT' variable (the 2-digits detailed socio-professional category defined on the whole population), where the categories of retirees are classified according to their previous profession. More specifically, a slightly adapted version of the six original groups in the 1982 nomenclature is used to define the Household PCS, as shown in Table 2. For reasons of sample size and proximity in terms of resources held, the two groups of farmers and artisans and traders have been grouped together (they are all "self-employed/small business owners"), and the company manager with more than ten people category is included in the group of executives and higher intellectual professions when data permits (in the opposite case, they remain with the "self-employed/small business owners").

14. In this case, we can even define a child's reference household in different ways according to whether we take a residential, educational or social background approach; the household may include the two parents or step-parents providing primary/alternate care of the child, ensuring their education, or the biological parents (who constitute a household or pseudo-household of origin).

principle, left to users and is modular according to analysis needs, but the version retained in official statistics sources will be consistent with the concepts of household and reference person in each survey, namely, a construction based on the household's "reference" adults in terms of their activity status, economic contribution, parental position, etc. that the reference person and their potential spouse represent. Thus constructed, the Household PCS enables biases linked to gender or age to be eliminated, including retrospectively, in the sense that the principles for drawing up the nomenclature are totally symmetrical between the two main adults (see Table 2), unlike the single reference person PCS.

The way in which groups and sub-groups in the Household PCS are referred to can also be adapted to the objects and fields studied. For example, groups VI and VII can be merged for analyses conducted on the parents' field (see below). Finally, the choice to mobilise groups or sub-groups – like the choice to rely on groups or socio-professional categories for analyses of individuals – is left to the discretion of each user, depending on the advantages and disadvantages that the following section will partially clarify.

2. Explanatory Power and Descriptive Interest: Three Empirical Illustrations

Frugal, the Household PCS has an undeniable advantage in describing social phenomena at household level. It is also more explanatory[15] in the statistical models, reflecting the socio-professional position of the two main adults in the household and their articulation. The analysis of three different research themes provides an illustration of its empirical contribution.

2.1. Place of Residence and Housing Conditions

Up until the 2000s, place of residence and housing conditions were mostly studied according to the socio-professional category of the household reference person taken as the social position of the household (for work conducted during this period see, in particular, Bonvalet & Lelièvre, 1991; Bonvalet, 2003). In light of today's dissatisfaction with this type of approach, some authors characterise households by the highest profession (or "dominant position"; see, for example, Le Roux *et al.*, 2020), but many others abandon the socio-professional categories and only take into account income and standards of living.[16] If, in this second trend, we can see an additional manifestation of the "twilight of PCS" (Pierru & Spire, 2008), we may also think that the income approach enables the difficulty of characterising a household on the basis of the PCS of one of its members to be circumvented. However, by considering the socio-professional positions of two potential adults, and also by taking into account the social homogamy or bi- or mono-activity of couples, the Household PCS better accounts for residential positions at all levels of the social hierarchy, and provides a significant statistical gain compared to other variables (PCS of the reference person, highest PCS, household income).

For the better-off, the combination of two high professional positions reinforces the residential advantage of executives. For the most part homeowners, predominantly executive households more often than not live in a house and have an average of 30 m^2 more than the average French household, although they are over-represented in the Parisian urban area (Table 3).[17] Sticking to a characterisation by the reference person would obscure part of this benefit, by showing, for households whose reference person is an executive in relation to group I of the Household PCS, a rate of ownership lower by 8 percentage points, a proportion of households residing in a house lower by 10 points, and a number of square meters separating them from the average divided by 2.

At the other end of the nomenclature, the Household PCS highlights the divide between working class households in groups V and VI. Though 50% of households whose reference person is a blue-collar worker are owners, this is the case for 62% of predominantly blue-collar worker households, and 37% of households composed of only one white- or blue-collar worker. Conversely, while 24% of households whose reference person is a blue-collar worker are tenants in social housing, this situation is rarer in predominantly blue-collar worker households and more frequent among households with only one white- or blue-collar worker (Table 3). The Household PCS thus accounts for the

15. Notions of "explaining" gain, or explanatory power are understood in the sense of the statistical quality of the models to account for the variance of the phenomena studied, not in an analytical sense. It is measured using McFadden's pseudo-R^2 (for logistic regressions conducted on nominal variables) or R^2 (for linear regressions conducted on continuous variables). These two indicators of statistical power are influenced by the number of nomenclature modalities compared; that is why their explanatory contribution is systematically reduced to the number of nomenclature modalities.

16. For example, all of the works published by INSEE on the 2013 Housing survey (Laferrère et al.*, 2017).*

17. These analyses are carried out on all households, the main difference with the field of households with no retirees or economically inactive people 60 years of age and over being the increase in groups and sub-groups composed of individuals with no spouse, due to widowhood.

