Winners and Losers of the COVID-19 Pandemic: An Excess Profits Tax Proposal

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Abstract

In this paper, we study the gains and losses incurred during the COVID-19 pandemic. We distinguish between the effects of the pandemic and those of the health measures implemented to reduce the death toll, notably 'the lockdown'. Our theoretical model is focused on within-sector firm heterogeneity and involves imperfect competition in a partial equilibrium setting. A comparison between the gains and losses triggered by both the pandemic and the lockdown indicates that an excess profits tax imposed on the 'winners' could partly compensate the 'losers' of the same sector.

Keywords: Excess profits, COVID-19, Lockdown, Imperfect competition, Transfers.

Classification JEL : L13, H12, H25, H81.

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1 Introduction

The purpose of an excess profits tax is to ensure that "a few do not gain from the sacrifices of the many." [Franklin D. Roosevelt, 1940.]

The COVID-19 pandemic, and the measures undertaken to slow down its spread, are having a major impact on economic activity. World output decreased by 3.3% in 2020, with countries such as France, the UK, Spain, India and South Africa experiencing a decline in economic output greater than 8% (IMF, 2021). The concomitant impact on companies is substantial. For instance, in France in 2020, 73% of companies incurred a decrease in their sales higher than 10%, 35% incurred a decrease larger than 50% and a third had to close for an average of two months (Insee, 2020). Many governments have reacted swiftly to the pandemic with initiatives encompassing tax filing extension and tax payment deferral, tax waivers, wage subsidies paid to employers, non-repayable grants, and government bailouts.[1] Those measures have considerably increased the accumulation of public debt. As emphasised by Piketty (2020) this COVID-19 debt cannot be entirely absorbed by central banks and a valuable option to fund these exceptional government policies could come from exceptional tax policies.

If many firms have been negatively affected by the pandemic, others have benefited from this health crisis and have earned excess profits. Some firms have benefited from a change in consumption caused by the pandemic *per se*, e.g. the increased demand for personal product hygiene has raised the annual growth rate of the hand sanitiser market from 5% to 46% (Insights, 2020). This market size boost has also been observed for protective equipment, face masks, swab makers for COVID-19 testing, and obviously COVID-19 vaccines. Other firms, operating 'digitally', have benefited from the temporary 'physical'

[1] See the OECD report on tax and fiscal policy in response to the coronavirus crisis (OECD, 2020).

closure of their competitors. When non-essential stores were closed, Amazon could supply books, clothes, or toys. Similarly, the closure of cinemas benefited Netflix and Amazon Prime, and events and conferences were replaced by Zoom and Teams virtual meetings.

The asymmetric effects of the pandemic are confirmed by the literature considering firm-level exposure to the COVID-19 at the early stage of the spread of the virus. Research has focused either on the stock market response (as in Alfaro et al., 2020, Bretscher et al., 2020 and Davis et al., 2020 for the US, Ramelli and Wagner, 2020 for the US and China, Griffith et al., 2020 for the UK and Ding et al., 2021 for 61 economies) or on quarterly earnings conference calls (as in Hassan et al., 2021). A common result of these papers is that firms' exposure to the pandemic has been widely heterogeneous, ranging from negative effects to positive effects depending on the sector, the business model of the firm, and health policies.[2]

The pandemic can be seen as an external shock, creating market distortions. From this perspective, it may be valid to use a tax on the excess profits of the winners to compensate the losers. Hence, the aim of this paper is to study the gains and losses incurred by firms during the COVID-19 pandemic. In so doing we distinguish between the effects of the pandemic and those of health measures implemented to reduce the death toll, in particular lockdown measures (the lockdown).[3] A theoretical model is presented focusing on the heterogeneous effects of the pandemic on firms in the same sector and emphasising the presence of imperfect competition in a partial equilibrium setting. We compare firms' gains and losses generated by both the pandemic and the lockdown and analyse whether the gains can offset the losses. We consider two cases which allow us to determine the conditions under which the gains can offset the losses: first, the supply shocks are identical

[2] A recent paper by Rothert (2021), focuses on the heterogeneity of impacts across regions rather than across sectors.

