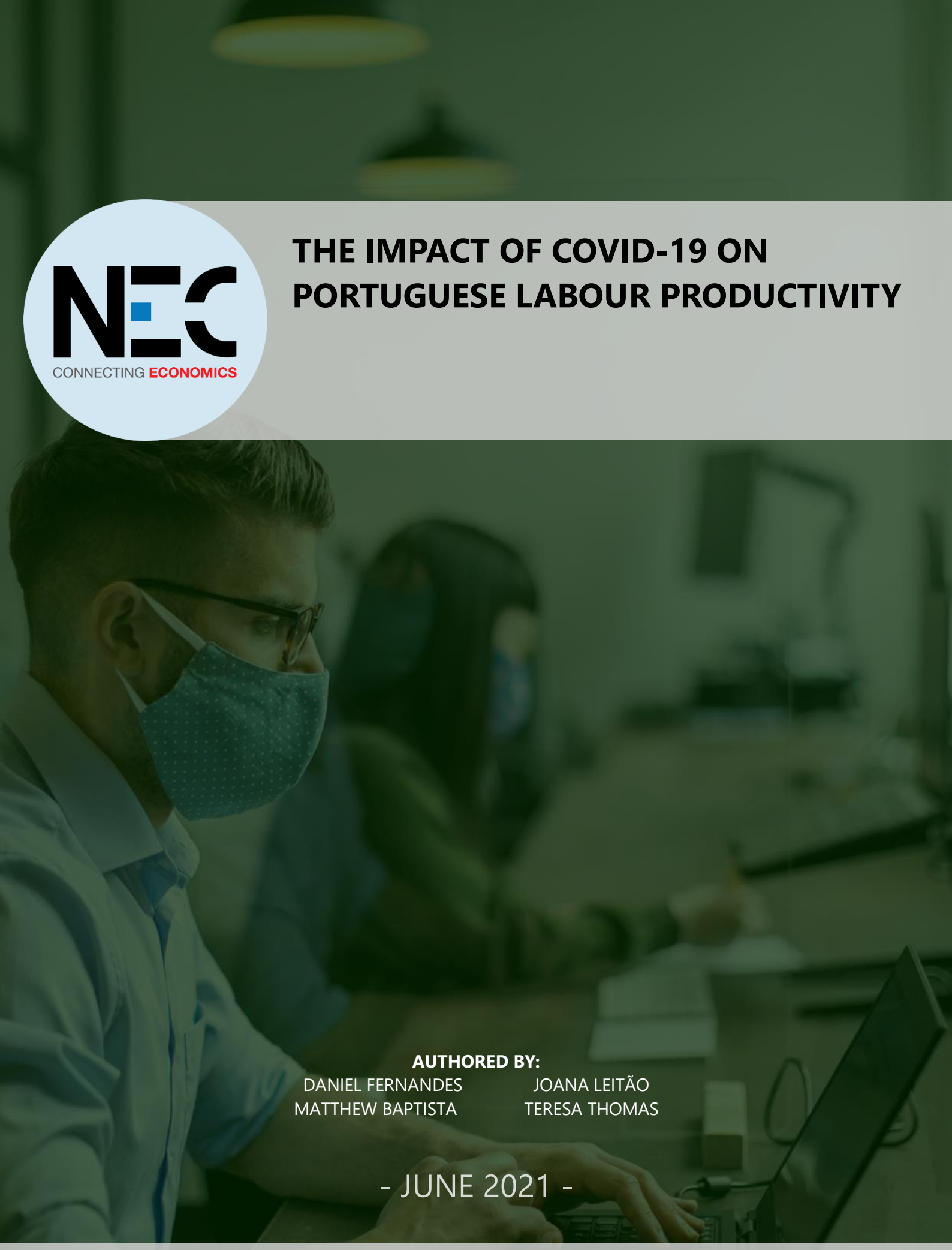

CONNECTING ECONOMICS

THE IMPACT OF COVID-19 ON PORTUGUESE LABOUR PRODUCTIVITY

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In partnership with:

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THE IMPACT OF COVID-19 ON PORTUGUESE LABOUR PRODUCTIVITY

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Abstract

The impact of Covid-19 in all aspects of the economy is undeniable. This paper aims at studying the consequences that the pandemic and the consequent lockdown and support measures had on labour productivity in Portugal in 2020. In order to do so, a similar methodology to the one applied in Bloom et al. (2020) was used, adapting it to data constraints. Information from the *Fast and Exceptional Enterprise Survey*, an exceptional firm panel survey, and from the *Balance Sheet - Harmonized Panel* was used to measure the impacts of the pandemic in business activity and consequently on productivity. According to the results, labour productivity of Portuguese firms fell 5.87% in 2020, with the magnitude of the decrease depending on firm characteristics such as dimension, sector and exporting factor. In particular, the results point to a sharper reduction on productivity in micro-enterprises, in the Food and accommodation services and Transportation sectors, and in non-exporting firms.

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1. Introduction

Portuguese firms have generally faced a low level of productivity in comparison to other OECD countries. Even with the GDP boom that the country was experiencing before the pandemic, Portuguese productivity growth has been disappointing for the last two decades. Indeed, over the period 2014-2018, productivity increased a timid 0.02% annually, falling largely behind the OECD's annual average growth rate of 0.9% and the Euro area average of 0.6% (*"Portugal: Productivity", OECD Insights on Productivity and Business Dynamics, October 2019*); considering labour productivity (measured as the value added per worker), Portugal is highly unproductive relative to other OECD countries. The productivity gap is especially larger in small firms, amounting to only 25% of OECD's average labour productivity level. This is particularly worrisome, as small firms account for a large employment share, meaning that low productivity also affects the labour market, as there is a strong correlation between wages and productivity. Besides recent positive developments, Portugal needs to continue improving framework policies and institutional efficiency in order to convergence to OECD productivity levels.

The pandemic seems to accentuate this tendency. Indeed, the effects of the unprecedented negative shock that the pandemic has caused are consensual across economists. Both the negative shocks in demand and supply have unambiguously contributed to the overall fall in output and in economic growth. On the demand side, consumption and especially investment have steeply dropped, as uncertainty increased; on the supply side, lockdowns have hampered firms' revenues and subsequently, their ability to stay afloat, calling for massive monetary and fiscal packages to support solvency. Therefore, even with governments' support to soften the negative income shock and help the recovery, the effect of the pandemic on productivity is expected to be negative and must be assessed in order to redefine policies. As aggregate data for 2020, currently available at Statistics Portugal, does not capture the heterogeneity of the impact in terms of sectors, firm size, regions, among others, we have used information on a firm level basis provided by Bank of Portugal from *Fast and Exceptional Enterprise Survey*, a survey designed to evaluate the effects of the pandemic in the Portuguese economy, and *Balance Sheet - Harmonized Panel* which contains economic and financial information about non-financial Portuguese companies.

Hence, the discussion of post-pandemic productivity cannot ignore the old structural problems that have hampered productivity growth and therefore, policy for the recovery should take the opportunity to also implement structural changes that promote medium and long-run productivity growth.

2. Literature: a review of BoE analysis of the impact of COVID-19 on firms' productivity for Great Britain

Our main inspiration is Bloom et al. (2020), a BoE working paper which aims at evaluating the productivity impacts of Covid-19 for Great Britain. The Bank of England's study on productivity during Covid-19 is notable because of its combination of timeliness and depth information. This is permitted by the use of a monthly firm panel survey that complement traditional data. The authors target two measures: TFP, and labour productivity (per hour, and per job).

The most important feature of this work is the mobilized dataset. They use the Decision Makers Panel (DMP), a monthly firm panel, based on a survey. This source is what allows the authors to quantitatively assess the productivity impact so quickly, in spite of the great delay needed to obtain official accounting data for all firms. The sample goes back to 2016. The survey includes questions on inputs (including employment), outputs (including sales), prices and investment. The DMP averaged 3000 responses a month since 2019. The firms included are supposed to be representative of all businesses in the UK.

The DMP includes questions that are quantitative in nature, and some that are forward looking. By comparing to the actual data, the authors find that both the diagnostic and the expectations on firm situation are quite accurate. The DMP is accounting data, on a per-firm basis, and allows pairing the firms from the two sources.

The pre-Covid-19 productivity comes from company accounts data and is projected forward using DMP survey data. This forward projection will be the object of economic commentary. They then use the accounting framework of Baily et al. (1992) to decompose between within and between effects.

We now dive into the authors' methods to obtain the figures for productivity.

Since April 2020, new questions were included in the DMP. They ask what the marginal impact of Covid was on inputs, outputs, and prices. These are the questions used to project the productivity, first calculated from the traditional sources. Pre-Covid productivity is the average for 2017-2019 (they use data from Bureau Van Dijk). A key assumption is that the 2020 productivity is assumed identical to 2017-2019 value, in the counterfactual scenario in which the Covid-19 pandemic did not happen. The change observed in 2020 will thus be entirely due to the impact of Covid-19. This assumption is justified by the stagnation of productivity in the UK.

The first measure of interest was total factor productivity. To obtain it, the authors start from a Cobb-Douglas with L, K and M, and decompose the productivity of each factor.

Then, they take an interest in labour productivity, as the real value added per worker, with real value added being defined as:

$$[(Operating\ profits\ +\ total\ labour\ costs)/RGDP\ deflator]$$

As an additional exercise, they perform a decomposition of labour productivity in within/between effects. They weigh together the pre and post covid estimates of productivity for each firm, allowing input quantities to vary. The dependent variable is GVA per head or per hour, for each period and each firm.

The explanatory variables are:

- Variation of productivity in firm i (this is the within effect)
- Variation of labour between surviving firms
- Variation of labour going towards new firms
- Labour liberated from firms exiting the market

Measuring the impact of Covid 19 on inputs and outputs with the DMP deserves a bit more attention, as a few hypotheses were required from the authors to treat the data.

The new questions (regarding marginal effects on inputs, outputs, and prices) were asked "relative to what would have otherwise happened", and regarded the current quarter, the three following quarters, and after 2022. Responses were numerical. 2000 firms answered all the questions.

For labour, three separate questions were used for productivity. They touched employment, average hours worked per still active worker, percentage of furloughed workers.

The conclusion of the BoE's study is that TFP in the private sector reduced by up to 5% in Q4 2020 and by around 1% in the medium term, based on DMP projections.

They also find that the shock had asymmetric effects depending on sectors, and triggered reorganizations of production processes that will affect productivity, effects that the methodology allows to decompose due to the use of firm level data.

Within firm, productivity will be reduced due to intermediate costs increasing. This effect is partially compensated by the reallocation of labour between firms, as low productivity firms and sectors have been impacted the most by the pandemic. Other effects that may play in the long run are diminished R&D expenditure and CEO's time diverse to handle the pandemic. The between effect, which is positive for productivity, is not destructive creation, but simple destruction of unproductive firms, which will not be replaced by more productive peers.

3. Data

We used micro-level panel data provided by BPlim of *Banco de Portugal* (**BdP**) that includes two databases:

- *Fast and Exceptional Enterprise Survey* (**COVID-IREE**), which is an exceptional survey, created in a partnership between *Instituto Nacional de Estatística* (**INE**) and Banco de Portugal (**BdP**). Its target is to identify the main effects of the restrictions of economic activity of Covid-19 pandemic and its respective lockdown. Each company is identified by a nine-digit code. Our first focus group of questions is composed by: question 2- "*This period, is the Covid-19 pandemic having an impact in your company's business volume?*", which has as possible answers "*Yes, a reduction*", "*Yes, an increase*", "*No effect*" and "*I don't know/Won't answer*"; and 2.1-"*This week, indicate the best estimate of a reduction or increase of your company's business volume*", which has as possible answers "*0-10%*", "*10-*

25%", "*25-50%*", "*50-75%*", "*75-100%*". Our second focus group of question is composed by: question 4- "*This week, is the Covid-19 pandemic having an impact in the number of employees effectively working for your company?*", which has as possible answers "Yes, a reduction", "*Yes, an increase*", "*No effect*" and "*I don't know/Won't answer*"; and 4.1-"*This week, indicate the best estimate of a reduction or increase of your company's business volume*", which has as possible answers "*0-10%*", "*10-25%*", "*25-50%*", "*50-75%*", "*75-100%*".

In 2020, there were 10 surveys: 4 weekly ones in April, 5 bi-monthly ones ranging between the entire month of May until the first fortnight of July, and a monthly one in November. Since the November survey did not include questions 2 and 2.1, we will not include it in our data set.

- *Balance Sheet - Harmonized Panel* (**CBHP**), contains economic and financial information about non-financial Portuguese companies. The data covered annual accounting data for each company. Each company is identified by the same nine-digit code as in the IREE survey. Despite having available data from 2008 until 2019, we will only use data from 2019, specifically the business volume and number of employees of each company.

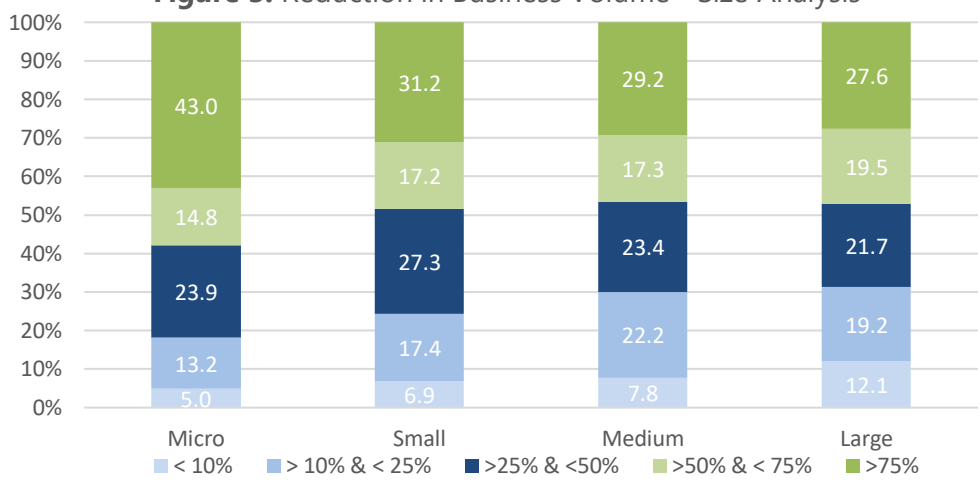
3.1 Description of the IREE Data

The analysis of the **IREE** data provided interesting conclusions regarding the effects of Covid-19 in the operations of firms depending on their size, sector and exporter character. In order to make this initial description of the data, the survey of 20-24 of April of 2020 was used.

The size of a firm is an important characteristic that influences its internal organization and, therefore, its resilience against shocks such as the Covid-19 pandemic. Overall, larger firms were more resilient than smaller firms. As it can be seen in **Figure 1,** micro and small firms were more likely to have shutdown (temporally or permanently) than medium and large firms. In terms of the impact of the pandemic on the business volume (**Figure 2**), in all the different size categories, more than 50% of the firms stated that it had decreased. Out of those, and as it can be seen in **Figure 3,** micro firms seem to have

suffered the most, with more than 43% of the firms reducing their business volume by more than 75%, while only 27.6% of large firms were in the same situation.