Table 3 – **Indicators of residence and dwelling per Household PCS**

	Occupancy status (%*)			Dwelling type (%*)		% living in deprived neigh-bour. (ZUS)	Average living area (m^2)	Place of residence (%)			
	Owner	Social sector hou-sing	Private rental	House	Apart.			Paris (urban area)	Other urban areas	Peri-urban areas	Rural areas
I. Predominantly executive households	82	2	15	67	32	6	121	29	42	22	8
I-A Executive with executive	84	1	14	63	37	6	125	36	40	18	6
I-B Executive with middle-management profession	81	2	15	71	29	6	118	23	43	25	9
II. Predominantly middle-management (or executive) households	71	6	21	60	39	7	104	23	40	25	11
II-A Executive with white or blue-collar worker	79	5	14	73	27	7	113	18	39	32	11
II-B Executive with economically inactive or no spouse	60	7	31	39	60	9	88	35	44	14	8
II-C Middle-management or executive profes-sion with self-employed small busi. own.	82	2	15	76	21	6	127	13	36	30	22
II-D Middle-management profession with middle-management profession	79	5	15	77	22	5	111	14	37	36	13
III. Predominantly white-collar (or middle-management) households	62	13	22	59	40	11	90	17	43	26	14
III-A Middle-management profession with white- or blue-collar worker	76	8	14	76	23	8	103	11	38	32	18
III-B Middle-management profession with economically inactive or no spouse	51	17	29	42	56	13	79	22	47	20	11
III-C White-collar worker with white-collar worker	58	16	21	64	34	15	94	14	45	28	13
IV. Predominantly self-employed small business owner households	77	6	14	79	19	5	107	8	30	29	33
IV-A Self-employed small business owner living with another self employed/ economically inactive adult or lives alone	76	6	15	77	20	5	104	7	29	28	35
IV-B Self-employed small business owner with white- or blue-collar worker	78	7	13	83	15	5	113	8	33	29	29
V. Predominantly blue-collar worker households	62	18	18	72	27	12	94	9	38	30	23
V-A Blue-collar worker with white-collar worker	61	18	18	71	28	13	94	9	39	31	21
V-B Blue-collar worker with blue-collar worker	64	18	16	74	24	11	93	6	37	30	27
VI. Households with a white- or blue-collar worker	37	31	29	41	56	21	72	14	51	18	17
VI-A White-collar worker with economically inactive or no spouse	38	31	28	38	59	21	72	17	52	17	14
VI-B Blue-collar worker with economically inactive or no spouse	35	31	30	45	52	22	73	10	50	20	20
VII. Economically inactive households	25	19	51	29	68	21	61	11	65	12	12
VII-A Economically inactive with economically inactive or no spouse	25	19	51	29	68	21	61	11	65	12	12
Total	*58*	*16*	*24*	*57*	*42*	*13*	*91*	*16*	*44*	*23*	*17*

* "other" situations involving between 1 and 4% of each sub-group are not shown here.
Sources and coverage: INSEE, *enquête Logement* (Housing survey) 2013; all households.

predominant weight of the couple and the bi-activity within working class households, which is also observed by ethnographers (Masclet *et al.*, 2020).

In the median fraction of the nomenclature, it is at sub-group level that the Household PCS turns out to be heuristic. On the one hand, the homogamous middle-management professions (II-D) are mainly homeowners, a situation that goes hand-in-hand with their larger presence in peri-urban areas. In this way, they are closer to predominantly self-employed households (group IV), who, in turn, choose to live in rural areas. On the other hand, the middle-management professions with an economically inactive spouse or no spouse (III-B) reside more in large urban areas (in particular Paris), more

often than not in an apartment, and are less often homeowners. This sub-group even resides as frequently as the average in a deprived neighbourhood, or in a ZUS (sensitive urban area) (13%), of which it is often the most well-off population.

Table 4 presents the result of further analyses conducted in order to quantify the explanatory gain of the Household PCS groups compared to the reference person's socio-professional group and the dominant position. Comparison of these three ways in which to characterise the household from six or seven groups (see the first three columns of Table 4) consistently shows an increase in the explanatory power (between 11% and 69% depending on variables and nomenclature) with the Household PCS.

The same type of comparison is made for income quartiles, which are the most used in recent literature, but this first implies to reduce the sample analysed, with 2% of respondents in the Housing survey having not declared their incomes. In this sub-sample, the income quartiles are, with only four categories, only a little better than the groups in the Household PCS in explaining the status of owner and the fact of living in a deprived neighbourhood (ZUS), but not very useful at all if we are interested in the type of housing or place of residence, determined more so by professional specificities (Bruneau *et al.*, 2018).

2.2. Household Financial Situation

The economic situation of households is another area of analysis for which the use of social position variables at household level is sought, but currently remains too limited. Statisticians, economists or sociologists thus describe the social differences in the population using internal logic – as when comparing average amounts of income, standard of living or wealth according to the deciles of these same variables – or by referring to the household reference person's group or socio-professional category (see Blasco & Labarthe, 2018 for a recent example). In the wealth or consumption surveys (*enquête Patrimoine, enquête Budget de famille*), the common sources for analysing these issues, the reference person is defined as the household's main contributor of resources. Yet, as we will see in the models explaining the poverty rate or level of wealth of households, the reference person has less statistical power than the Household PCS.

Firstly, we note that the Household PCS reflects the hierarchy of economic situations (Table 5). The median standard of living (disposable income per unit of consumption) varies from €30,800 per year for predominantly executive households (group I) to €8,000 for economically inactive households (group VII). Reflecting the lifetime differences and household debt capacity, the median gross wealth has an even wider spectrum of variation, ranging from €372,900 to €4,900 (a multiplicative factor of 75). Between these two extreme situations, the gradation is regular between the groups in the Household PCS; only the predominantly self-employed household group is singled out both by poverty rates that bring them closer to working class household groups (V, VI and VII) and by levels of wealth that, on the contrary, link them to more affluent households (groups I and II). By showing this pivotal position, the nomenclature reflects the singularity of self-employed small business owners, whose incomes, often unstable, are marked by a large dispersion and are, in part, determined according to a logic of wealth

Table 4 – **Comparison of the explanatory powers in terms of residence and dwelling**