[3] There is a recent literature studying the costs and benefits of lockdown. For instance, see Gollier (2020), Gallic et al. (2021) and Gori et al. (2021).

for all the firms of the sector; second, the supply shocks are different for the active and inactive firms of the sector during the lockdown. When shocks are identical, we show that it is always possible to compensate the losses with the gains generated by the lockdown. Compared to business-as-usual, however, it is possible to compensate the losses with the gains generated by the pandemic and the lockdown policy if the demand shock is sufficiently large. When shocks are not the same for active and inactive firms (for example the online and the offline firms), it is still possible to compensate the losses with the gains generated by COVID-19 and lockdown under some specific conditions. In particular, we show that when the shock for the active firms is lower than the shock for the offline firms, it is always possible to compensate the losses induced by the lockdown with the gains generated by lockdown. When the shock for the online firms is higher than the shock for the offline firms it is possible to compensate the losses induced by the lockdown with the gains generated by the lockdown if the number of active firms is sufficiently low regarding to the initial number of firms. When, however, the shock for the online firms is higher than the shock for the offline firms but the number of active firms is not sufficiently low regarding to the initial number of firms, it is possible to compensate the losses induced by the lockdown with the gains generated by the lockdown if the shock on demand is sufficiently large.

The results of this analysis support the implementation of an exceptional tax on excess profit, as advocated by Avi-Yonah (2020), in line with the one used during the World Wars I and II by thirteen countries (including the US, the UK, France and Canada). With this measure, profits corresponding to the normal pre-pandemic level would be taxed at the regular corporate tax rate whereas the profits above the normal pre-pandemic level would be taxed at a much higher tax rate. This tax would be retroactive for the years 2020 and 2021 and would stop at the end of the pandemic.

This paper contributes to the literature focusing on the effect of shocks on marginal production costs, on demand and on the number of firms on oligopoly?s profits. First, Seade (1985) considers symmetrical firms competing à la Cournot and a general demand function, and shows that profits may increase with a shock on the constant marginal cost of production. Indeed, if the elasticity of the demand slope is sufficiently high, an increase in the marginal cost of all firms induces an increase in profits. This result has been extended in several directions. Kimmel (1992) focuses on firms facing different production costs but which are subject to an identical negative shock while Février and Linnemer (2004) consider both heterogeneous firms and heterogeneous shocks. The increase in profits following a positive shock to marginal production costs is only possible if and only if if the elasticity of the demand slope is sufficiently high. However, such a result is impossible under a linear demand. The welfare consequences of an increase in the cost of firms has been studied by Sajal Lahiri (1988); Zhao (2001); Wang and Zhao (2007). In all these papers, shocks are considered as an increase in marginal production costs and general demands are considered. Second, studies have also focused on demand shocks and Quirmbach (1988) have shown that oligopoly?s profits can fall when the demand curve rises. Finally, Amir and Lambson (2000) determine the conditions under which an increase in the number of firms reduce the oligopoly?s profits when firms compete à la Cournot. Our paper considers a linear demand but shocks can affect at the same time demand, marginal production costs and the number of firms.

The remainder of the paper is organised as follows. Section 2 presents some stylised facts. Section 3 describes the set-up of the model. Section 4 assesses the impacts on profits of COVID-19 and the lockdown while Section 5 compares the gains and the losses. Section 6 discusses the policy implications of our findings with the adoption of an excess profits tax and Section 7 offers concluding comments.