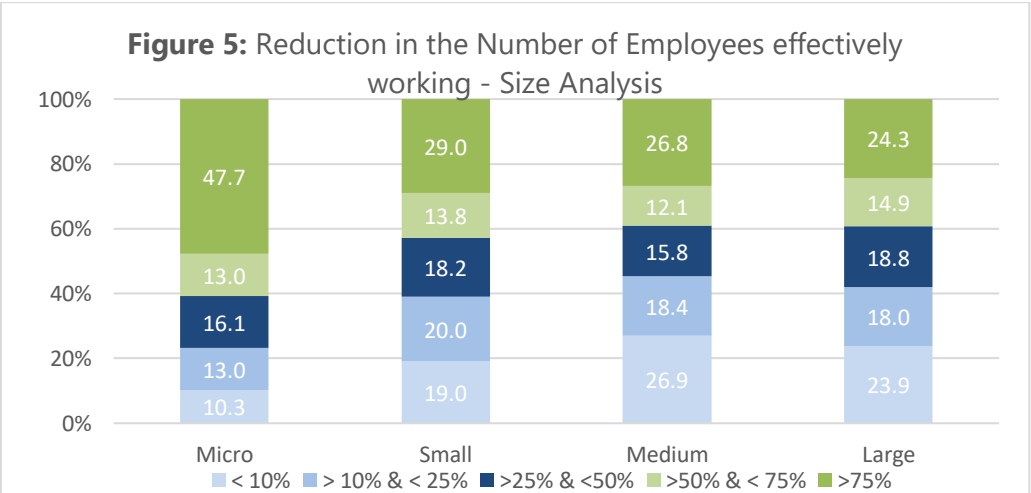
Figure 3: Reduction in Business Volume - Size Analysis



Source: IRRE, April 2020

Concerning the number of employees effectively working (**Figure 4**), more than 50% of small, medium, and large firms reported a reduction. However, in **Figure 5** it is possible to observe that micro firms, which suffered a decrease in their staff, have done it in a greater magnitude than the remaining size categories, with 48% of firms reducing the number of workers by more than 75%. The impact of the pandemic on the number of employees effectively working of the other size categories is rather heterogeneous.

Figure 5: Reduction in the Number of Employees effectively working - Size Analysis

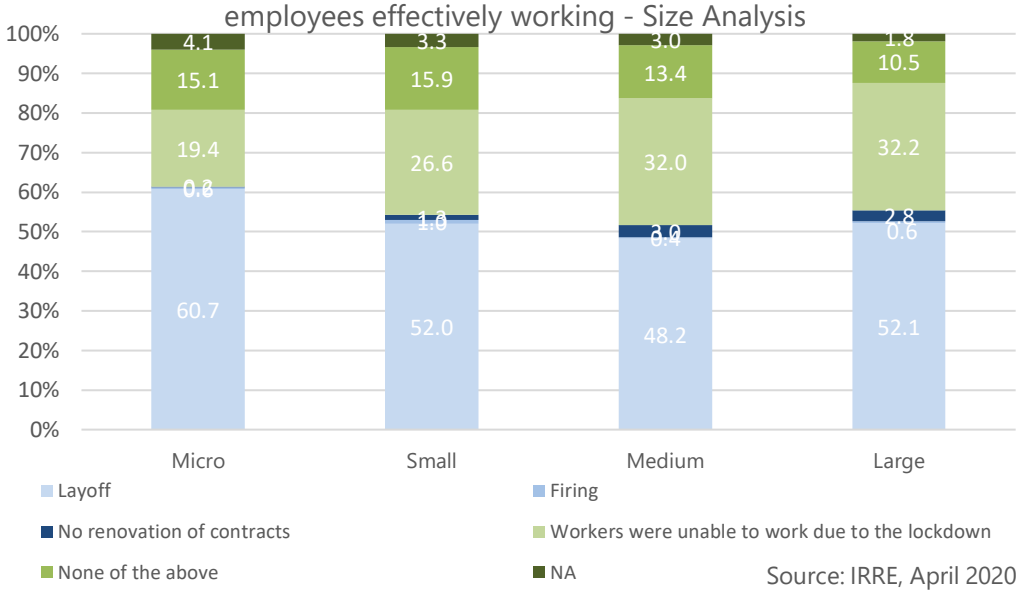


Source: IRRE, April 2020

More than 50% of micro, small, and large firms stated that the layoff program was the main reason for the reduction in their number of employees effectively working (**Figure 6**), with the program having a greater relevance in micro firms (60.7%). The fact that the

lockdown restrictions did not allow some workers to perform their job was the second most common reason for all types of firms.

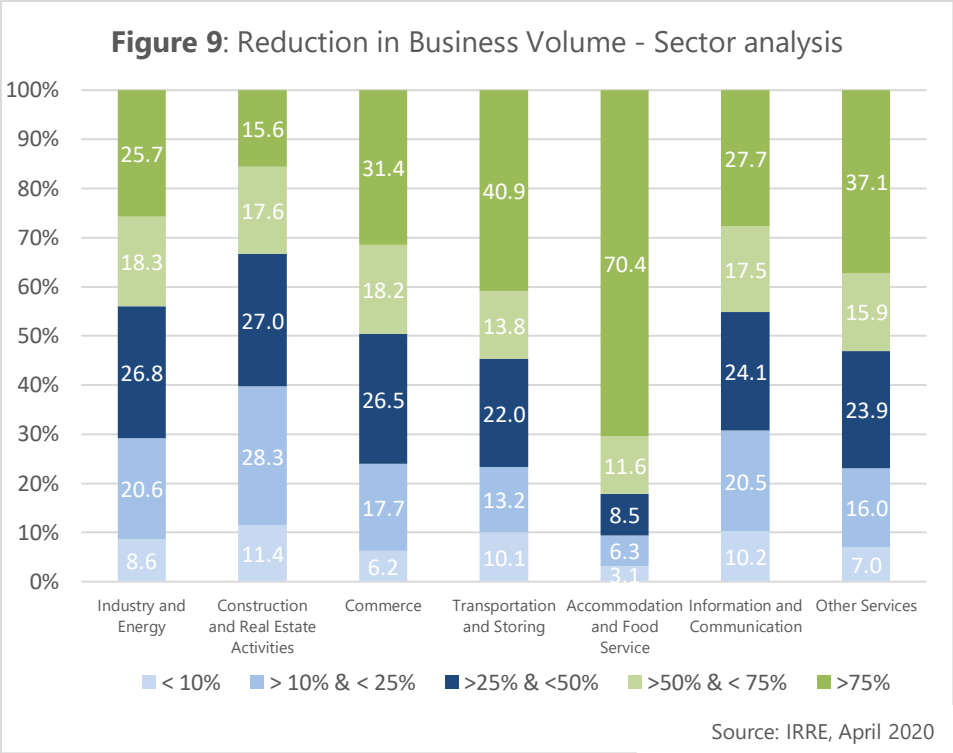
Figure 6: Reasons for the Reduction in the Number of employees effectively working - Size Analysis



Source: IRRE, April 2020

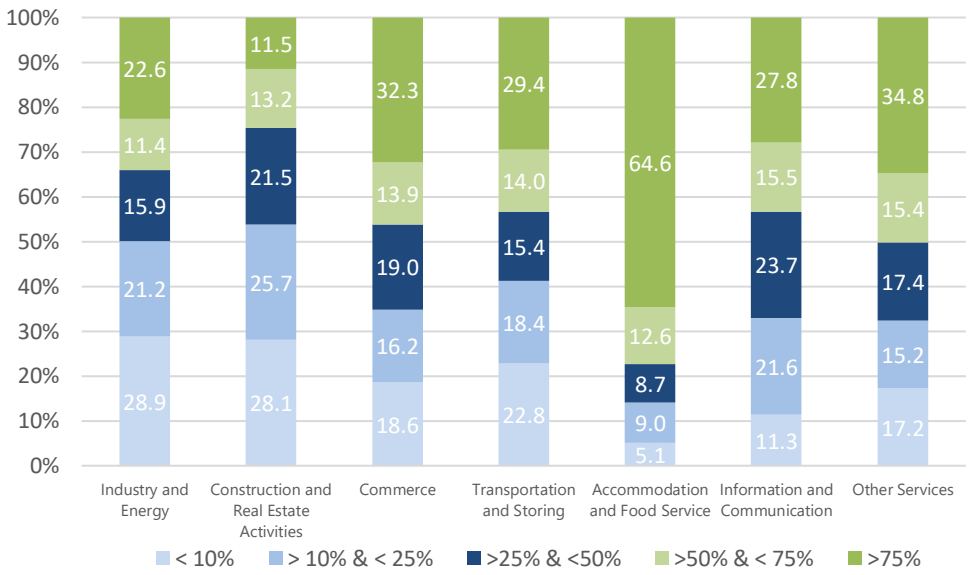
Overall, micro-sized and small firms have been more affected by the pandemic and the consequent lockdown measures than the other types of firms.

Additionally, it is critical to analyse the differences between sectors. As it was expected, sectors where activities were heavily dependent on human interactions were the most affected. As illustrated in **Figure 7**, 5.3% of firms in the Accommodation and Food Services sector and 1.5% of the firms in Commerce have closed permanently, while the rest of the sectors had less than 1% of firms in that situation. Regarding the impact on the business volume (**Figure 8**), the Accommodation and Food Services was once again the most affected sector with 88.6% of firms suffering a reduction in business activity, followed by the Transports and Storing sector with 79.5% of the firms in a similar position. Observing **Figure 9,** it is easy to conclude that the Accommodation and Food Services was the sector in which firms that reduced their activity suffered the greatest losses – 70.4% of firms reduced their business volume by more than 75%. The Transportation and Storing and the Commerce sectors were also deeply affected.



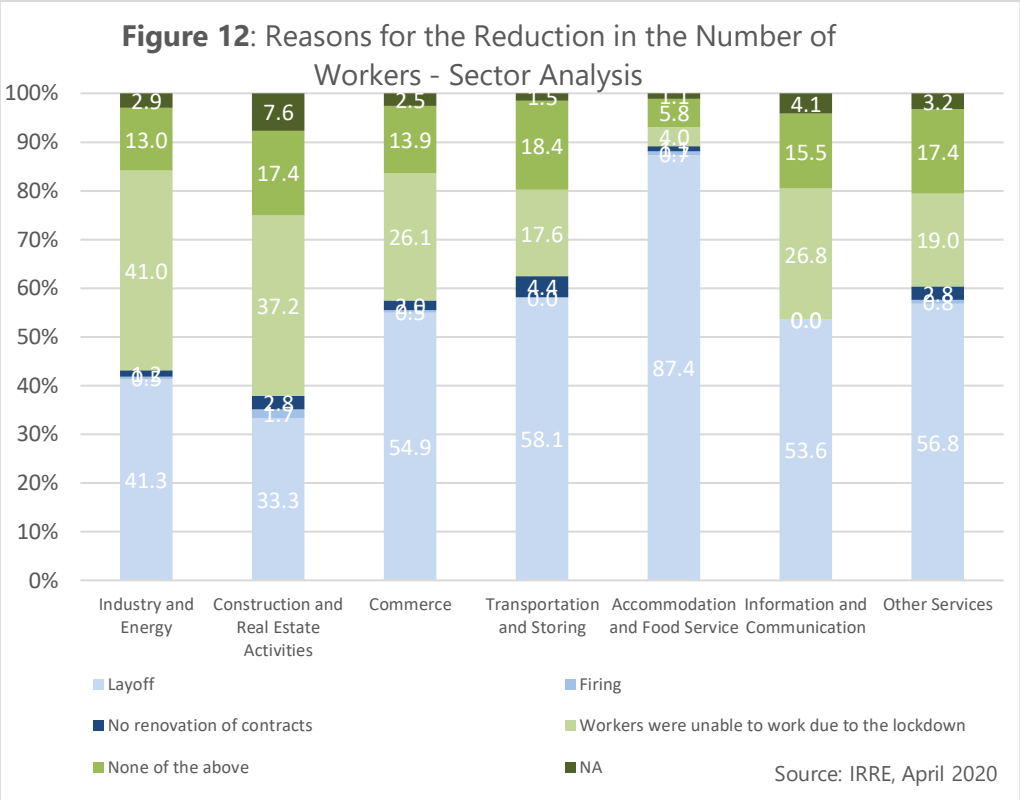
Concerning the number of employees effectively working (**Figure 10)**, 77.2% of the firms in the Accommodation and Food Services Sector has decreased their staff, while only 41.1% of firms in the Information and Communication Sector did the same. In **Figure 11,** it is possible to see the magnitude of the reduction of the staff in the Accommodation and Food Services sector, where 64.5% of the firms that reduced the number of employees did it by more than 75%.

Figure 11: Reduction in the Number of Employees effectively working - Sector Analysis



Source: IRRE, April 2020

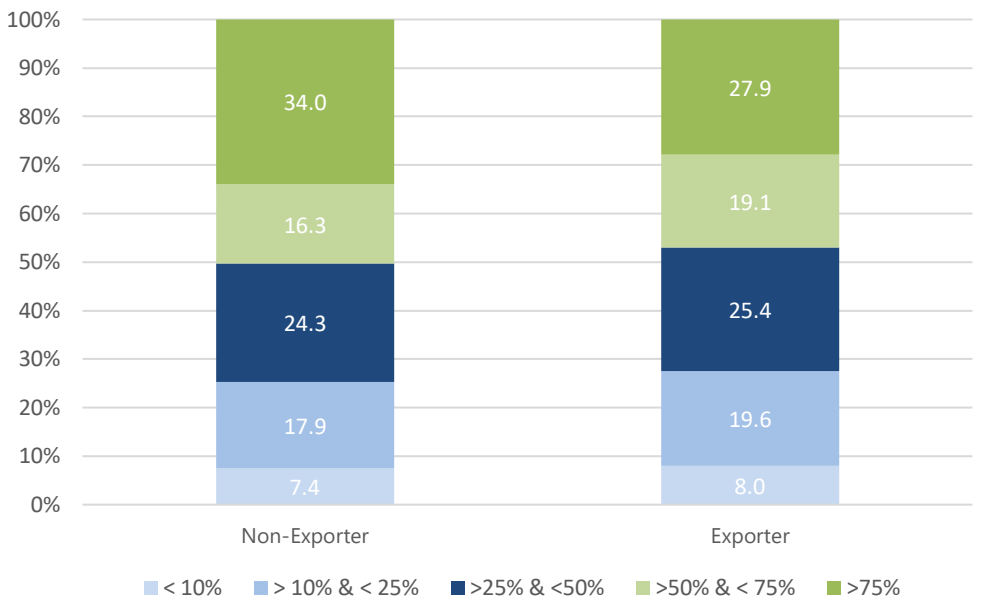
Regarding the main reasons for that reduction (**Figure 12**), the layoff program and the consequences of the lockdown measures were the most common in all sectors. The layoff program had a greater importance in Accomodation and Food Services (87%) followed by the Transportion and Storing sector (58%). The Industry and Energy sector was the one in which the movement restrictions were more relevant (41%).