	McFadden's pseudo-R^2 depending on nomenclatures (%)					Explanatory gains (%)		
	(1) Household PCS (7 groups)	(2) Reference persons (6 groups*)	(3) Dominant position (6 groups)	(4) Revenue quartiles (4 categories)**	(5) Household PCS (16 sub-groups)	1 vs 2	1 vs 3	1 vs 4
Being an owner [58%]	9.2	6.2	7.3	7.5	10.8	+48	+26	+23
Living in a deprived neighbourhood (ZUS) [13%]	4.5	3.4	3.9	4.0	4.9	+32	+15	+13
Living in a house [57%]	5.9	3.5	3.5	1.5	9.5	+69	+69	+293
Living in a large urban area (including Paris) [60%]	3.0	2.6	2.7	1.0	4.9	+15	+11	+200

* Defined using the same socio-professional groups as in the construction of the Household PCS (see above): executives or company managers; middle-management professions; farmers, artisans or traders; white-collar workers; blue-collar workers; economically inactive people. The order of these groups is that used to determine the dominant position.
Notes: Statistics obtained from weighted regressions. Percentages in the whole population in brackets.
Sources and coverage: INSEE, *enquête Logement* (Housing survey) 2013; all households (**: who have declared their income)

Table 5 – **Economic indicators by Household PCS**

	Median annual standard of living (€)	Poverty rate (%)	Wealth rate (%)	Median gross wealth (€)	Share of gross wealth less than €4,300	Share of gross wealth over €595,700
I. Predominantly executive households	30,800	3.1	21.1	372,900	0.0	29.0
I-A Executive with executive	35,300	2.7	30.5	458,300	0.0	39.7
I-B Executive with middle-management profession	28,600	3.4	12.9	331,800	0.0	19.6
II. Predominantly middle-management (or executive) households	24,300	8.1	12.7	270,300	2.0	16.3
II-A Executive with white or blue-collar worker	23,900	6.3	10.0	317,500	1.5	16.8
II-B Executive with economically inactive or no spouse	25,300	10.4	18.3	194,600	3.6	12.8
II-C Middle-management or executive profession with self-employed small business owner	27,000	4.9	13.0	414,300	0.0	36.4
II-D Middle-management profession with middle-management profession	22,700	7.5	4.6	259,400	0.7	9.3
III. Predominantly white-collar (or middle-management) households	19,500	11.5	2.3	150,400	5.7	3.6
III-A Middle-management profession with white- or blue-collar worker	20,500	6.7	1.1	213,000	2.5	4.3
III-B Middle-management profession with economically inactive or no spouse	18,500	16.2	3.7	59,600	9.0	3.3
III-C White-collar worker with white-collar worker	18,600	10.7	0.9	161,500	4.1	1.9
IV. Predominantly self-employed small business owner households	14,000	39.2	5.5	293,700	2.8	25.5
IV-A Self-employed small business owner living with another self-employed/economically inactive adult or lives alone	12,600	45.9	5.4	249,700	4.2	24.0
IV-B Self-employed small business owner with white- or blue-collar worker	16,300	30.0	5.5	329,600	1.0	27.6
V. Predominantly blue-collar worker households	17,100	17.8	0.1	144,400	6.8	1.1
V-A Blue-collar worker with white-collar worker	17,200	17.7	0.1	153,600	5.4	1.1
V-B Blue-collar worker with blue-collar worker	16,800	17.9	0.0	105,800	11.5	1.1
VI. Households with a white- or blue-collar worker	13,900	35.8	0.7	13,600	25.6	1.1
VI-A White-collar worker with economically inactive or no spouse	14,300	32.3	0.3	13,200	25.7	0.9
VI-B Blue-collar worker with economically inactive or no spouse	13,600	39.8	1.1	14,000	25.4	1.4
VII. Economically inactive households	8,000	73.3	0.8	4,900	45.9	0.4
VII-A Economically inactive with economically inactive or no spouse	8,000	73.3	0.8	4,900	45.9	0.4
Total	*17,900*	*22.5*	*5.3*	*135,900*	*11.2*	*9.0*

Notes: Standards of living, poverty rates (standard of living below 60% of the median, i.e. €1,015 per month as of 1 January 2015) and wealth rates (standard of living above double the median, i.e. €3,384 per month as of 1 January 2015) are obtained from tax data; the total gross wealth indicators are calculated from the respondents' declarations, with thresholds of €4,300 and €595,700 corresponding to the first and last decile (Ferrante *et al.,* 2016).
Sources and coverage: INSEE, *enquête Patrimoine* (Wealth survey) 2014; all households with no retirees or economically inactive people aged 60 years or over.

accumulation (professional assets constitute on average only one fifth of their total wealth).

High levels of wealth can also be seen in sub-group II-C (executive or middle-management profession in a couple with a self-employed/small business owner), but this time associated with a more comfortable economic position. Contrary to the reference person approach, the Household PCS thus gives us a new way of perceiving fundamental distinctions between households with self-employed/small business owners according to the position of their spouse. More broadly, the nomenclature allows the economic situation of couples according to the degree of social homogamy to be differentiated. The median gross wealth levels of couples in which one of the spouses is an executive are thus between €458,300 if the other spouse is an executive (I-A), €331,800 if he/she is in a middle-management profession (I-B), €317,500 if he/she is a white- or blue-collar worker (II-A), and €194,600 if he or she is economically inactive or if there is no spouse (II-B).

Finally, the sub-groups in the Household PCS highlights the particular situation of households with only one economically active person: whether at the top (II-B), in the middle (III-B, IV-A), or at the bottom of the nomenclature (VI-A,

VI-B), these households are systematically more at risk of poverty and have a lower level of wealth than those in which both spouses are economically active. In this landscape, groups VI and VII (households with only one white- or blue-collar worker, or households of economically inactive persons) are distinguished by the accumulation of particularly high poverty rates (above 30%) and an equally high proportion of absence (or near absence) of wealth. Their situation is very different from couples that are predominantly blue-collar (group V), whose poverty rate is twice lower and the proportion of quasi-zero wealth is divided by four. Such distinctions cannot, again, be highlighted using the socio-professional group of the household's sole reference person.