2 Stylised facts

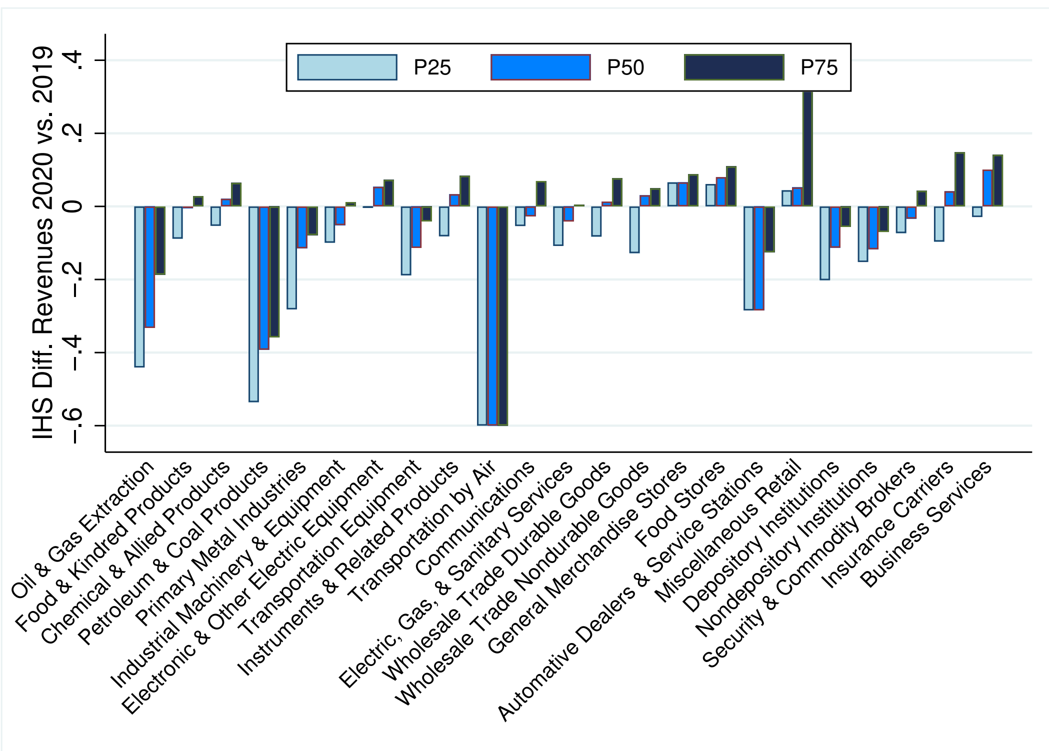
We provide in this section a series of stylised facts which highlight that the economic effects of the COVID-19 pandemic have been heterogeneous across sectors. Our data come from *S&P Compustat North America*.[4] It covers publicly held companies in the United States and Canada. These firms are often the main players in their respective sectors, domestically (e.g. the U.S. company Walmart) and sometimes globally (e.g. the French company Danone). Our sample includes about 11000 firms during the period 2017-2020, that we group into two-digit SIC sectors.[5]

Figures 1 and 2 respectively report the relative changes in revenues and profits (all expressed in US$) between the year 2020 (the pandemic year) and the year 2019 (a baseline year). To deal with negative values, we use the IHS (inverse hyperbolic sine) transformation. The IHS transformation behaves similarly to a log transformation but allows retaining negative observations (Burbidge et al., 1988; MacKinnon and Magee, 1990). Some sectors have been clear losers (e.g. oil or air transport) and some other sectors have been clear winners (e.g. general merchandise, food, and retail stores). Within other sectors (e.g. food, chemical products, communications, business services) there has been losers and winners. Overall, these two figures suggest that some firms have gained customers and market shares during the pandemic.

Figure 3 indicates the change in the average profit margin between the year 2020 and the period 2017-2019. It is a key indicator of profitability, i.e. the ability of firms to extract profits from a given amount of revenues. Best-performing (P75) firms in some sectors (e.g. chemical products, merchandise or food stores, business services) have improved, sometimes substantially, their profit margin during the pandemic. Over such a short-term