The exporter character (or lack of it) of firms is also an important aspect to be analysed. Exporter firms seem to have been more resilient to the consequences of the pandemic than non-exporter firms have. For example, as shown in **Figure 13,** a higher share of non-exporting firms has either permanently (1.2%) or temporarily (0.7%) closed down when comparing to exporting firms.

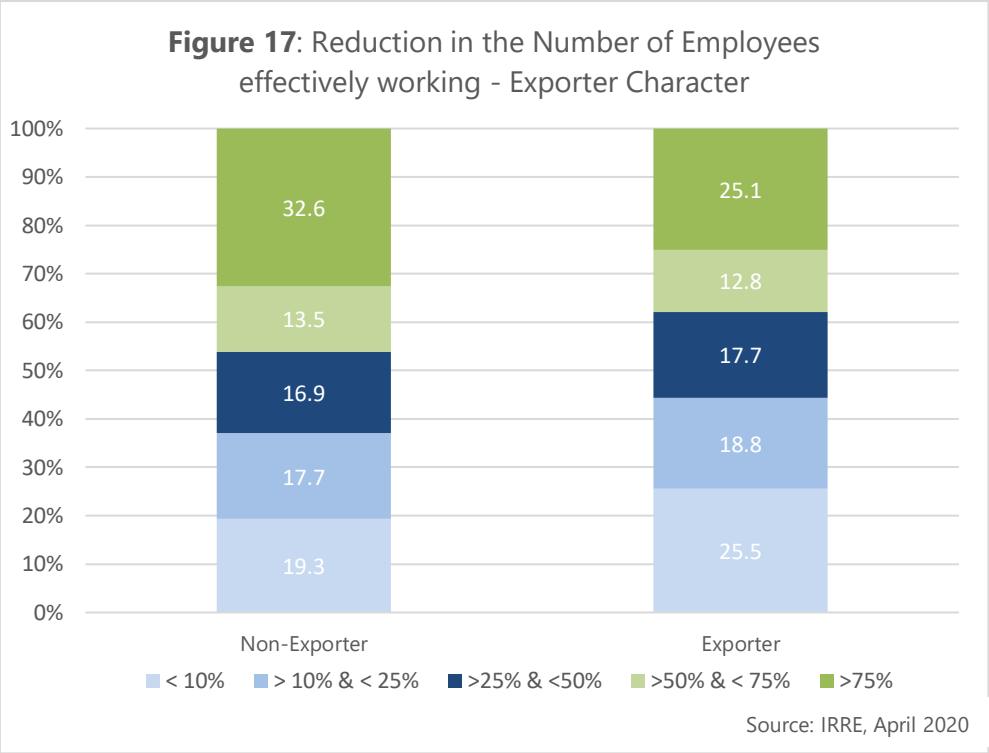
In terms of business volume (**Figure 14**) both types of firms have equally stated to have reduced their activity. However, and according to **Figure 15,** the magnitude of this reduction was greater for non-exporting firms, with 34% of firms having a reduction in business volume of more than 75%, which compares to 28% for exporting firms. For the other classes of business volume' reduction, the difference between export and non-export firms is not significant.

Figure 15: Reduction in Business Volume - Exporter Character

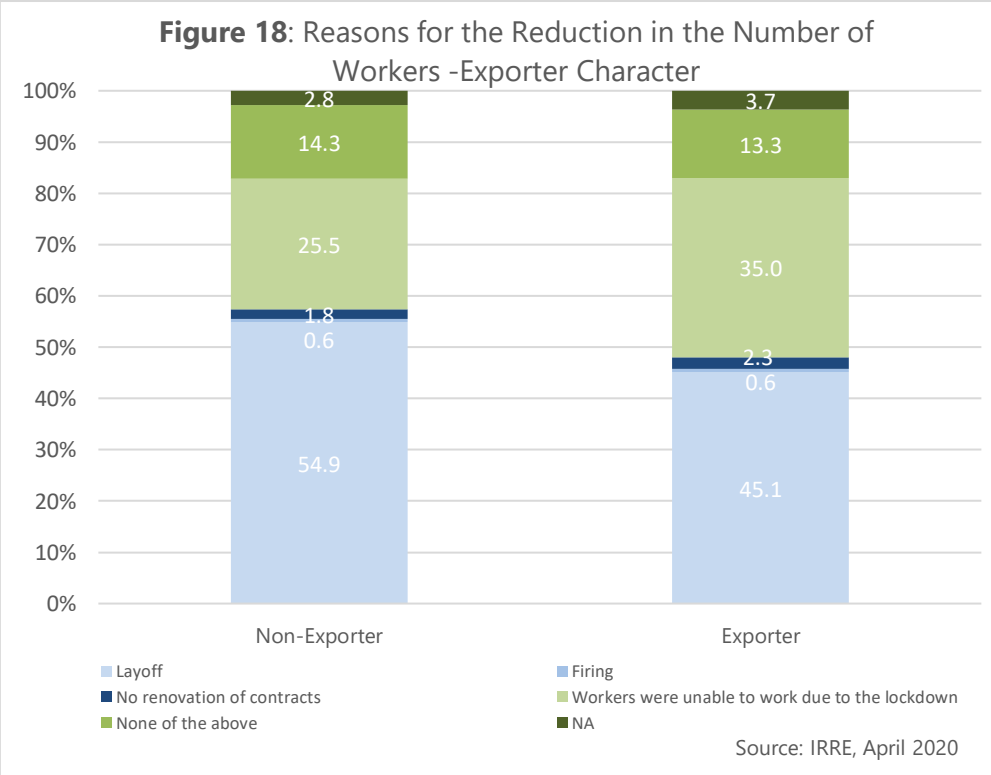


Source: IRRE, April 2020

When it comes to the staff, both types of firms have reduced their number of employees effectively working (**Figure 16**) and there is not a significant difference in terms of the number of firms. However, looking at **Figure 17,** the reduction in the number of workers was slightly greater in non-exporting firms – with 33% of firms reducing their staff by more than 75% - than in exporting firms (25% of firms).



As it can been in **Figure 18,** both types of firms stated that the layoff program was the main reason behind that reduction, having a higher prevalence in non-exporting firms (55%) than in exporting firms (45%). The movement restrictions were the second most common reason with a greater incidence in exporter firms (35%).



4. Methodology

Our target result is the variation rate of labour productivity between 2019 and 2020, which we can obtain with:

$$\frac{\frac{\sum_{i=1}^{N} value\ added_{i,2020}}{\sum_{i=1}^{N} nº\ of\ employees_{i,2020}}}{\frac{\sum_{i=1}^{N} value\ added_{i,2019}}{\sum_{i=1}^{N} nº\ of\ employees_{i,2019}}} - 1$$

Since we do not have access to the reported impact of Covid-19 on the value added of each company in the *Fast and Exceptional Enterprise Survey*, we will use business volume as a proxy variable. The logic is that relative variation of the business variable is the same as variation of value added, assuming that costs change in the same proportion as sales:

$$\frac{\sum_{i=1}^{N} business\ volume_{i,2020}}{\sum_{i=1}^{N} business\ volume_{i,2019}} = \Delta \sum_{i=1}^{N} business\ volume_i = \Delta \sum_{i=1}^{N} value\ added_i$$

Such that we can calculate 2020's aggregate value added by multiplying its 2019 value with 1 plus the reported variation rate of their business volume:

$$\sum_{i=1}^{N} value\ added_{i,2020} = \sum_{i=1}^{N} ((1 + \Delta\ business\ volume_i) * value\ added_{i,2019})$$

For these assumptions to be satisfied, however, costs should evolve in accordance with the business volume. If they do not, the variation of the proxy variable could be different from the original variable.

To calculate the impact of Covid-19 on number of employees, we used information on the changes to the number of employees effectively working reported in the *Fast and Exceptional Enterprise Survey*. These changes include firings and no renovation of contracts, as well as, reductions in labour associated with layoffs or inability to work due to the lockdown. This approach allows for a more comprehensive assessment on the impact Covid-19 on labour, as we are only considering employees that were effectively working, and therefore contributing to the firm's value added.

For the 2019's aggregate value added and number of employees, we use information from *Balance Sheet - Harmonized Panel*. As the database does not provide each company's value added, we had to calculate it with the following formula:

$$Value\ Added = Sales\ and\ Services\ Provided + Work\ for\ Own\ Company + Variation\ in\ Production\ Inventory + Suplementary\ Income + Exploration\ Subsidies - Supply\ and\ External\ Services - Indirect\ Taxes - Cost\ of\ Sold\ Merchandise\ and\ Consumed\ Materials$$

We also assumed that the impact of Covid-19 on business volume or in employees effectively working in companies which chose to not report the impact was of 0, such that we could use the impact of the other variable, which the company reported.

For the companies which reported that Covid-19 had a negative or positive impact on the business volume or number of employees effectively working, we assume that the actual impact was the middle value of the interval which they reported. (Ex: if a company reports its business volume decreased between 25% and 50%, we assume it decreased 37,5%).

We divided the 2020 year in three sections which we approached differently:

- **January-March**: Due to lack of data and since this period is prior to the Covid-19 related restrictions, we assume that the business volume and number of effective employees did not alter from the 2019 baseline.
- **April-July,1st fortnight**: We calculate an average of the reported impact of Covid-19 on the proxy variable, weighted on the length of the period reported. While reports of weekly surveys have a weight of 1/14 of the overall impact of Covid-19 on the respective variable during this period, bi-monthly surveys have a weight of 1/7.
- **July,2nd fortnight-December**: Since the restrictions were looser during this period, we assume that hypothetical answers to a survey covering this period would be the interval closer to 0, in comparison with the last survey (1st fortnight of July). For example, if in the 1st fortnight of July, a firm reported a decrease of business volume in the interval between 25% and 50%, we assume that for the rest of the year, it would report a decrease in the interval between 10% and 25%.

We can check availability and completeness of data in the following table:

January	No data	**June, 1st fortnight**	Available data
February	No data	**June, 2nd fortnight**	Available data
March	No data	**July, 1st fortnight**	Available data
April, 1st week	Available data	**July, 2nd fortnight**	No data
April, 2nd week	Available data	**August**	No data
April, 3rd week	Available data	**September**	No data
April, 4th week	Available data	**October**	No data
May, 1st fortnight	Available data	**November**	Incomplete data
May, 2nd fortnight	Available data	**December**	No data

Not every company answered to all surveys in the studied period (April 1st week to July 1st fortnight). We only use observations from companies which answered to every survey, or companies which only missed one survey since the other companies have incomplete observations and would require further assumptions, depending on the missing periods of each company.

Take T, a dummy variable, which equals 1 if the company answered all of the studied surveys, or all but one, and it equals 0 if the company did not. We assume T is independent from every studied variable, including number of employees (labour), business volume (sales), company's sector, company's size and whether the company exports or not:

$$T \perp business\ volume, \qquad T \perp labour, \qquad T \perp sector,$$
$$T \perp size, \qquad T \perp exporting\ profile$$

To ensure this assumption, we can distribute the existing observations over the variables in question, conditional on the number of surveys answered. The following table shows the number of companies which answered each number of surveys:

9	8	7	6	5	4	3	2	1
2343	1706	491	308	210	162	105	84	71

Since most companies answered either 9 or 8 surveys, we are going to distribute observations conditional on three groups: companies which answered 9 surveys; companies which answered 8 surveys; companies which answered less than 8 surveys.

Sector	9		8		<8	
	Nº	%	Nº	%	Nº	%
Industry	670	28.6	324	30.1	402	28.1
Construction	259	11.1	102	9.45	185	12.4
Commerce	719	30.7	341	31.7	435	30.4
Transportation	76	3.2	35	3.3	45	3.1
Food Service	144	6.2	70	6.5	84	5.9
Information	98	4.2	32	3	51	3.6
Other	377	16.1	172	16	229	16
Total	2343	100	1076	100	1431	100

Dimension	9		8		<8	
	Nº	%	Nº	%	Nº	%
Micro	485	20.7	221	20.5	337	23.6
Small	830	35.4	358	33.3	522	36.5
Medium	668	28.5	317	29.5	398	27.8
Large	360	15.4	180	16.7	174	12.2
Total	2343	100	1076	100	1431	100

Exporter	9		8		<8	
	Nº	%	Nº	%	Nº	%
Yes	1748	74.6	795	73.9	1011	70.7
No	590	25.4	281	26.1	420	29.3
Total	2343	100	1075	100	1431	100

As we can see from the last three tables, the distribution of observations over sector, dimension and exporting character is similar enough to accept the independence assumption. Therefore, we conclude that leaving out the companies that did not answer an excessive number of surveys does not take the internal representativeness of our sample.

5. Results

In 2020, according to the outlook of the IRRE, the sample of 3219 companies (corresponding to 26% of 2019 total valued added) recorded a reduction of 12% and 7% of aggregate value added and aggregate labour, respectively, which leads to an annual decrease of 6% of labour productivity. Looking at the actual data from Statistics Portugal, these figures compare with a drop of 5% in labour productivity for the total economy driven by a decrease of 6% in value added (GVA) and a reduction of 2% in labour

(employment). These differences may be related to a more negative outlook foreseen in the survey when compared to the economic evolution observed in the first semester. They can also result from differences in the definition of employment, since we exclude employees that are not effectively working. Additionally, the hypothesis considered for the second semester may also be conservative, as it does not fully account for the recovery and the extension of policy support measures, resulting in a more negative expectation for that period.

Size	VAB	Labour	Productivity
Micro	-13,67%	-6,42%	-7,74%
Small	-11,41%	-6,01%	-5,75%
Medium	-11,21%	-7,19%	-4,34%
Large	-12,36%	-6,59%	-6,17%
Baseline	-12,15%	-6,67%	-5,87%

Analyzing the impact of Covid-19 by size of the company, we can conclude that Medium-sized firms had the lowest absolute impact on labour productivity, due to both the lowest impact in terms of VAB and to the higher decrease of labour. When compared to medium sized' firms, small firms have a less pronounced reduction of labour and micro-sized firms have a higher decrease of activity, which explains a higher decrease of labour productivity.

To conclude, the higher decrease of labour and the smaller decrease of value added grants medium-sized companies the lowest decrease of labour productivity, of 4%. On the other hand, the high variation of value added grants micro-sized firms the highest decrease of labour productivity, of 8%.