Overall, the statistical power of the Household PCS appears to be equivalent or superior of a characterisation by the reference person for all of the indicators analysed (Table 6). The most notable explanatory gains relate to the poverty and wealth rate below the first decile, which refers to the relevance of groups VI and VII of the Household PCS in representing the most fragile economic situations (on the contrary, diluted in the "white-collar worker" and "blue-collar worker" groups when referring to the sole reference person). The advantage of sub-groups over groups appears clearly for indicators of wealth and high level of wealth, due to the specificity of the sub-group of homogamous executives on the one hand, and the differences between sub-groups with self-employed small business owners on the other.

2.3. Children's Educational Trajectories

In the field of education, the father's profession has long been used as a measure of the social background of children. Its administrative adaptation through the category of "pupil guardian" – the father when there is one, the mother in the opposite case – now determines certain scientific and analytical uses, and implementation beyond reflection on public policy. Therefore, for example, the map of priority education networks (REP) is drawn from a small number of indicators, including the profession of the pupil guardian. Recently, however, some sociologists have advocated use of the mother's profession, arguing that it is the mother who does most of the educational work (Champagne *et al.*, 2015), while still others have implemented *ad hoc* nomenclatures with regard to the dominant position (Brinbaum *et al.*, 2018; Cayouette-Remblière & Moulin, 2019). In light of these plural uses, the nomenclature of the Household PCS has several advantages.

Firstly, it provides a statistical gain compared to other nomenclatures of common professions. The study of three "events" in educational trajectories correlated with social background, namely general or technological (GT) orientation in Year 11 (a situation that concerns 59% of a generation of pupils), repeating a year in primary school or in one of the first three years at high school (27% of pupils) and being enrolled for at least one year in enhanced priority education[18] (2.7% of pupils) illustrates this. For these three events of a varied nature, and with an equivalent number of modalities for each nomenclature, the Household PCS enables an average gain of 7% in explanatory power compared to the dominant profession, 35% compared to the father's profession and 31% compared to the mother's profession (Table 7). The interest is not only descriptive: it also makes

*18. At the end of the 2000s, priority education was divided into two levels: an enhanced framework called the "*Réseau Ambition Réussite*" (ambition success network) was created for the minority of establishments most in need; the current equivalent is REP+.*

Table 6 – **Comparison of the explanatory power in terms of economic situation**

	R^2 (or McFadden's pseudo-R^2) for the three nomenclatures			Explanatory gains (%)	
	(1) Reference person (6 groups*)	(2) Household PCS (7 groups)	(3) Household PCS (16 sub-groups)	2 vs 1	3 vs 2
Standard of living	14.2	16.1	16.8	+13	+4
Poverty rate	12.1	15.3	16.2	+26	+6
Wealth rate	18.6	18.4	21.3	−1	+16
Gross wealth	6.5	6.7	8.3	+3	+24
Share of gross wealth ≤ €4300	13.8	19.6	20.9	+42	+7
Share of gross wealth ≥ €595,700	17.7	19.8	22.1	+12	+12

* cf. Table 3.
One variant of reference person, in which farmers are separated from artisans and traders (which allows the exact same number of modalities in both nomenclatures), only modifies the results marginally.
Notes: Statistics obtained from weighted regressions.
Sources and coverage: INSEE, *enquête Patrimoine* (Wealth survey) 2014; all households with no retirees or economically inactive people aged 60 years or over.

Table 7 – **Comparison of explanatory power on school events**

	McFadden's pseudo-R^2				Explanatory gains (%)		
	(1) Household PCS (6 groups)[a]	(2) Dominant profession (6 groups)[b]	(3) Father's profession (6 groups)[c]	(4) Mother's profession (6 groups)[c]	1 vs 2	1 vs 3	1 vs 4
At least one year in enhanced priority education	9.5	8.8	7.0	7.7	+8	+35	+23
Repeated year in primary, Year 7, Year 8 or Year 9	9.0	8.3	6.5	6.8	+9	+39	+33
Orientation in Year 11 GT	11.9	11.2	9.1	8.7	+6	+31	+37

[(a)] Given the lower share of groups VI (13%) and VII (1.5%) of the parent population of pupils in relation to the total population, they were grouped together.
[(b)] The dominant profession variable was built iteratively by prioritising professions as follows: (1) at least one executive or company manager parent; or (2) at least one middle-management profession parent; or (3) at least one farmer, artisan or trader parent; or (4) at least one white-collar worker parent; or (5) at least one blue-collar worker parent; or (6) all parents are economically inactive.
[(c)] The professions of the father and mother were also classified into six groups. Following the example of what is done for the Household PCS, company managers have been grouped together with executives, and farmers, artisans, and traders form the "self-employed/small business owners" category. When no profession was entered for the mother (6%), the father's profession was considered, and when no profession was entered for the father (10%), the mother's profession was considered.
Notes: Statistics obtained from weighted regressions.
Sources and coverage: MEN-DEPP, *Panel d'élèves du second degré* 2007 and family survey 2008; all students entered in Year 7 in 2007, respondents to the Family survey, except pupils for whom no parent profession is provided (*N*=32,585).

it possible to avoid attributing part of the effect of social background to other variables that are correlated to it (place of residence, schooling context, immigrant status, etc.).