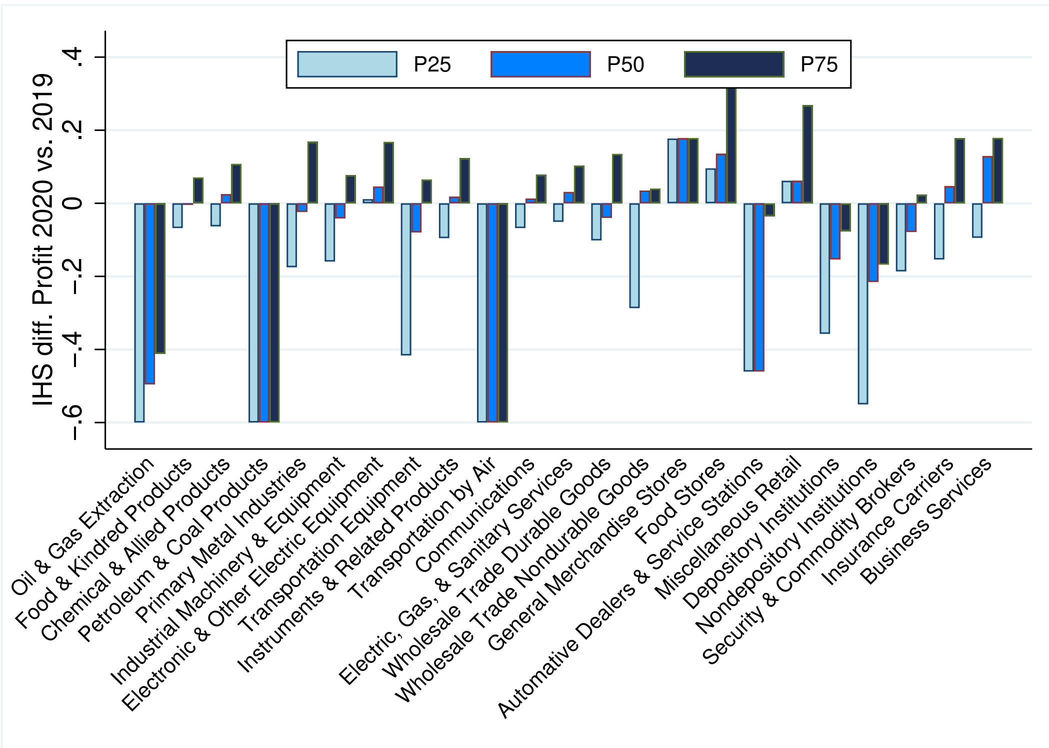
[4] https://www.spglobal.com/marketintelligence/en/client-segments/academia
[5] https://mckimmoncenter.ncsu.edu/2digitsiccodes/

Figure 1: Changes in revenues, by sector



Notes: Revenues: total revenues. IHS: inverse hyperbolic sine transformation. P25: 25th percentile value; P50: 50th percentile value; P75: 75th percentile value. Data are weighted according to 2019 revenues and only sectors whose 2019 share in total revenues exceeds one percent are reported. Negative values are winsorised to -0.6 to facilitate legibility.