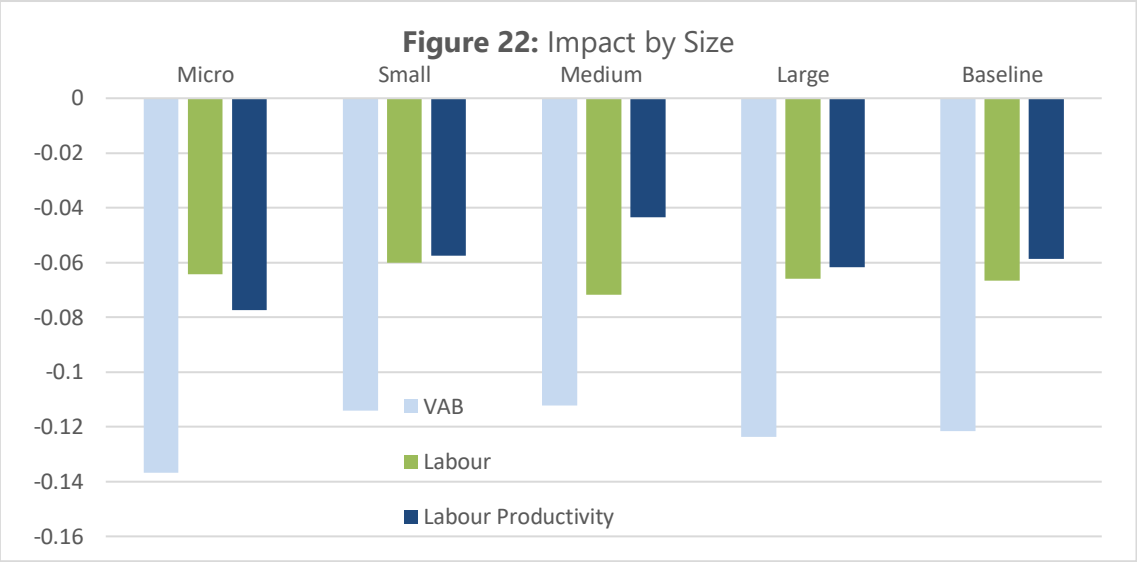


Figure 22: Impact by Size

It is possible to see under figure 22, that for both years, the bigger the size of the company, the higher is the labour productivity ratio.

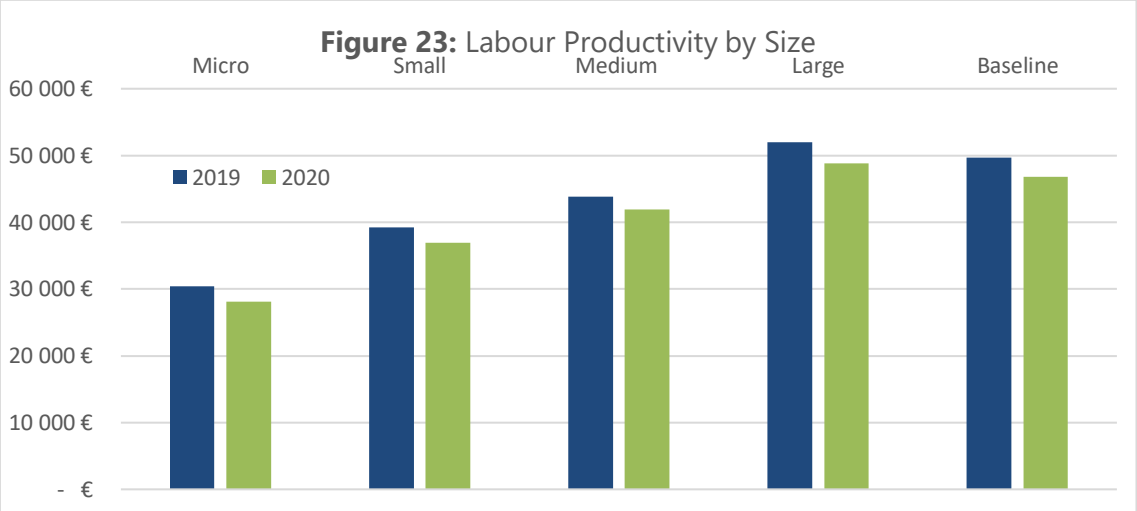


Figure 23: Labour Productivity by Size

Nevertheless, as these results already consider the effect of layoffs and workers unable to work due to lockdown, the impact of the pandemic on the estimated labour productivity is lower, and therefore more conservative.

Export	VAB	Labour	Productivity
Not Exporter	-12,73%	-6,13%	-7,03%
Exporter	-11,23%	-7,77%	-3,75%
Baseline	-12,15%	-6,67%	-5,87%

The non-exporting sector presents lower ratios of labour productivity for both years under analysis. The evolution in 2020, in this segment is explained by the higher impact of non-exporters' value added and the smaller decrease of labour.

Exporting companies had a drop in labour productivity (-4%) which was almost half of non-exporting companies (-7%), even reflecting small differences in VAB and Labour percentage changes.

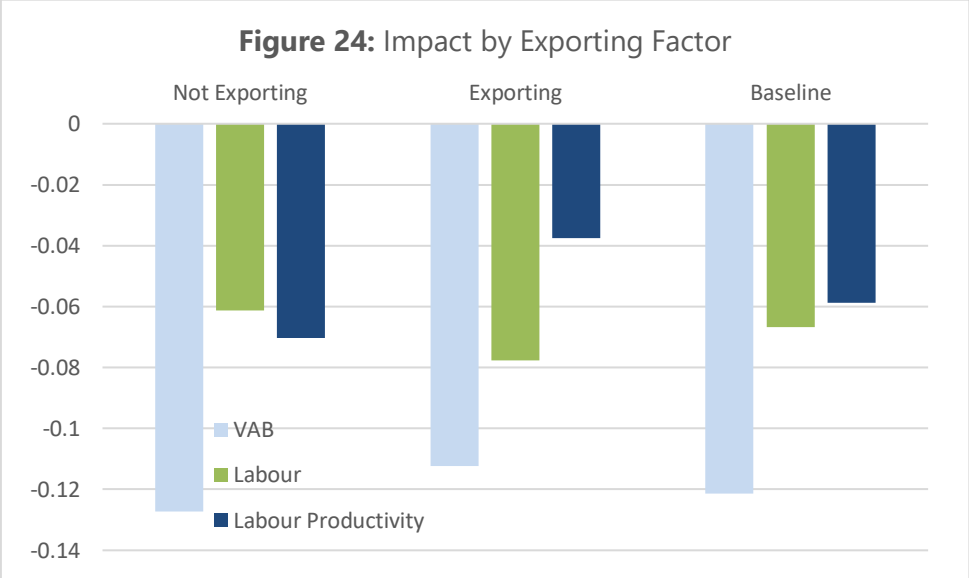


Figure 24: Impact by Exporting Factor

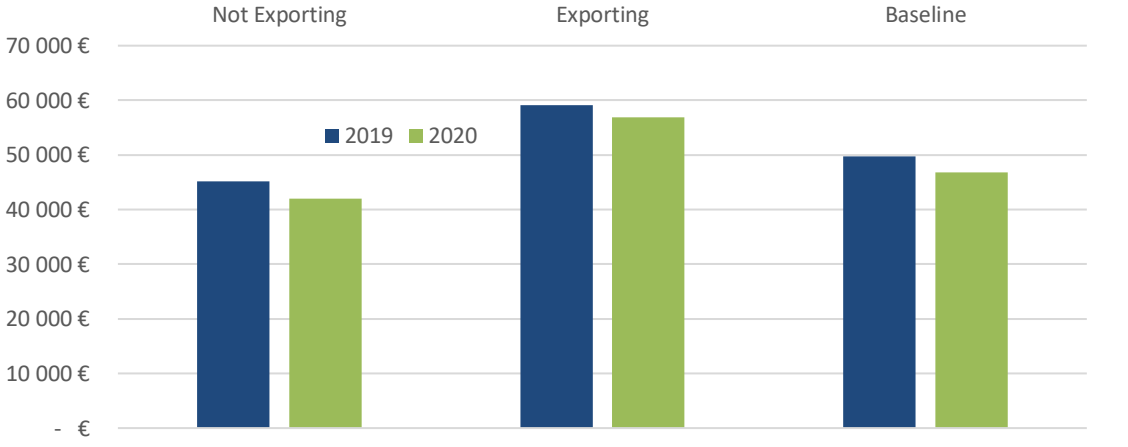


Figure 25: Labour Productivity by Exporting Factor

Although the drop of value added was similar among exporting and non-exporting firms, that of non-exporting firms was more intense. This may be explained by the non-exporting nature of firms with activities of higher risk of infection. This argument is further reinforced with **Figure 13**, which shows that non-exporting firms suffered a higher percentage of temporary and permanent closings.

Analyzing the impact of Covid-19 by the sector of the company, the Transportation and Storage sector and the Food Service and Accommodation sector had, by far the biggest impact in terms of value added, being -27,56% and -33,08%, respectively. This type of

activities was the most affected by the increase of remote working and the enforcement of Covid-19 restrictions on gatherings, respectively. This argument, specifically for the Food Service sector, is reinforced again by **Figure 7** which displays a higher percentage of temporary and permanent closures of activities for companies of this sector.

In terms of actual labour productivity, the sectors with the highest negative impact were the Transportation and Storing and the Food Service and Accommodation sectors, since, although they had the highest decreases of labour, this was not enough to compensate the massive decrease of value added. The sectors with the lowest negative impact were the Industry and the Commerce sectors, since their moderate decrease of labour was almost enough to compensate for their moderate decrease of value added.

Sector	VAB	Labour	Productivity
Industry and Energy	-8,73%	-6,74%	-2,14%
Construction and Real Estate Activities	-10,18%	-6,53%	-3,90%
Commerce	-7,56%	-5,17%	-2,52%
Transportation and Storage	-27,56%	-8,07%	-21,20%
Accommodation and Food Service	-33,08%	-14,36%	-21,85%
Information and Communication	-5,54%	-0,90%	-4,68%
Other Services	-12,06%	-7,35%	-5,09%
Baseline	-12,15%	-6,67%	-5,87%

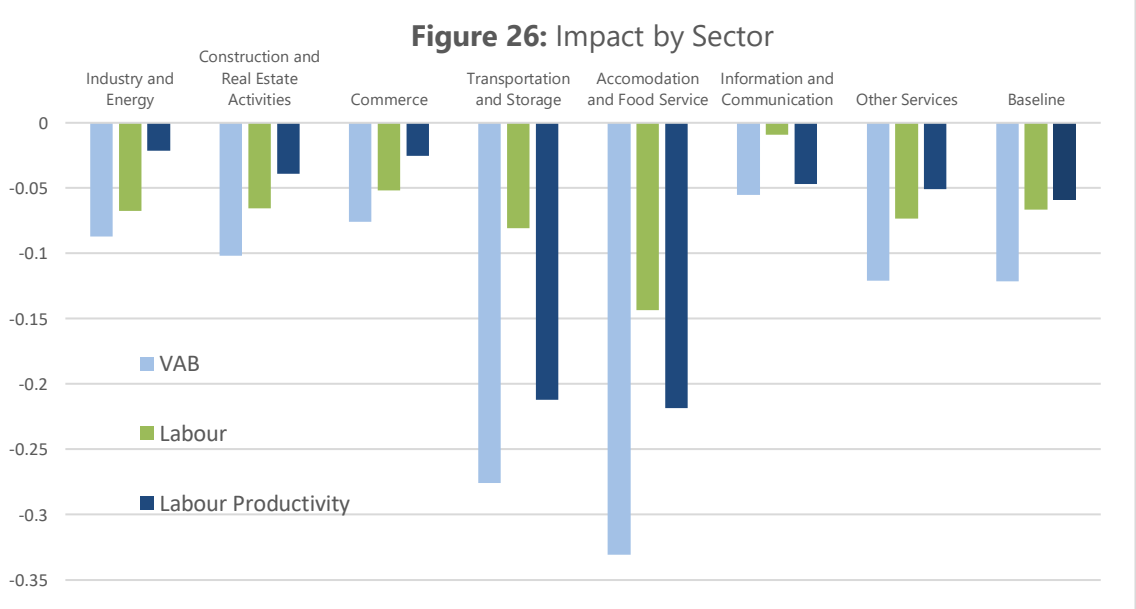
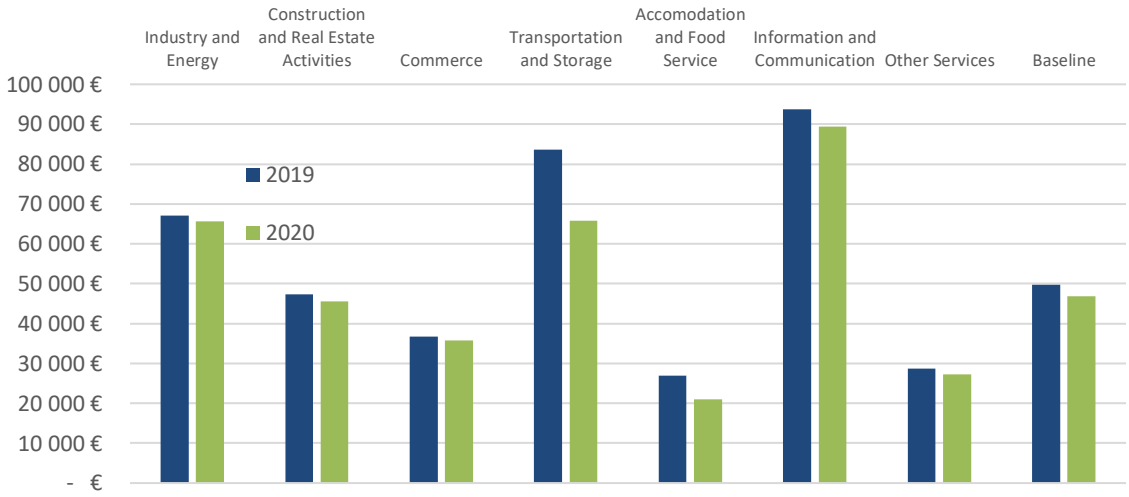


Figure 26: Impact by Sector

Figure 27: Labour Productivity by Sector



6. Conclusion

The short-term impact of Covid-19 is clear. Labour productivity has fallen, but policy measures, like State' guarantees and tax exemptions, help to mitigate some effects. According to IREE questionnaire, micro and small firms have experienced a larger fall relative to bigger firms; export firms proved to be more resilient and productivity in industries with higher rate of teleworking has dropped less relative to others.

The effects in terms of firms' dimension and export profile aligns with the proposition that economies of scale and industry concentration, accompanied by the investment in intellectual property and digitalization, that are usually unattainable to these smaller firms, allow bigger companies to be more productive than micro firms, who face entry hardships and hardly manage to stay in the market. Thus, an exogenous negative shock like this will inevitably have a much higher impact on micro-firms' productivity relative to bigger firms.

Although globally we will see a negative effect of the pandemic on productivity, in the long-term the reallocation of factors across industries and the inevitable restructuring effect that it involves may lead to benefits. According to Stefen Profit, Deputy Director General in the Economic Policy Department of the German Federal Ministry of Economic Affairs and Energy, the pandemic will lead to a fall in productivity, due to postponement

of investment, a fall in investment in R&D and a reduction in firm entry rates and a disruption in the labour market. On the other hand, he affirms that the liquidity provision to young and small firms will help their productivity. Additionally, he points out that there will be a **compensation effect**, as firms that were unproductive before the pandemic will not survive, which can contribute to an overall increase in productivity as well. However, he also acknowledges that mitigation measures will allow these unproductive firms to stay afloat, delaying the compensation effect, meaning that the overall prediction is that productivity will fall.