The Household PCS also better accounts for the social hierarchy of pupils' families (Table 8) by distinguishing, at the top, homogamous executive families (I-A) and, at the bottom, those of groups VI and VII, which better highlight the school dropout rate which is more frequent in children from the most vulnerable households.

Finally, the sub-groups of the nomenclature highlight the effects of the bi-activity and social homogamy of the parental couple on the educational trajectories of children in upper-, middle- and working-class households (Online Appendix, Table C4). For example, a secondary school pupil, both of whose parents are executives (I-A) has a 91% chance of being oriented towards a GT pathway in Year 11, compared to 78% if one of their parents is an executive and the other a white- or blue-collar worker. Among households with a lower social position, a student whose parents are both in a middle-management profession (II-D) has an 81% chance of being of being oriented towards a GT pathway in Year 11, compared with 59% if they have just one economically active parent in a middle-management profession (III-B). Finally, in working-class households, a child whose parents are a white- and a blue-collar worker (V-A) has a 44% chance of being oriented towards a GT pathway in Year 11 and a 3.0% chance of being oriented to priority education but, if only one of his parents is economically active and is a blue-collar worker (VI-B), he only has a 30% chance of being oriented towards a GT pathway in Year 11, and his probability of going into priority education is triple (9.2%).

In the field of housing, financial situation or even the educational trajectory of children, the analyses presented show the descriptive empirical contribution and the explanatory gain of the Household PCS. Taking into account the socio-professional position of the two main adults in the household, this nomenclature restores reinforcement effects (resp. mitigation) related to social homogamy (resp. heterogamy), as well as the specificity of mono-active households.

3. A Nomenclature That Can be Used Retrospectively back to 1982

In addition to offering a tool to re-examine contemporary society from a household perspective, the Household PCS can also be mobilised retrospectively on all data sets constituted since 1982, thanks to the stability of socio-professional groups. This use for time comparisons, however, calls for interpretative caution, because it involves having a construction based on a resource analysis conducted in the 2010s cross several decades. The meaning of "blue-collar worker" (Beaud & Pialoux, 1999) or "economically inactive woman" (Maruani & Meron, 2012) may have changed over this period, just as "forming a household" or "being in a couple" may have been affected by the individualisation of finances or the reorganisations of domestic labour division (Champagne *et al.*, 2015). Analysis of the evolution of the weight of different family configurations in society and that of the

Table 8 – **Three school events with different household nomenclatures**

	% of pupils entered in Year 7	Orientation in Year 11 GT	Repeated year in primary, Year 7, Year 8 or Year 9	At least one year of high school in enhanced priority education
Household PCS, households...				
predominantly executive	14	90	7	0.2
predominantly middle-management	17	79	14	0.6
predominantly white-collar worker	22	61	23	1.9
predominantly self-employed small business owner	10	54	28	1.6
predominantly blue-collar worker	23	42	36	3.1
with a white- or blue-collar worker or economically inactive person	15	33	51	8.6
Dominant position				
Executive or company manager	23	85	10	0.4
Middle-management profession	23	68	18	1.3
Self-employed small business owner	10	54	28	1.7
White-collar worker	30	45	35	3.6
Blue-collar worker	12	32	47	6.8
Economically inactive	2	21	69	15.8
Father's profession				
Executive or company manager	20	85	10	0.4
Middle-management profession	18	69	19	1.2
Self-employed small business owner	12	60	25	1.3
White-collar worker	15	52	32	3.9
Blue-collar worker	34	43	37	4.1
Economically inactive	2	24	65	14.2
Mother's profession				
Executive or company manager	11	87	8	0.3
Middle-management profession	20	77	13	0.8
Self-employed small business owner	5	59	25	1.2
White-collar worker	45	53	30	2.5
Blue-collar worker	12	36	42	4.5
Economically inactive	7	37	51	10.5
Total	*100*	*59*	*27*	*2.7*

Sources and coverage: MEN-DEPP, *Panel d'élèves du second degré* 2007 and Family survey 2008; all students entered in Year 7 in 2007, respondents to the Family survey, except pupils for whom no parent profession is provided (*N*=32,585).

transformations internal to groups and sub-groups seems particularly necessary from this point of view. It makes visible the family configurations made equal by groups and sub-groups in 1982 and 2019; in other words, it explains the evolution of the "conventions of equivalence" (Desrosières, 1992; 2001) that the nomenclature expects to adopt. In doing so, it provides users of the Household PCS the elements needed to interpret its evolution over the past few decades – following an approach similar to that followed by Maruani & Meron (2012) about women's activity – which, enriched by contemporary sociological work, reflects the descriptive interest and analytical scope of the nomenclature.

3.1. Transformations at Individual Level…

After a period during which household entry predominated (until the 1970s), and then another period when individual analyses became increasingly established, the way in which these two levels are articulated has seemed, for around ten years, to be taking a new direction of research into statistics and social sciences (Amossé & De Peretti, 2011). In fact, evolution of the household structure (see below, Table 9) is inseparable from the transformations observed at individual level, including the three main ones that we will indicate here.