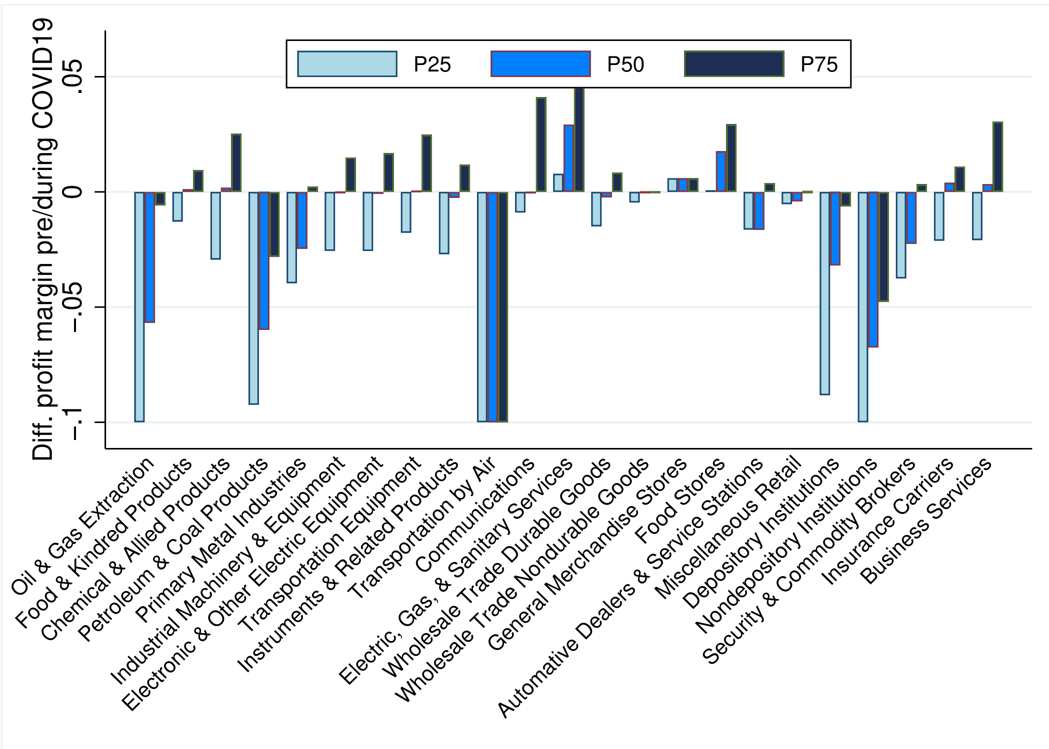
Figure 2: Changes in profits, by sector



Notes: Profit: earnings before interest, tax, depreciation and amortisation (EBITDA). IHS: inverse hyperbolic sine transformation. P25: 25th percentile value; P50: 50th percentile value; P75: 75th percentile value. Data are weighted according to 2019 revenues and only sectors whose 2019 share in total revenues exceeds one percent are reported. Negative values are winsorised to -0.6 to facilitate legibility.

time period, this stronger profitability may partly result from the ability of some firms to have taken advantage of the pandemic to increase their market power and raise prices.

Figure 3: Changes in profit margin, by sector



Notes: Profit margin: EBITDA/Revenues. P25: 25th percentile value; P50: 50th percentile value; P75: 75th percentile value. Data are weighted according to 2019 revenues and only sectors whose 2019 share in total revenues exceeds one percent are reported. Negative values are winsorised to -0.1 to facilitate legibility.

Overall, these stylised facts highlight that the COVID-19 pandemic has generated winners and losers.

3 The set-up

Demand. We assume an homogeneous good. The consumers face a linear demand, given by $p = \alpha - Q$, where Q denotes the total quantity of good consumed, p the price and α

the market size.

Market structure. There are n firms producing the above-mentioned homogeneous good. All firms use the same production technology with same marginal cost, which is constant and denoted by c. Heterogeneity across firms emerges *ex-post* as a consequence of the shocks generated by both the pandemic and the lockdown. Since the aim of the paper is to focus on the way firms are affected by these shocks and for the sake of simplicity, we assume that firms are identical ex-ante but the differences among them will manifest themselves only after the shocks. Firms may differ in terms of geographical location, presence of firms online, and relations with suppliers. Therefore, we consider that firms use the same technology but will bear different supply shocks. Our assumption seems reasonable in this particular context and the model does not lose in generality. We also assume that the marginal cost is lower than the market size, i.e. $c < \alpha$, such that firms produce positive quantities.

COVID-19 pandemic and the lockdown. The effects of the COVID-19 pandemic are twofold. It impacts both demand and supply. First of all, the market size is affected by a shock, denoted by ϵ, which can be either positive or negative. The market size after the shock is given by $\alpha + \epsilon$. Second, the pandemic may alter the production process of any firm. We denote by η_i the shock on the marginal production cost of firm i such that the effective marginal production cost is equal to $c + \eta_i$, with $\eta_i > 0$. Finally, one of the main health measures used by governments to fight against the pandemic is the implementation of lockdown measures ('the lockdown'). We consider that the lockdown prevents some firms from being active. We assume that only m firms are active (with $0 \leq m \leq n$). The active firms correspond to the online firms while the others correspond to the offline ones.

Business-as-usual. We use the superscript B to refer to the business-as-usual environment. Firms choose their production by maximising their profits. The profits of firm i are equal to $(p-c)q_i$. The first-order condition for firm i is given by $\alpha - c - Q - q_i = 0$, with $Q = \sum_{i=1}^{n} q_i$. By summing the first-order conditions from 1 to n, we derive the quantities produced and the product price at equilibrium, which are equal to:

$$q_i^B = \tfrac{\alpha-c}{n+1}, \tag{1}$$

$$p_i^B = \tfrac{\alpha+nc}{n+1}. \tag{2}$$

From the previous equations, we deduce the profit made by firm i in the business-as-usual case, which is equal to:

$$\Pi_i^B = \left(\frac{\alpha - c}{n+1}\right)^2. \tag{3}$$

All firms make the same profit in the business-as-usual case. This result is directly derived from the assumption that the firms use the same technology. However, it should be noted that we make this assumption to highlight the different effects of the pandemic shocks on firms. The higher the number of firms, the lower the individual profit of a firm and the lower the sum of the firms' profits. Indeed, the higher the number of firms, the less firms can exercise their market power.