Nevertheless, regardless of a company's dimension, these potential long-run improvements of productivity caused by Covid-19 cannot be ignored. For instance, if lower productivity firms close their business as they face more difficulties to circumvent the crisis, there will be a more efficient allocation of resources, leading to improvements in labour productivity. Furthermore, the pandemic forced some businesses to restructure and reinvent themselves, with a focus on digitalisation, which may also enhance productivity in the long run. Also, the implementation of policy measures to support firms (such as moratoria and layoffs schemes) has prevented the destruction of productive capacity and human capital, avoiding the potential closure of efficient but liquidity constrained firms and preventing a steep increase in unemployment. Although these employment support policies may actually cause a temporary decrease in labour productivity when measured by GVA per worker (due to the fact that changes in employment will be lower than changes in GVA), in the medium and long-term, these policies can help reduce the negative effect of the pandemic on productivity and actually enhance it.

Will the pandemic create a long-lasting scar in the economy's productivity? Is teleworking a permanent solution to decrease costs or will it negatively affect production and location spill overs that are crucial to productivity? Is the compensation effect enough to overcome the general fall? In this new context, firms will need to adapt to the new global conditions that will be staying for a while. In addition, policymakers should promote structural changes that tackle the pre-pandemic productivity problem. Thus, the pandemic is an opportunity to promote productivity in the medium and long run, as the new challenges may turn out to be positive.

7. References

[1] Banco de Portugal Microdata Research Laboratory (BPLIM) (2021): Central Balance Sheet Harmonized Panel. Extraction: June 2021. Version: V1. BANCO DE PORTUGAL. Dataset. https://doi.org/10.17900/CB.CBHP.Jun2021.V1

[2] Statistics Portugal and Bank of Portugal (2021): Fast and Exceptional Enterprise Survey – COVID-19. Extraction: April 2021. Version: V1.

[3] Dave Altig, Scott Baker, Jose Maria Barrero, Nick Bloom, Philip Bunn, Scarlet Chen, Steven J Davis, Julia Leather, Brent Meyer, Emil Mihaylov, Paul Mizen, Nick Parker, Thomas Renault, Pawel Smietanka & Greg Thwaites (2020). "Economic uncertainty before and during the Covid-19 pandemic". Bank of England Staff Working Paper Nº 876.

8. Appendix

Figure 1 – Situation of the Firms: Size Analysis

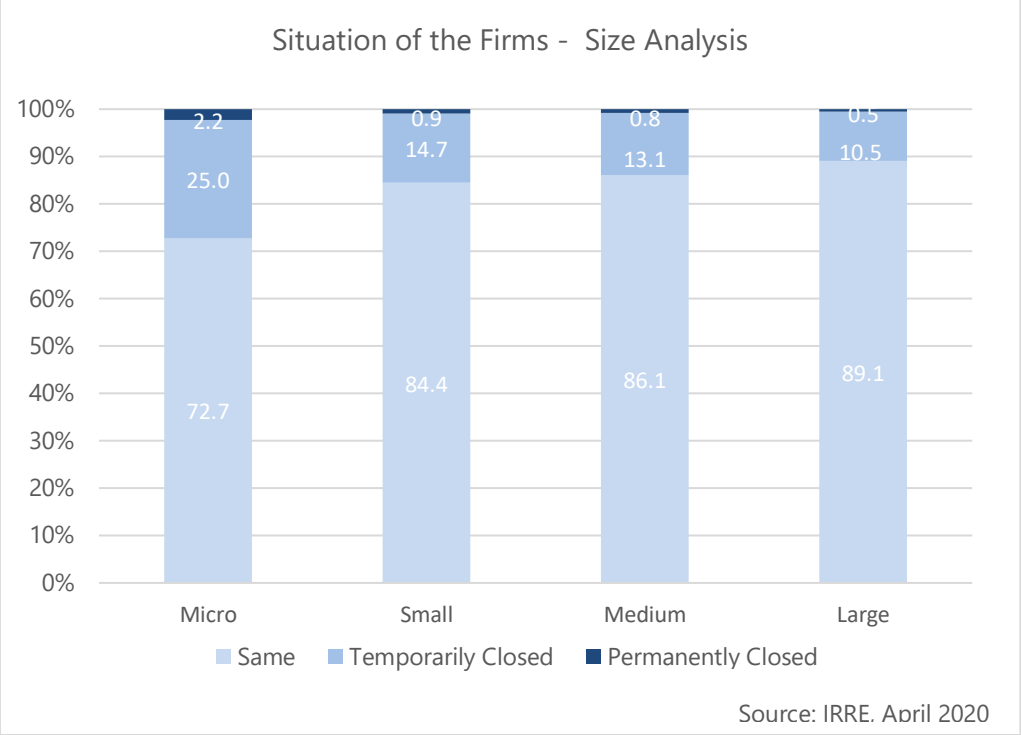
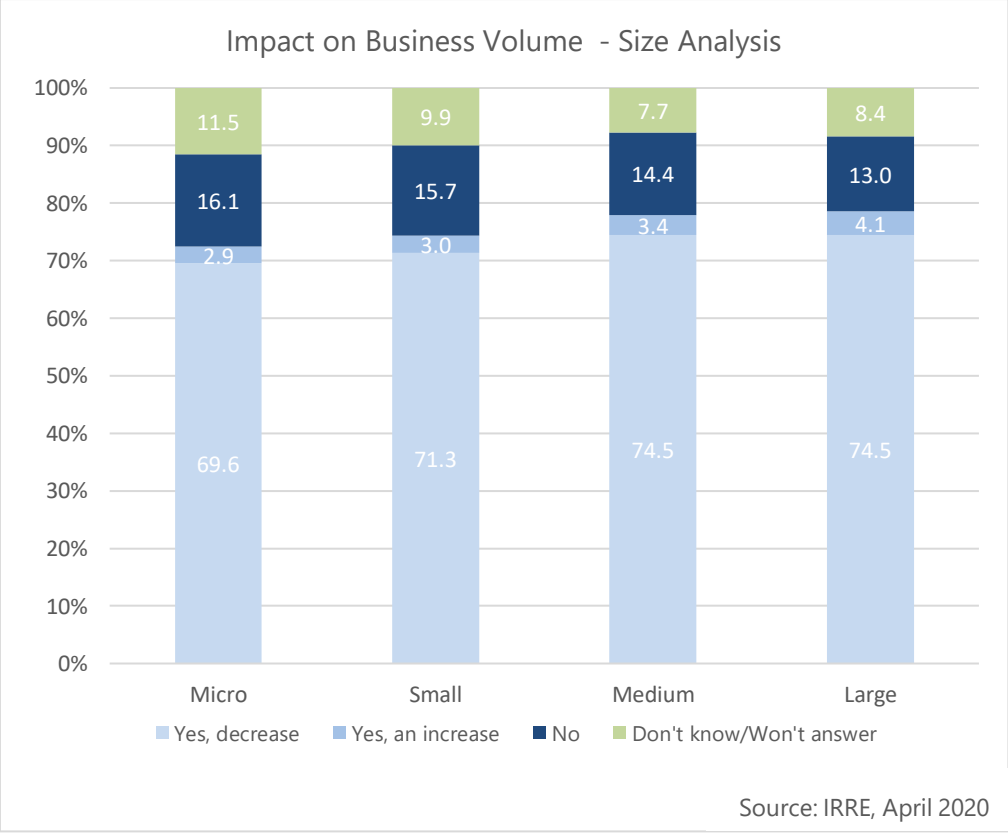


Figure 2 and Figure 3 –Impact on Business Volume: Size Analysis



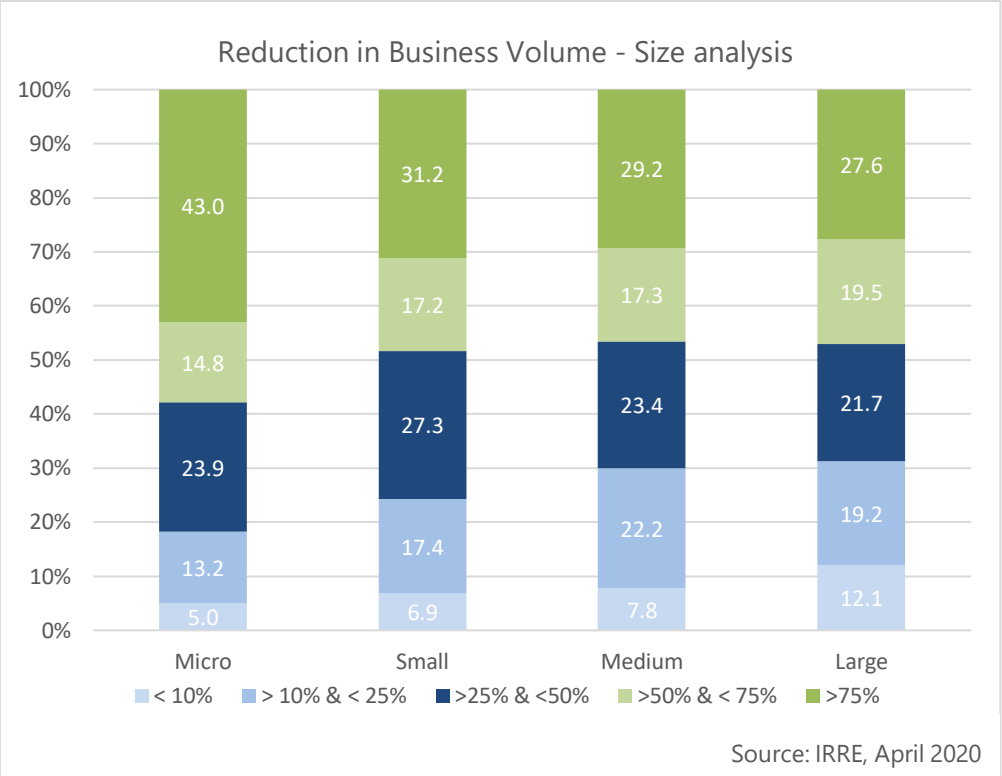
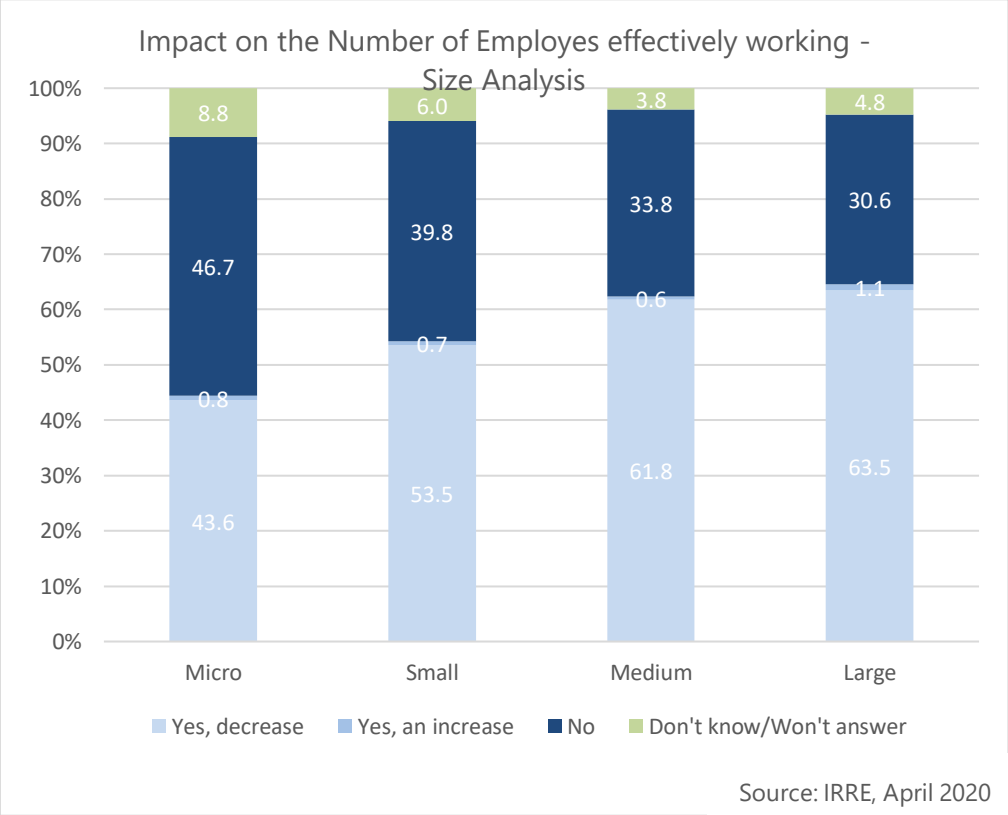


Figure 4 and Figure 5 - Impact on Number of Employees effectively working: Size Analysis



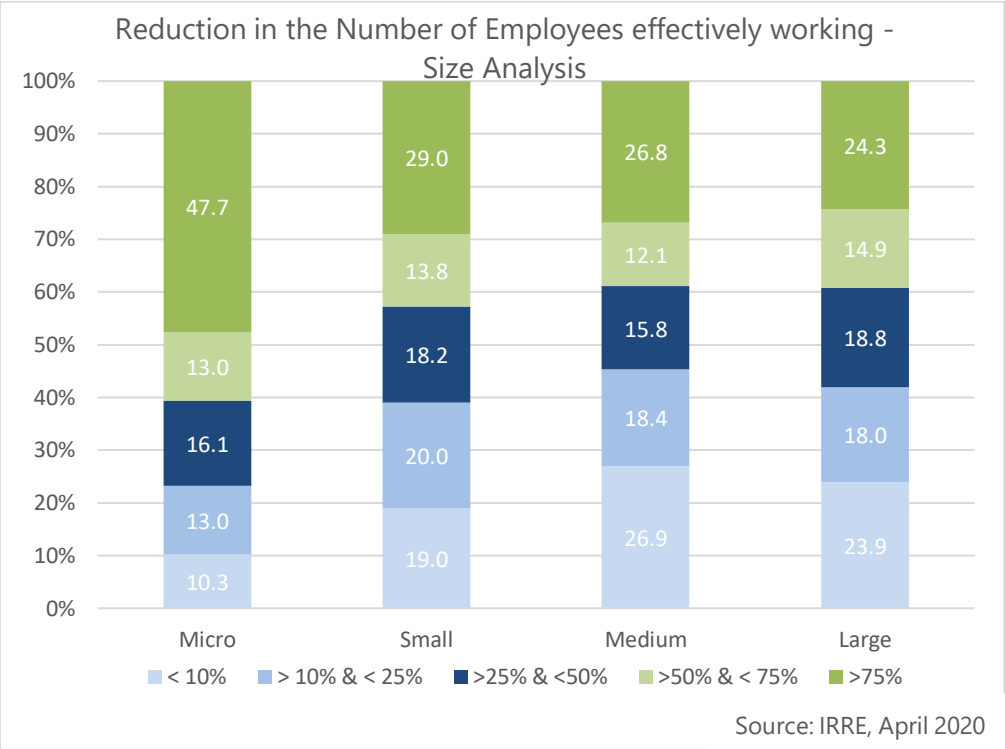


Figure 6 –Reasons for the Decrease in the Number of Employees effectively working: Size Analysis