A first transformation concerns the structure of jobs. Firstly, this is marked by a massive increase in qualifications: between 1982 and 2019, the proportion of executives and company managers increased by 2.4 (from 7.7% to 18.7%) and that of middle-management professions by 1.5 (from 15.8% to 23.4%). This rise is accompanied by, among other, the decline in agriculture, crafts and small retail, going along

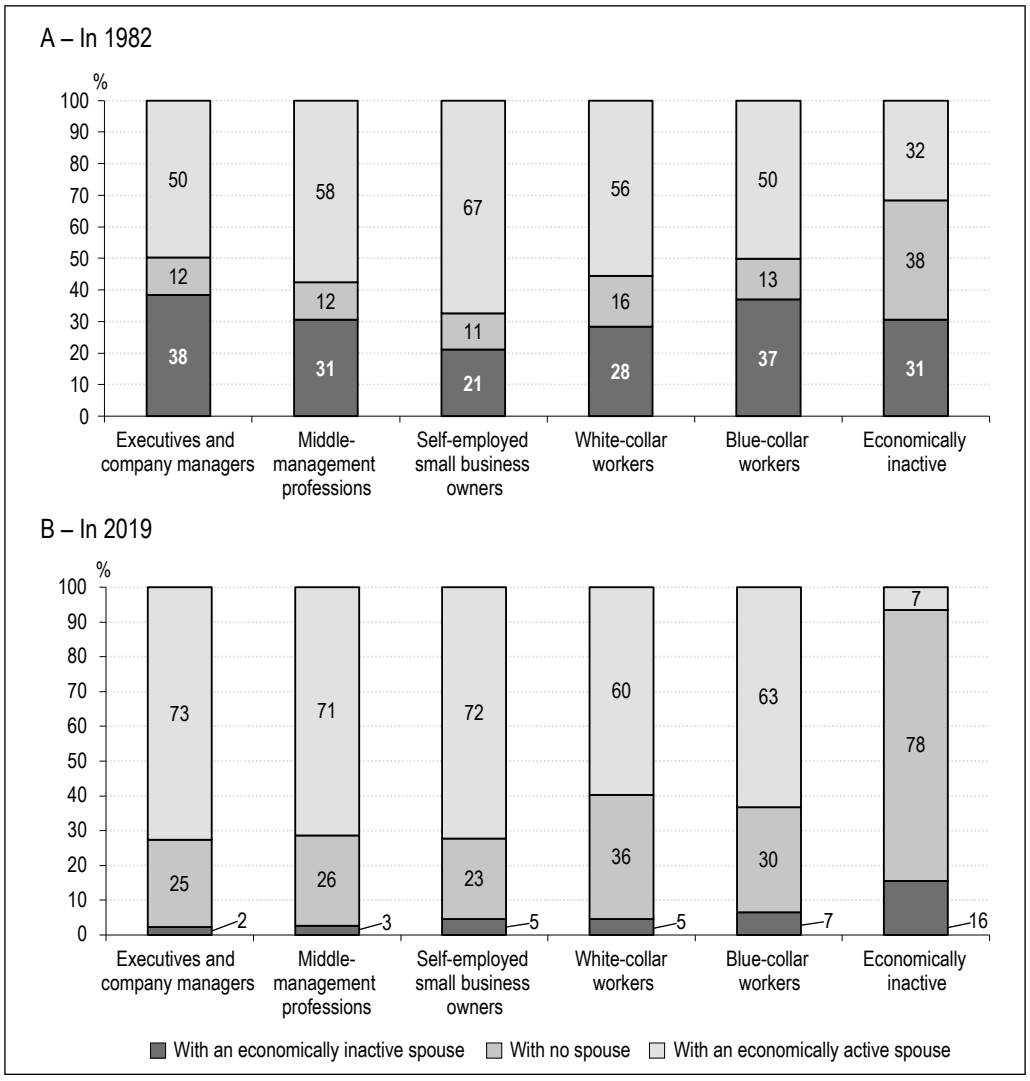
with, for example, a decline in the proportion of "self-employed/small business owners" (from 9.5% to 6.6%).

The second notable development is the fall in women's economic inactivity. Between 1982 and 2019, in households with no retirees or economically inactive people aged 60 years and over, the proportion of women in couples who are economically inactive decreased from 37% to 6%.[19] This disruption particularly affects households in which a man is an executive or a blue-collar worker, which constituted the most common situations of male mono-activity in couples: between 1982 and 2019, the proportion of men in a couple with an economically inactive woman decreased from 38% to 2% among executives, and from 37% to 7% among blue-collar workers (Figure). But the increase in women's economic activity is huge at all levels of the socio-professional scale.

The third major development is the increase in the proportion of people who do not live as a couple (whether they be single, divorced, separated or widowed). In 1982, in the field of reference persons and their potential spouse, 14% of men and 18% of women lived without a spouse; in 2019, this situation concerns 31% of men and 38% of women. This results in new divides between those who live in a couple and others. For men, there has been a change from small gaps between socio-professional groups

19. In 40 years, economic inactivity in the working ages has changed dramatically in both scale and appearance: quantitatively, it has been practically halved; qualitatively, it has become highly masculinised and now affects a large majority of people living alone (or, more rarely, with another economically inactive person).

Figure – **Family structure of households according to the man's profession**



Sources and coverage: INSEE, *enquête Emploi* (Labour Force survey) (2019); male reference persons or spouses in households with no retirees or economically inactive persons aged 60 years and over; the analyses conducted at individual level are carried out on the field of reference persons and spouses of households with no retirees or economically inactive persons aged 60 years and over.

in 1982 to a greater absence of spouses among white- and blue-collar workers. For women, the proportion of executives with no spouse drops slightly (from 35% in 1982 to 32% in 2019), whilst it increases among white-collar workers (from 23% to 34%) and blue-collar workers (from 20% to 39%). In short, the absence of a spouse is more concentrated in the working classes for men, while it spreads and equalises across all social classes for women. Thus, although "being in a couple" may appear as a resource (Masclet *et al.*, 2020), it is both rarer and more unevenly distributed in 2019 than it was in 1982.