4 The impacts on profits of COVID-19 and the lockdown

In order to disentangle the various effects generated by the COVID-19 pandemic, we study two different cases: first, the case in which the lockdown is not implemented by the government; second, the case considering the lockdown. We determine whether the profit of a firm increases or not as compared to business-as-usual.

The COVID-19 pandemic without the lockdown. We use the superscript C to refer to this case. As described previously, the market size is now equal to $\alpha + \epsilon$ and the marginal production cost of firm i is given by $c + \eta_i$. It should be remembered that firms' production costs are affected differently due to different locations, presence or not on the internet and relationships with suppliers. We proceed as in the previous section and we determine the quantities produced and the product price, which are given by:

$$q_i^C = \frac{\alpha+\epsilon-c+\sum_{j=1}^n \eta_j-(n+1)\eta_i}{n+1}, \tag{4}$$

$$p_i^C = \frac{\alpha+n(c-\epsilon)+\sum_{j=1}^n \eta_j}{n+1}. \tag{5}$$

Obviously, firms produce either strictly positive quantities or do not produce. Note that if the supply shock of one firm is too large, the firm may have no incentives to produce anymore. This depends both on the magnitude of the shock suffered by this firm and on the comparison with the shock suffered by other firms. For instance, if all shocks are symmetric, firms produce if and only if $\alpha + \epsilon - c > \eta_i$. If firms are not identically affected, a firm does not produce if $\alpha + \epsilon - c + n(\bar{\eta} - \eta_i) - \eta_i < 0$ where $\bar{\eta} = \frac{\sum_{j=1}^n \eta_j}{n}$ is the average supply shock. We focus here on the case where all firms produce positive quantities, which is guaranteed by the following assumption.[6]

Assumption 1. *We assume that for all* $i \in [1, n]$, $\alpha + \epsilon - c + n(\bar{\eta} - \eta_i) - \eta_i > 0$.

Assumption 1 guarantees the existence of the solution and it allows for interesting comparative statics. Intuitively, a positive shock on the demand side ($\epsilon > 0$) increases total production ($Q^C = \frac{n(\alpha+\epsilon-c)-\sum_{j=1}^n \eta_j}{n+1}$) and decreases the price. However, the price increases

[6] Otherwise, a different equilibrium will emerge where a smaller number of firms will be active.

with any shock on supply while total production decreases with any supply-side shock. The price will be higher than in the business-as-usual case either if the demand shock is negative or if it is positive and smaller than the average supply shock (i.e, $\epsilon < \frac{\sum_{j=1}^{n} \eta_j}{n}$). From equations (4) and (5), we deduce the profit made by firm i, which is equal to:

$$\Pi_i^C = \left(\frac{\alpha + \epsilon - c + \sum_{j=1}^{n} \eta_j - (n+1)\eta_i}{n+1} \right)^2 . \tag{6}$$

We can now study the impact of the pandemic on individual profits. The following lemma determines this impact.

Lemma 1. *The profits of firm i increase with the COVID-19 pandemic if $\epsilon > (n+1)\eta_i - \sum_{j=1}^{n} \eta_j$.*

Consider first the case in which all the firms are equally negatively affected by the pandemic shock on the supply side, meaning that $\eta_i = \eta_j$, $\forall i, j \in [1, n]$. If the shock on demand is negative, firms' profits decrease with the pandemic since $(n+1)\eta_i - \sum_{j=1}^{n} \eta_j = \eta_i$. If, however, the shock on demand is positive, the impact on firms' profits is ambiguous and depends on the relative size of demand and supply shocks. Indeed, it increases with the pandemic if and only if the shock on demand is sufficiently large to offset the negative shock on supply. This is the case of markets in which the market size is strongly positively affected by the pandemic, such as food, online retailing, pharmaceuticals, media and entertainment, software and online services (as seen in Section 2).

When the firms are not equally affected by the shock on the supply side, i.e. there exists at least one j such that $\eta_i \neq \eta_j$, the profit of firm i may increase even if the shock on the market size is negative. Indeed, if a firm's marginal cost is weakly increased by the shock while its competitors' marginal costs rise substantially, the firm then takes advantage of its competitors' losses of competitiveness and its profits may increase even if the market size decreases.