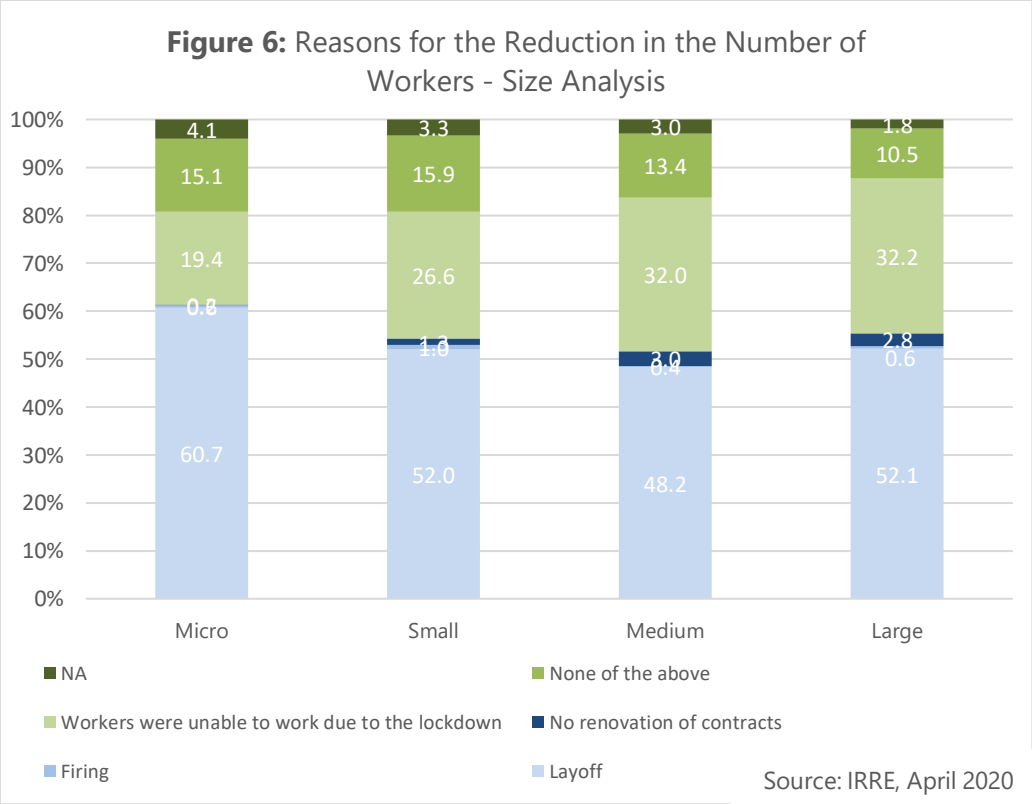


Figure 7 –Situation of the firms: Sector Analysis

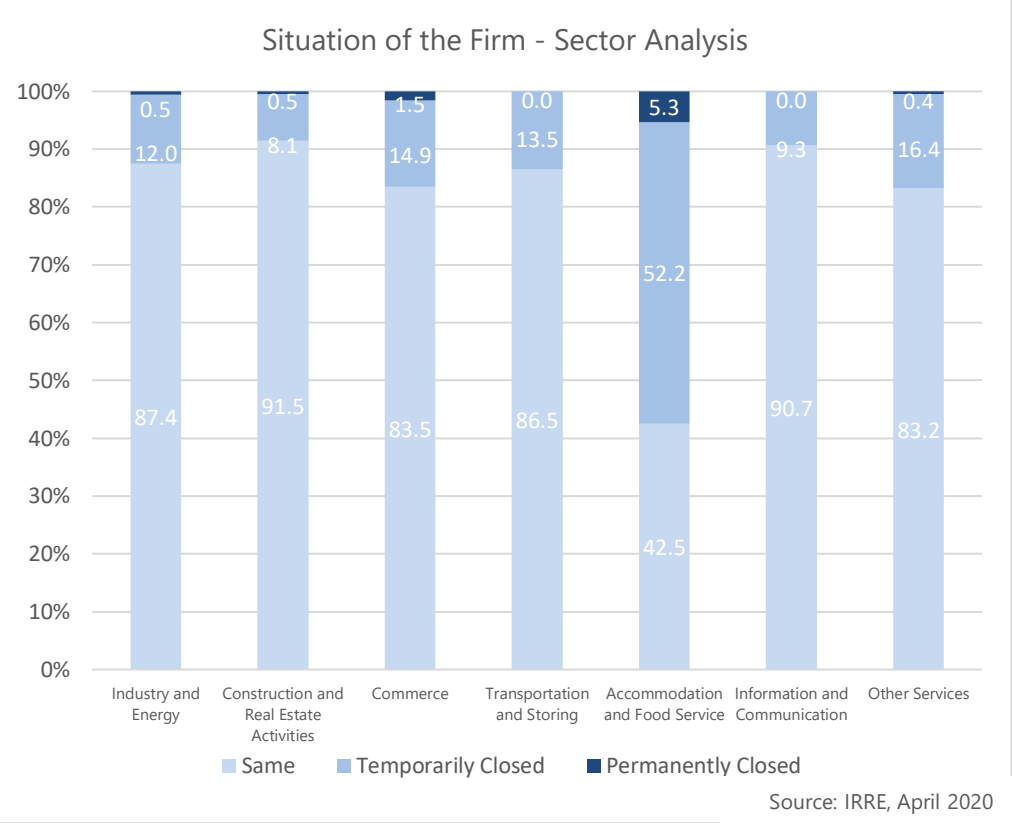
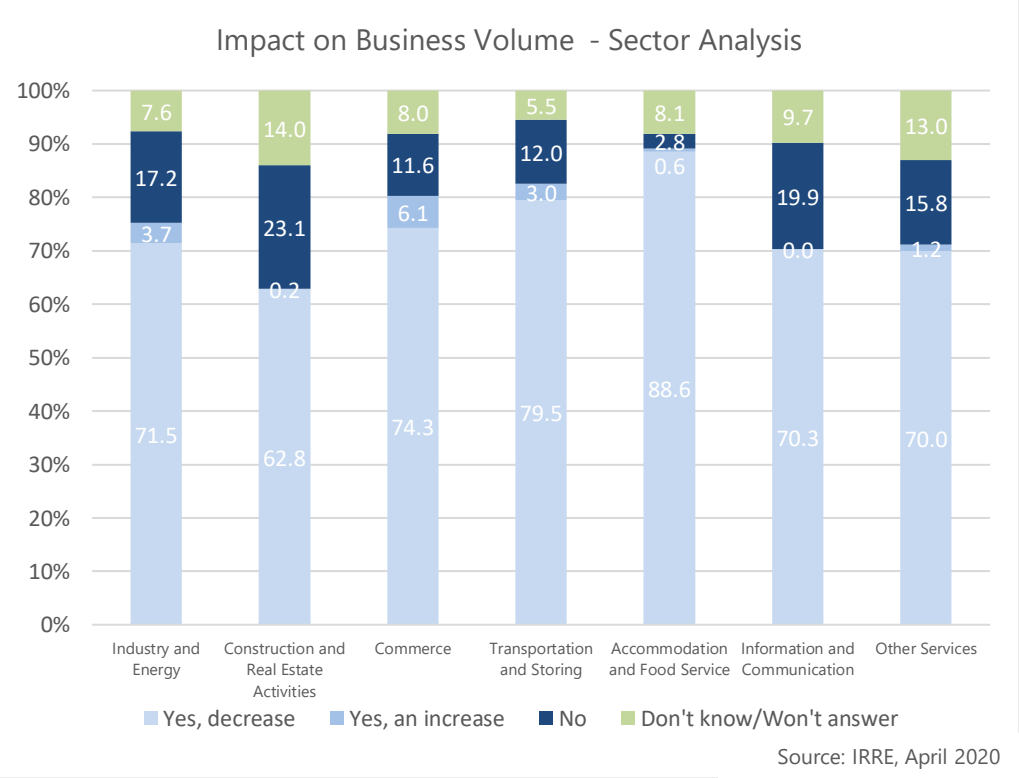


Figure 8 and Figure 9 - Impact on Business Volume : Sector Analysis



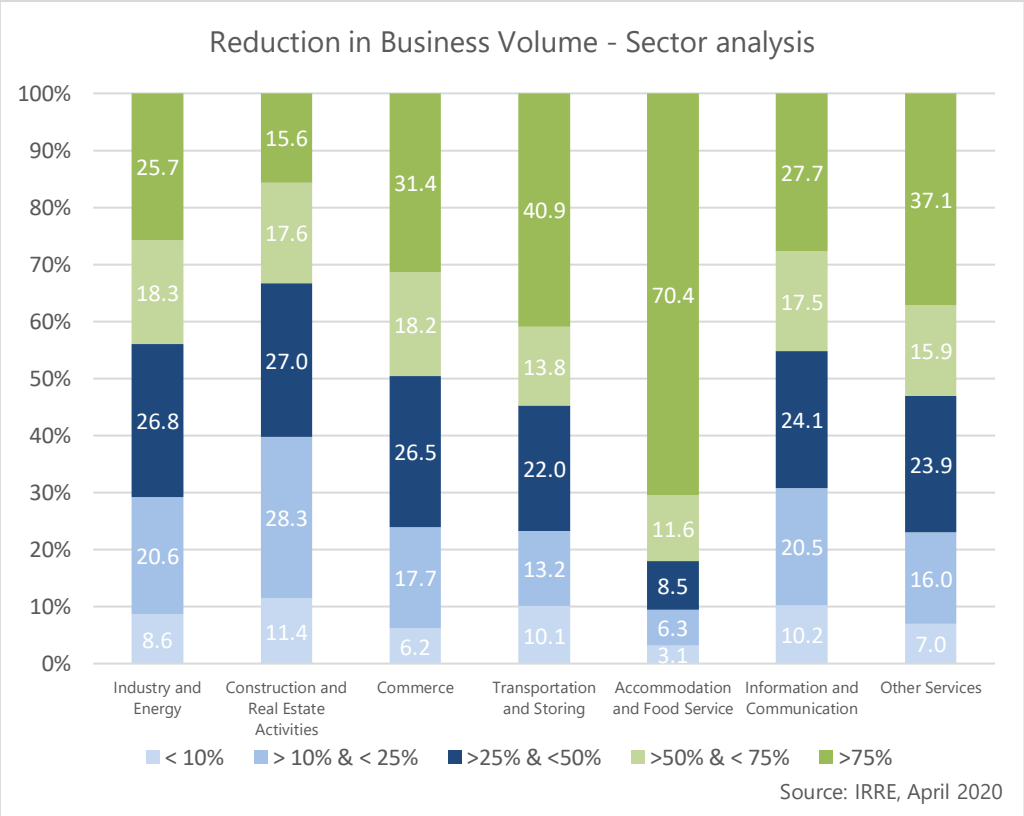
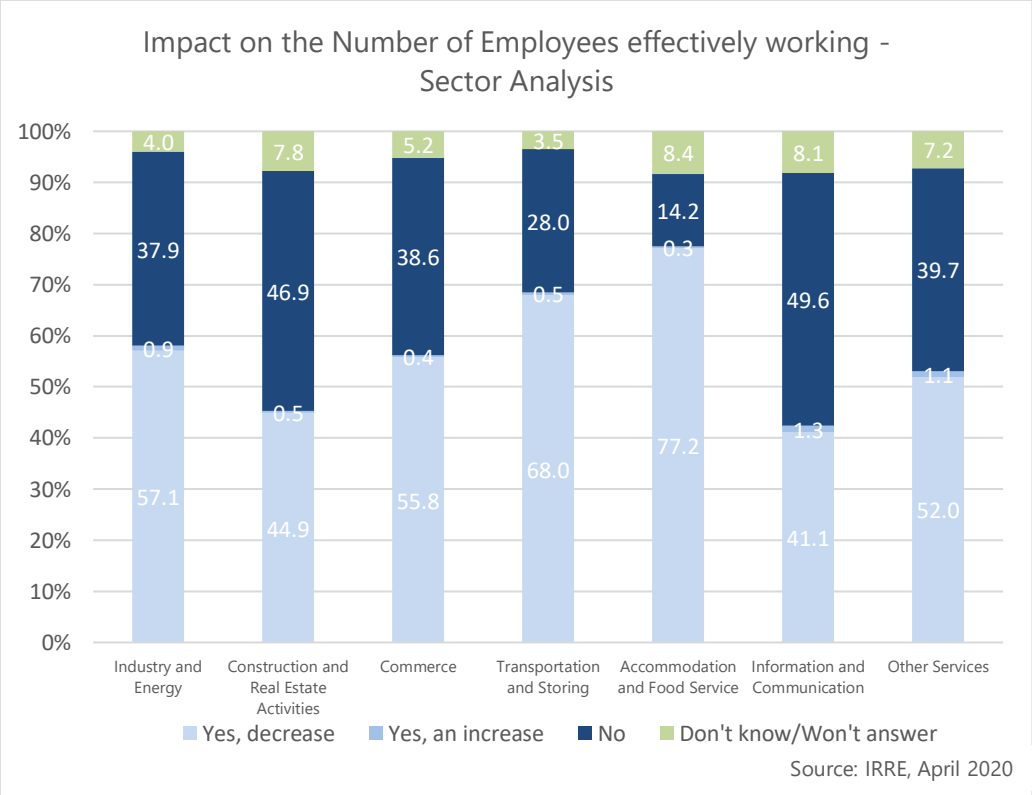


Figure 10 and Figure 11 - Impact on the Number of Employees effectively working: Sector Analysis



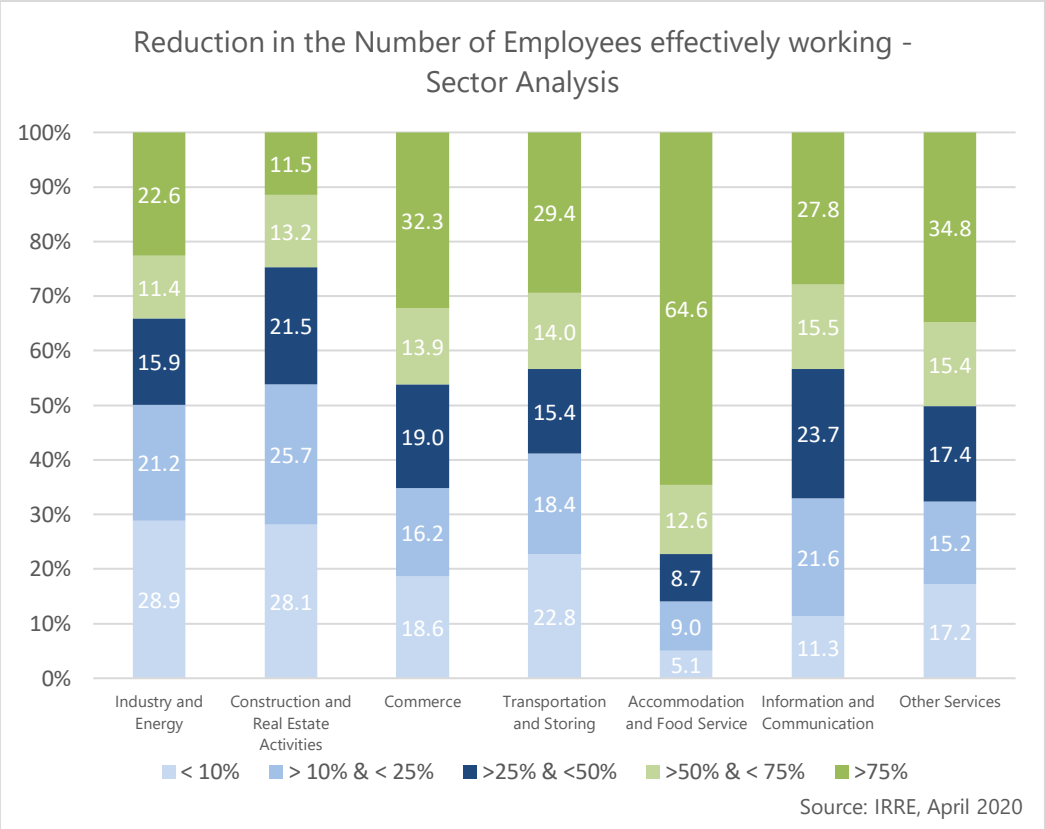


Figure 12 – Reasons for the Decrease in the Number of Employees effectively working: Sector Analysis