3.2. … Which are Disrupting the Households Structure

Under the impetus of these dynamics, but also of the transformations in the social structure of conjugal unions, French society changed profoundly between 1982 and 2019, which is reflected in the evolution of Household PCS (Table 9). Overall, these transformations have led to a strengthening of the proportion of households[20] located at both the top and bottom of the socio-professional structure. As such, there is a sharp increase in the weight of households with a predominantly executive and middle-management background (groups I and II) and, admittedly more moderately, an increase in the proportion of households with an economically inactive or white-collar worker with an economically inactive or no spouse (sub-groups VII-A and VI-A), which are now the poorest. At the same time, the decline in female economic inactivity and the rise in the proportion of people with no spouse have led to a profound internal transformation of groups and sub-groups of households with an economically inactive or no spouse, with the proportion of households with no spouse now far exceeding that of mono-active couples. Beyond these general trends, four evolutions in household structure deserve to be mentioned.

The first and main development in the socio-professional structure of households over the last 40 years has been the massive transformation in employment structure, which has resulted in an increase in the proportion of the first two groups of the household nomenclature (it has tripled,

20. The analyses presented below relate to the field of households with neither a retiree nor an economically inactive person aged 60 years or over.

Table 9 – **Share of the groups and sub-groups of the Household PCS in 1982 and 2019**

	1982	2019	Change (%)
I. Predominantly executive households	3.5	10.5	+200
I-A Executive with executive	1.3	4.9	+279
I-B Executive with middle-management profession	2.2	5.7	+157
II. Predominantly middle-management (or executive) households	12.4	19.4	+56
II-A Executive with white or blue-collar worker	1.9	3.5	+88
II-B Executive with economically inactive or no spouse	6.2	8.9	+43
II-C Middle-management or executive profession with self-employed small business owner	1.2	2.6	+111
II-D Middle-management profession with middle-management profession	3.1	4.4	+41
III. Predominantly white-collar (or middle-management) households	21.1	22.4	+6
III-A Middle-management profession with white- or blue-collar worker	7.8	8.9	+14
III-B Middle-management profession with economically inactive or no spouse	10.1	11.0	+9
III-C White-collar worker with white-collar worker	3.3	2.5	−23
IV. Predominantly self-employed small business owner households	13.6	6.7	−51
IV-A Self-employed small business owner living with another self-employed or with an economically inactive adult or lives alone	10.9	4.1	−63
IV-B Self-employed small business owner with white- or blue-collar worker	2.7	2.7	−1
V. Predominantly blue-collar worker households	15.1	9.5	−37
V-A Blue-collar worker with white-collar worker	9.9	7.5	−24
V-B Blue-collar worker with blue-collar worker	5.2	2.1	−60
VI. Households with a white- or blue-collar worker	29.2	24.1	−17
VI-A White-collar worker with economically inactive or no spouse	10.7	13.4	+25
VI-B Blue-collar worker with economically inactive or no spouse	18.4	10.7	−42
VII. Economically inactive households	5.1	7.4	+45
VII-A Economically inactive with economically inactive or no spouse	5.1	7.4	+45

Sources and coverage: INSEE, *enquête Emploi* (Labour Force survey) 1982, 2019; households with no retirees or economically inactive people aged 60 years or over.

and more than doubled, respectively.) At the same time, the increase in women's economic activity, the increase in their level of qualifications and the strengthening of homogamy among graduates of prestigious higher education institutions (Bouchet-Valat, 2014) have contributed to increasing the proportion of homogamous executives: the proportion of executives (both men and women) in a couple with an executive or partner in a middle-management profession increased from 36% in 1982 to 54% in 2019. Together, these developments are part of the increase in the proportion of predominantly executive households in society.

The decline in and transformation of self-employed small business owners is a second notable development, with the professions of self-employed small business owners whose workforce has declined least being the least endogamous. Of 6% of households in 1982, couples composed of two self-employed small business owners became scarce in 2019 (they represent just 1% of households), as did those composed of a male self-employed small business owner and an economically inactive woman. As such, it was sub-group IV-A that absorbed all of the decline observed in group IV. Conversely, the transformation of some self-employed small business owners and their lifestyle (Bernard, 2017; Laferté, 2018) has resulted in an increase in the proportion of households composed of a self-employed small business owner in a couple with an executive or someone in a middle-management profession (II-C): in 2019, one in four self-employed small business owners belonged to the II-C sub-group, compared to 6% in 1982.

The third development that can be observed through the Household PCS is the strengthening of divides in white- and blue-collar worker households, which refers to the growth of women's economic activity, the increase in the proportion of people with no spouse, and various desegregation processes among the working classes (Schwartz, 1998). White-collar worker couples evolve in two opposite directions: the proportion of white-collar workers with an economically inactive or no spouse (VI-A) increases, but so does the proportion of white-collar workers in a couple with an executive (II-A). While blue-collar workers are also more concerned by hypergamy in 2019 than in 1982 (a sharp increase in the proportion of those who are classified in groups II and III), they remain more heavily concentrated in groups V and VI (Table 10). These developments are consistent with the breakdown of the "archipelago of white-collar workers" (Chenu, 1990) observed over the period and, more generally, the contribution of the marital status and social position of the spouse to the segmentation of the working classes (Amossé, 2019b; Masclet *et al.*, 2020).

As a result of these developments, the composition of group VI has changed fundamentally: couples with a male blue- or white-collar worker and an economically inactive spouse who formed the basis in 1982 are now replaced by households composed of white- or blue-collar workers with no spouse. This movement widens the differences in living conditions and housing of group VI white- and blue-collar workers and those of other groups, contributing to the increasing heterogeneity of working class households (Amossé, 2019a; Cayouette-Remblière, 2015).