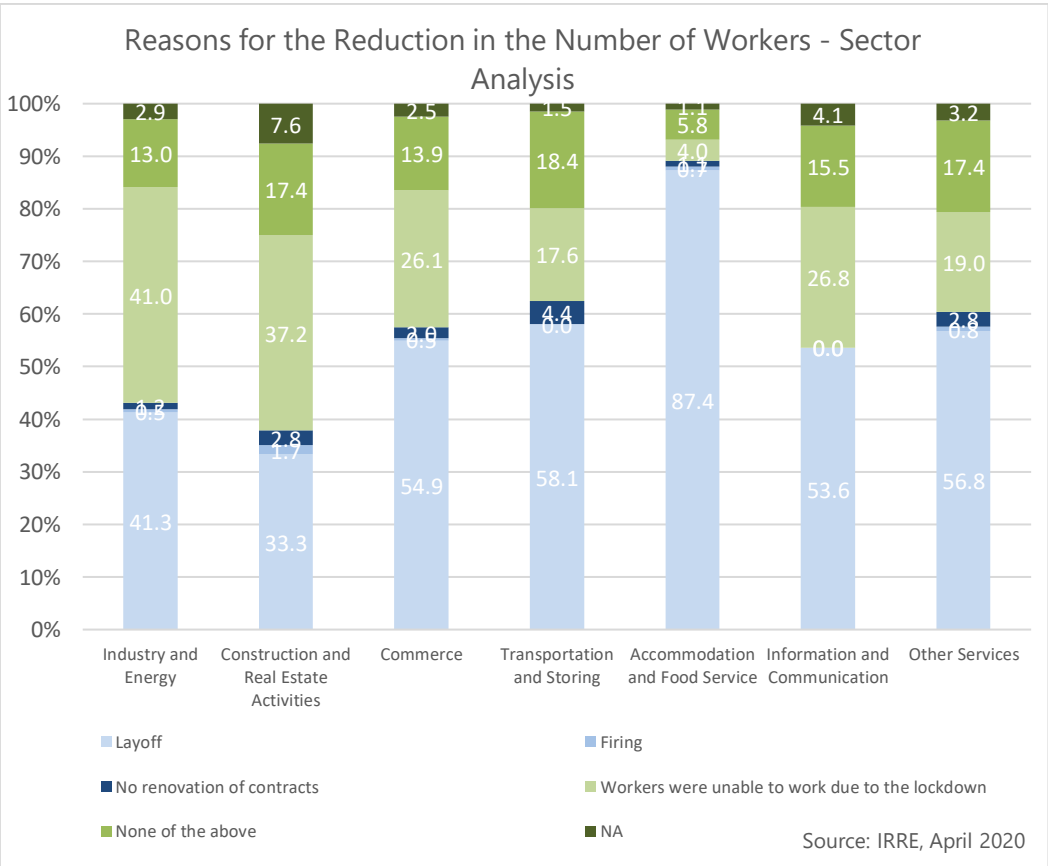


Figure 13–Situation of the firms: Exporter Character

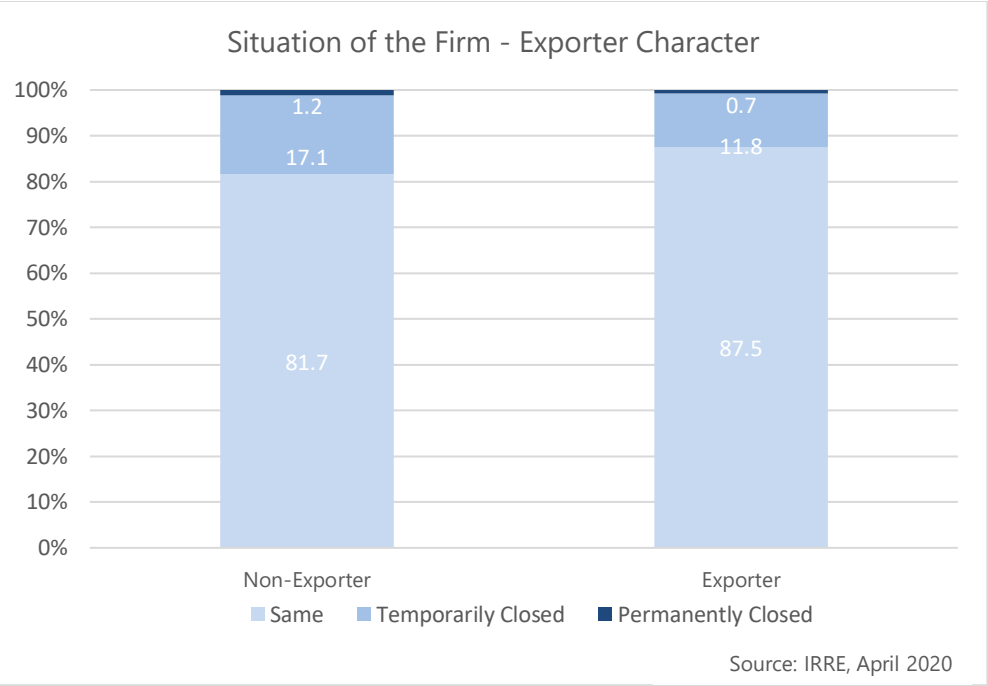
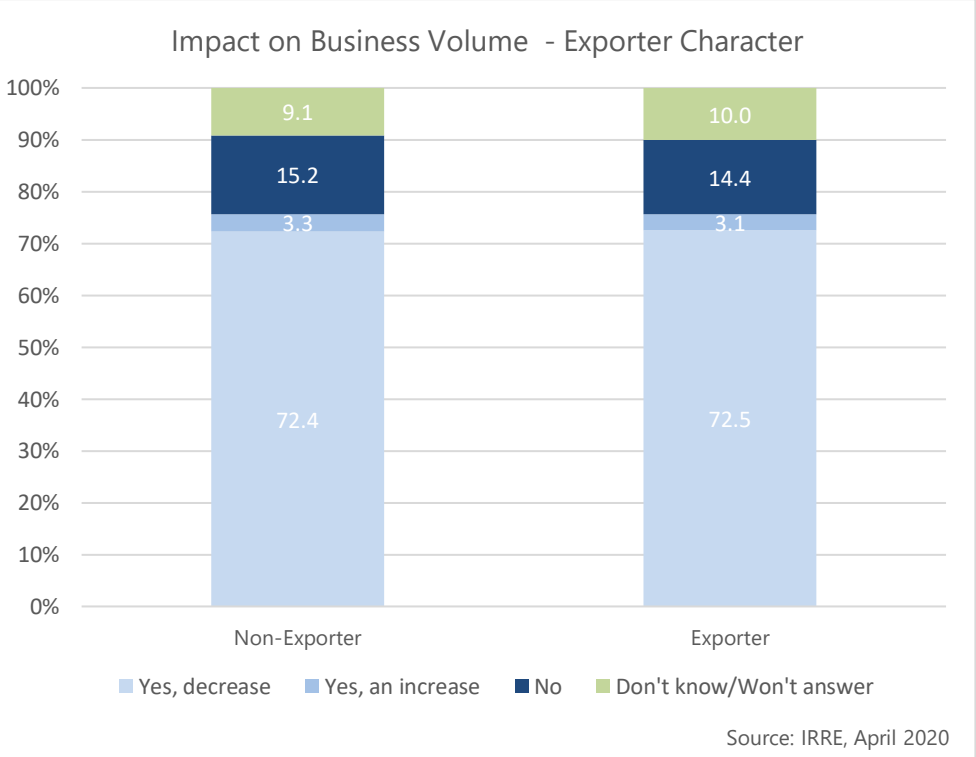


Figure 14 and Figure 15 – Impact on business volume: Exporter Character



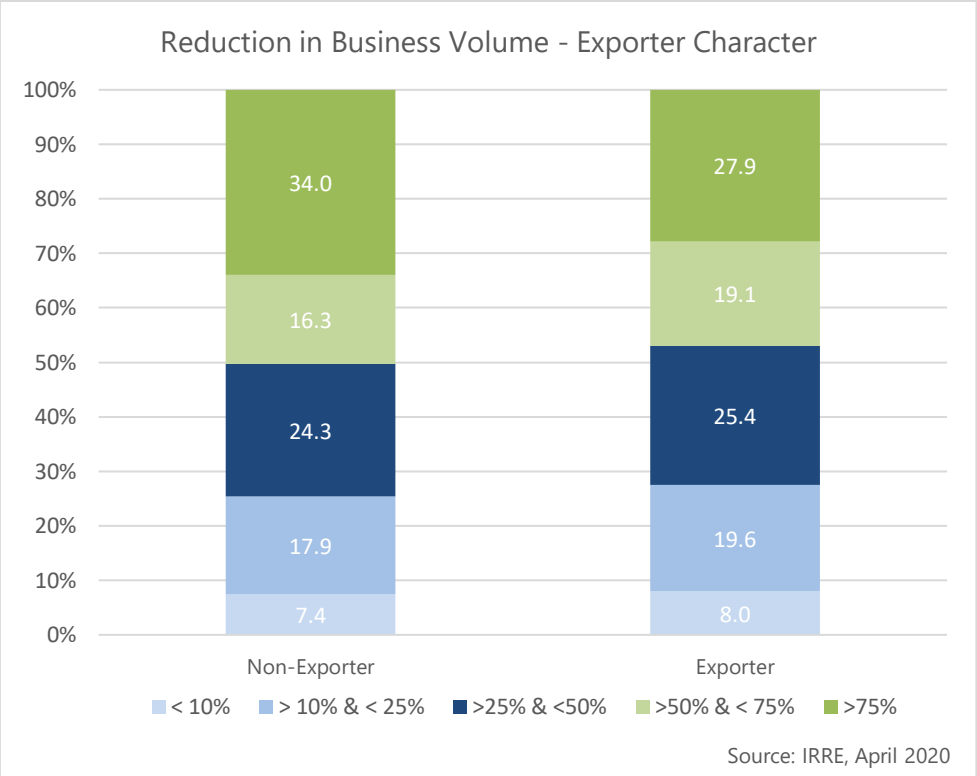
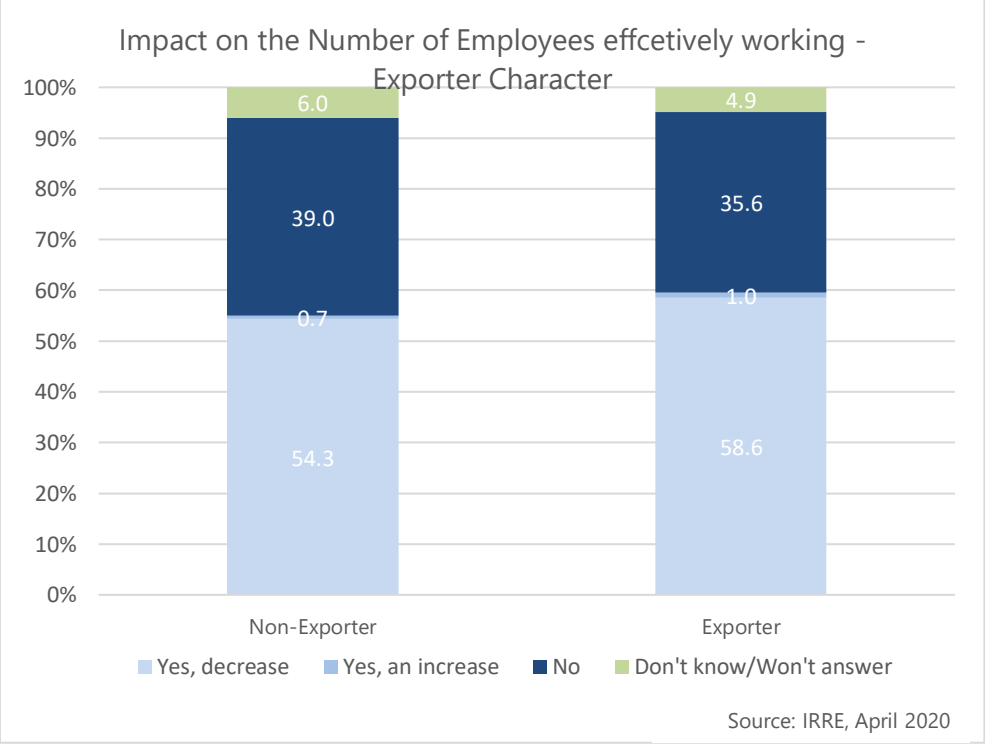


Figure 16 and Figure 17 - Impact on Number of Employees effectively working: Exporter Character



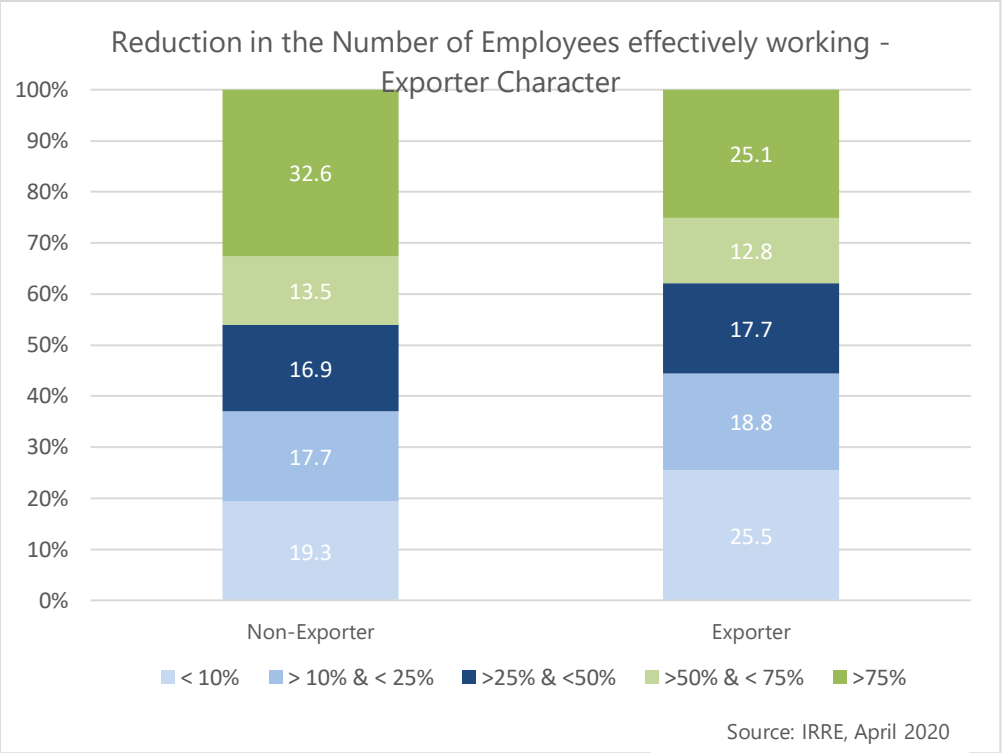


Figure 18 – Reasons for the Decrease in the Number of Employees effectively working: Exporter Character

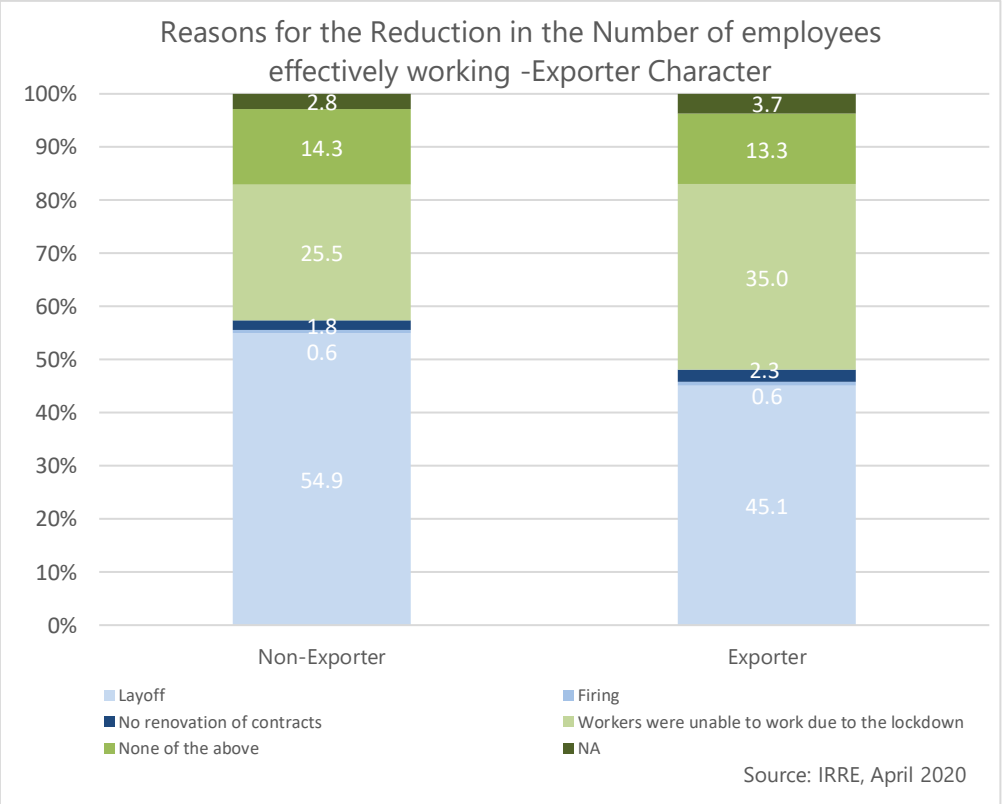


Figure 19 – Stata Code

```
*********************************************************
*            Start data analysis                        *
*********************************************************

**APPENDING ALL SURVEYS**

use "IREE_A_WFRM_152020_JUL20_V01.dta", clear

append using "IREE_A_WFRM_162020_JUL20_V01.dta"

append using "IREE_A_WFRM_172020_JUL20_V01.dta"

append using "IREE_A_WFRM_182020_JUL20_V01.dta"

append using "IREE_A_WFRM_192020_JUL20_V01.dta"

append using "IREE_A_WFRM_202020_JUL20_V01.dta"

append using "IREE_A_WFRM_212020_JUL20_V01.dta"

append using "IREE_A_WFRM_222020_JUL20_V01.dta"

append using "IREE_A_WFRM_232020_JUL20_V01.dta"

**GIVING WEIGHTS TO DIFFERENT SURVEYS (1/14 TO WEEKLY SURVEYS, 1/7 TO FORTNIGHT SURVEYS)**

gen weight=cond(p_infra_cod<19, 1/14, 1/7)

gen sales_vol_impact=cond(V2010==3,0,cond(V2110==1,-0.05,cond(V2110==2,-0.175,cond(V2110==3,-0.375, cond(
V2110==4,-0.625,cond(V2110==5,-0.875,cond(V2120==1,0.05,cond(V2120==2,0.175,cond(V2120==3,0.375,cond(
V2120==4,0.625,cond(V2120==5,0.875,0)))))))))))

gen labour_impact=cond(V4010==3,0,cond(V4110==1,-0.05,cond(V4110==2,-0.175,cond(V4110==3,-0.375, cond(
V4110==4,-0.625,cond(V4110==5,-0.875,cond(V4120==1,0.05,cond(V4120==2,0.175,cond(V4120==3,0.375,cond(
V4120==4,0.625,cond(V4120==5,0.875,0)))))))))))

gen w_sales_impact=weight*sales_vol_impact

gen w_labour_impact=weight*labour_impact

egen weighted_sales_impact= sum(w_sales_impact), by(tina)

egen weighted_labour_impact= sum(w_labour_impact), by(tina)

**CALCULATING THE NUMBER OF SURVEYS EACH COMPANY ANSWERED**
gen one=1

egen sum=sum(one), by(tina)

**LEAVING ONLY DATA FROM LAST SURVEY (FOR ASSUMED IMPACT OF THE REST OF THE YEAR)**

keep if p_infra_cod==23

**CHECKING NUMBER OF COMPANIES WHICH ANSWERED TO EACH NUMBER OF SURVEYS**

count if sum==9
count if sum==8
count if sum==7
count if sum==6
count if sum==5
count if sum==4
count if sum==3
count if sum==2
count if sum==1

**KEEPING ONLY COMPANIES WHICH ANSWERED ALL SURVEYS OR MISSED ONE SURVEY**

replace sum=7 if sum<8

tab AGCAE if sum==9

tab AGCAE if sum==8

tab AGCAE if sum==7

tab AGDIM if sum==9

tab AGDIM if sum==8

tab AGDIM if sum==7
```

```
tab P_EXPORT if sum==9

tab P_EXPORT if sum==8

tab P_EXPORT if sum==7

keep if sum==9|sum==8

**CALCULATING ASSUMED VALUES FOR UNSURVEYED PERIOD**

gen yearend_impact_sales=cond(V2010==3,0,cond(V2110==1,0,cond(V2110==2,-0.05,cond(V2110==3,-0.175, cond(
V2110==4,-0.375,cond(V2110==5,-0.625,cond(V2120==1,0,cond(V2120==2,0.05,cond(V2120==3,0.175,cond(V2120==4
,0.375,cond(V2120==5,0.625,0)))))))))))

gen yearend_impact_labour=cond(V4010==3,0,cond(V4110==1,0,cond(V4110==2,-0.05,cond(V4110==3,-0.175, cond(
V4110==4,-0.375,cond(V4110==5,-0.625,cond(V4120==1,0,cond(V4120==2,0.05,cond(V4120==3,0.175,cond(V4120==4
,0.375,cond(V4120==5,0.625,0)))))))))))

**CALCULATING WEIGHTED ANNUAL IMPACT ON LABOUT AND SALES**

gen sales_impact_final=weighted_sales_impact*(3.5/12)+yearend_impact_sales*(5.5/12)

gen labour_impact_final=weighted_labour_impact*(3.5/12)+yearend_impact_labour*(5.5/12)

**ELIMINATING USELESS VARIABLES"

keep tina AGCAE AGDIM P_EXPORT sales_impact_final labour_impact_final

**COMPLETING P_EXPORT VARIABLE**

replace  P_EXPORT=1 if P_EXPORT==1

replace  P_EXPORT=0 if P_EXPORT!=1

**SAVING DATA SET, CLEARING DATA AND OPENING LABOUR DATASET CENTRAL DE BALANCOS**

save "/bplimext/projects/p095_Leitaoetal/work_area/iree altered.dta"

clear all

use "CBHP_A_YFRM_20062019_JUN21_PESSOAL_V01.dta", clear

**KEEPING ONLY 2019 DATA AND THE LABOUR VARIABLE**

drop if ano!=2019

keep tina E001

**SAVING DATA SET, CLEARING DATA AND OPENING SALES DATASET CENTRAL DE BALANCOS**

save "/bplimext/projects/p095_Leitaoetal/work_area/hours worked.dta"

clear all

use "CBHP_A_YFRM_20062019_JUN21_CONTAS_V01.dta", clear
gen VAB=D001+D007+D006+DL043+D005-D026-DL047-D025
*D001 - VENDAS E SERVICOS PRESTADOS
*D007 - TRABALHOS PARA A PROPRIA ENTIDADE
*D006 - VARIACAO NOS INVENTARIOS DE PRODUCAO
*DL043 - RENDIMENTOS SUPLEMENTARES
*D005 - SUBSIDIOS A EXPLORACAO
*D026 - FORNECIMENTOS E SERVICOS EXTERNOS
*DL047 - IMPOSTOS INDIRETOS
*D025 - CUSTOS DAS MERCADORIAS VENDIDAS E MATERIAS CONSUMIDASS (CMVMC)

**KEEPING ONLY 2019 DATA AND THE SALES VARIABLE**

drop if ano!=2019

keep tina VAB

**MERGING ALL DATASETS**

merge 1:1 tina using "/bplimext/projects/p095_Leitaoetal/work_area/hours worked.dta"

drop _merge

merge 1:1 tina using "/bplimext/projects/p095_Leitaoetal/work_area/iree altered.dta"
```

```
**KEEPING ONLY OBSERVATIONS FROM COMPANIES WHICH EXIST IN ALL DATA SETS**

keep if _merge==3

drop _merge

**CALCULATING PREDICTED LABOUR AND SALES OF 2020, USING CALCULATED IMPACT OF THOSE VARIABLES**

gen labour_2020=E001*(1+labour_impact_final)

gen VAB_2020=VAB*(1+sales_impact_final)

save "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

**SAVING AND MERGING SUMS OF VARIABLES - NORMAL**

collapse(sum) VAB

gen one=1

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB.dta"
*impact on VAB*
display VAB_2020/VAB -1

*impact on labour*
display labour_2020/E001-1

*impact on produtivity*
gen lp_2020=VAB_2020/labour_2020
gen lp_2019=VAB/E001
display (VAB_2020/labour_2020)/(VAB/E001) -1

save "/bplimext/projects/p095_Leitaoetal/work_area/prod_normal.dta"


clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) VAB, by(AGCAE)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_sector.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) VAB_2020, by(AGCAE)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020_sector.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) E001, by(AGCAE)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001_sector.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) labour_2020, by(AGCAE)
```

```
clear all
use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"
collapse(sum) VAB_2020
gen one=1
save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020.dta"
clear all
use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"
collapse(sum) E001
gen one=1
save "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001.dta"
clear all
use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"
collapse(sum) labour_2020
gen one=1
merge 1:1 one using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020.dta"
drop _merge
merge 1:1 one using "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001.dta"
drop _merge
merge 1:1 one using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB.dta"
drop _merge
drop one

************************************************************
*                PRODUTIVITY OF PORTUGAL                   *
************************************************************

*impact on VAB*
display VAB_2020/VAB -1

*impact on labour*
display labour_2020/E001-1

*impact on produtivity*
gen lp_2020=VAB_2020/labour_2020
gen lp_2019=VAB/E001
display (VAB_2020/labour_2020)/(VAB/E001) -1

save "/bplimext/projects/p095_Leitaoetal/work_area/prod_normal.dta"
```

```
clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) VAB, by(AGCAE)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_sector.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) VAB_2020, by(AGCAE)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020_sector.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) E001, by(AGCAE)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001_sector.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) labour_2020, by(AGCAE)
```

```
merge 1:1 AGCAE using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020_sector.dta"

drop _merge

merge 1:1 AGCAE using "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001_sector.dta"

drop _merge

merge 1:1 AGCAE using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_sector.dta"

drop _merge

*********************************************************
*            PRODUTIVITY OF PORTUGAL-SECTOR             *
*********************************************************

*impact on VAB*
gen impact_VAB=VAB_2020/VAB -1

*impact on labour*
gen impact_labour=labour_2020/E001-1

*impact on produtivity*
gen lp_2020=VAB_2020/labour_2020
gen lp_2019=VAB/E001
display (VAB_2020/labour_2020)/(VAB/E001) -1

save "/bplimext/projects/p095_Leitaoetal/work_area/prod_sector.dta"
```

```
clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) VAB, by(AGDIM)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_dimension.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) VAB_2020, by(AGDIM)
save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020_dimension.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) E001, by(AGDIM)

save "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001_dimension.dta"

clear all

use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"

collapse(sum) labour_2020, by(AGDIM)

merge 1:1 AGDIM using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020_dimension.dta"

drop _merge

merge 1:1 AGDIM using "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001_dimension.dta"

drop _merge

merge 1:1 AGDIM using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_dimension.dta"

drop _merge

*********************************************************
*          PRODUTIVITY OF PORTUGAL-DIMENSION            *
*********************************************************

*impact on VAB*
gen impact_VAB=VAB_2020/VAB -1

*impact on labour*
gen impact_labour=labour_2020/E001-1

*impact on produtivity*
gen lp_2020=VAB_2020/labour_2020
gen lp_2019=VAB/E001
display (VAB_2020/labour_2020)/(VAB/E001) -1

save "/bplimext/projects/p095_Leitaoetal/work_area/prod_dimension.dta"
```

```
clear all
use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"
collapse(sum) VAB, by(P_EXPORT)
save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_exporting.dta"
clear all
use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"
collapse(sum) VAB_2020, by(P_EXPORT)
save "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020_exporting.dta"
clear all
use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"
collapse(sum) E001, by(P_EXPORT)
save "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001_exporting.dta"
clear all
use "/bplimext/projects/p095_Leitaoetal/work_area/final data.dta"
collapse(sum) labour_2020, by(P_EXPORT)
merge 1:1 P_EXPORT using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_2020_exporting.dta"
drop _merge
merge 1:1 P_EXPORT using "/bplimext/projects/p095_Leitaoetal/work_area/sum_E001_exporting.dta"
drop _merge
merge 1:1 P_EXPORT using "/bplimext/projects/p095_Leitaoetal/work_area/sum_VAB_exporting.dta"
drop _merge

*********************************************************
*          PRODUTIVITY OF PORTUGAL-EXPORTING            *
*********************************************************

*impact on VAB*
gen impact_VAB=VAB_2020/VAB -1

*impact on labour*
gen impact_labour=labour_2020/E001-1

*impact on produtivity*
gen lp_2020=VAB_2020/labour_2020
gen lp_2019=VAB/E001
display (VAB_2020/labour_2020)/(VAB/E001) -1

save "/bplimext/projects/p095_Leitaoetal/work_area/prod_exporting.dta"
```

NEC CONNECTING ECONOMICS

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