The fourth and final evolution concerns the growing weight of group VII (economically inactive households), which goes hand-in-hand with its internal transformation. In 1982, the majority of economically inactive men (68%) already belonged to this group, but only a small proportion of economically inactive women (13%) did. With the end of the housewife model, economic inactivity is increasingly associated with the most fragile social positions and, in 2019, 47% of economically inactive women and 75% of economically inactive men belong to this group, more often than

Table 10 – **Classification of white- and blue-collar workers in the Household PCS groups in 1982 and 2019**

Proportion of individuals in the group… / ranked among the households…:	… White-collar worker		… Blue-collar worker	
	1982	2019	1982	2019
predominantly middle-management (II)	5	8	0	3
predominantly white-collar worker (III)	33	30	5	11
predominantly self-employed small business owner (IV)	5	6	2	2
predominantly blue-collar worker (V)	27	20	48	43
with a white- or blue-collar worker (VI)	30	37	44	40
Total	100	100	100	100

Sources and coverage: INSEE, *enquête Emploi* (Labour Force survey) 1982, 2019; all white- and blue-collar worker reference persons or spouses of households with no retirees or economically inactive people aged 60 years or over.

not because they do not have a spouse (with economically inactive couples becoming rarer over the period, decreasing from 20% to 6% of the group). This evolution is, on the one hand, driven by an increase in the duration of studies (the proportion of students doubles in the population considered)[21] and the period of professional integration (Epiphane *et al.*, 2019), and, on the other hand, induced by the fragility and precariousness of growing segments of working class households that are on the fringes of employment (Perrin-Heredia, 2009; Rosa Bonheur, 2017).

* *
*

Based on statistical analyses carried out within the framework of the last socio-professional nomenclature reform, the Household PCS provides a new reading grid for society. It responds to the need for a definition of the social position at household level for various areas of analysis (demographic behaviours, child development, educational practices and performance, economic and housing situations, etc.). Multidimensional and backed by the socio-professional groups of adults in the household, it reports on their cross-referenced situations by proposing 7 hierarchical groups and 16 sub-groups where both social homogamy and mono- or bi-activity are identified. Retaining a unique place in the modular self-employed small business owner category, the Household PCS can be used in a stratification perspective at group level (even grouping them together if we want to adopt a binary, ternary class diagram, etc.) or as-is in order to preserve the wealth of information associated with sub-groups, possibly on sub-fields (e.g. households with executives, self-employed small business owners, blue-collar workers, etc.). Compared to existing categorisations (reference person and dominant position), it is both heuristic from a descriptive point of view and statistically powerful from an explanatory point of view. Made available in official statistics surveys from 2022 and simple to use retrospectively, it enables a wide range of new empirical research at household level, on classic questions posed by statisticians and social scientists, to be considered. □

21. These are the reference persons and their spouses of households with no retirees or economically inactive people aged 60 years and over.

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6472323/ES532-33_Amosse-Cayouette_Annexe-en-ligne_Online-Appendix.pdf

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Economie et Statistique / Economics and Statistics

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Economie et Statistique / Economics and Statistics publie des articles traitant de tous les phénomènes économiques et sociaux, au niveau micro ou macro, s'appuyant sur les données de la statistique publique ou d'autres sources. Une attention particulière est portée à la qualité de la démarche statistique et à la rigueur des concepts mobilisés dans l'analyse. Pour répondre aux objectifs de la revue, les principaux messages des articles et leurs limites éventuelles doivent être formulés dans des termes accessibles à un public qui n'est pas nécessairement spécialiste du sujet de l'article.

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Les propositions d'articles, en français ou en anglais, doivent être adressées à la rédaction de la revue (redaction-ecostat@insee.fr), de préférence en format MS-Word. Il doit s'agir de travaux originaux, qui ne sont pas soumis en parallèle à une autre revue. Un article standard fait environ 11 000 mots en français (y compris encadrés, tableaux, figures, annexes et bibliographie, non compris éventuelles annexes en ligne). Aucune proposition initiale de plus de 12 500 mots (11 500 pour les soumissions en anglais) ne sera examinée.

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- Un fichier d'une page indiquant : le titre de l'article ; le prénom et nom, les affiliations (maximum deux), l'adresse e-mail et postale de chaque auteur ; un résumé de 160 mots maximum (soit environ 1 050 signes espaces compris) qui doit présenter très brièvement la problématique, indiquer la source et donner les principaux axes et conclusions de la recherche ; les codes JEL et quelques mots-clés ; d'éventuels remerciements.
- Un fichier anonymisé du manuscrit complet (texte, illustrations, bibliographie, éventuelles annexes) indiquant en première page uniquement le titre, le résumé, les codes JEL et les mots-clés.

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Economie et Statistique / Economics and Statistics publishes articles covering any micro- or macro- economic or sociological topic, either using data from public statistics or other sources. Particular attention is paid to rigor in the statistical approach and clarity in the concepts and analyses. In order to meet the journal aims, the main conclusions of the articles, as well as possible limitations, should be written to be accessible to an audience not necessarily specialist of the topic.

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- A one-page file providing: the title of the article; the first name, name, affiliation-s (at most two), e-mail et postal addresses of each author; an abstract of maximum 160 words (about 1050 characters including spaces), briefly presenting the question(s), data and methodology, and the main conclusions; JEL codes and a few keywords; acknowledgements.
- An anonymised manuscript (including the main text, illustrations, bibliography and appendices if any), mentioning only the title, abstract, JEL codes and keywords on the front page.

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