Lemma 1 shows that an increase in firms' profits can come from firms' ex-ante choices but also from the out-of-control effects of the pandemic on demand and costs. Indeed, some choices made before the outbreak of the pandemic by firms can generate lower cost shocks than those experienced by their competitors (such as the development by retailers of online e-commerce platform). However, both a lower supply shock than those experienced by competitors and the demand shock can also be due to luck. For instance, insurance companies specialised in motor insurance and, somehow paradoxically health insurances, have experienced a fall in insurance claims during the pandemic due to self-preserving individual behaviours. We understand here that an increase in corporate profits cannot be completely explained by better performance or better choices by firms. Put differently, we see that from a risk pooling point of view, it seems legitimate to compensate for the gains and losses generated by the pandemic.

The COVID-19 pandemic with the lockdown. We use the superscript L to refer to this particular case. As in the previous scenario, the market size equals to $\alpha + \epsilon$ and the marginal production cost of firm i is given by $c + \eta_i$. However, when a lockdown policy is implemented we assume the following: only m firms are active. Here we are interested in the effects of the implementation of the lockdown in the sector under examination.

We use the superscript a to refer to the active firms during the lockdown. The others are not able to produce at all. We proceed as before and we determine the quantity produced by an active firm i, which is given by:

$$q_i^{La} = \frac{\alpha + \epsilon - c + \sum_{j=1}^{m} \eta_j - (m+1)\eta_i}{m+1}. \tag{7}$$

The price of the product is then deduced and is equal to:

$$p^L = \frac{\alpha + m(c-\epsilon) + \sum_{j=1}^{m} \eta_j}{m+1}. \tag{8}$$

We easily show that the price will be higher than in the business-as-usual case either if the demand shock is negative or if it is positive and smaller than the average supply shock on the active firms (i.e, $\epsilon < \frac{\sum_{j=1}^{m} \eta_j}{m}$).[7] In contrast, the comparison between the price in the COVID-19 scenario alone and the price with the lockdown is ambiguous and crucially depends on the cost shock to the firms that are no longer active as well as the number of active firms. For instance, if all firms are equally affected by the cost shocks, the price will be higher because there are fewer firms in the market and they will have more market power.

We deduce then that the profits of an active (inactive) firm i is given by:

$$\Pi_i^{La} = \left(\frac{\alpha + \epsilon - c + \sum_{j=1}^{m} \eta_j - (m+1)\eta_i}{m+1} \right)^2, \quad (\Pi_i^{Ln} = 0). \tag{9}$$

We can now study both the impact of the pandemic and the lockdown on the profits as compared to the business-as-usual case. The following lemma determines this impact.

Lemma 2. *If a lockdown policy is implemented, a firm which is not active loses as compared to the business-as-usual, while a firm which is active gains if and only if* $\epsilon > (1+m)\eta_i - \frac{n-m}{n+1}(\alpha - c) - \sum_{j=1}^{m} \eta_j$.

Note that if firms are not able to participate to the market their profit will be nil. Therefore, as expected, excluded firms will lose compared to business-as-usual. However, a firm which is active can gain as compared to the business-as-usual depending on the number

[7] Note also that if $p^C > p^B$ then $p^L > p^B$ given that $n > m$.

of active firms, the shock to the market size and the shocks to the marginal production costs. Note that when all firms are active ($m = n$), Lemma 2 corresponds to Lemma 1.

One possible extreme scenario is when only one firm is active ($m = 1$). The firm will gain relatively to business-as-usual if and only if $\epsilon > \eta_i - (1 - \frac{2}{n+1})(\alpha - c)$. First of all, the larger the initial number of firms n, the more likely the condition above will be satisfied. This is because the lower the profits realised in business-as-usual by each firm and the single active firm becomes a monopoly. On the other hand, the lower the shock on the marginal cost of production, the more likely the firm gains relatively to business-as-usual. If the shocks are of the same size, that is $\epsilon = \eta_i$, the single active firm will always increase its profit as compared to business-as-usual. When η_i dominates ϵ (or ϵ is negative), then the likelihood of gains during the lockdown will be lower. More precisely, the gains will be dependent on the number of firms active in the market before the lockdown. Think for instance of online retailers which were able to remain active and gain market shares relative to firms which had to close their face-to-face activity due to lockdown measures.

Let's go back to the interesting case where m firms are active, with $1 < m < n$. Consider for a moment that all the firms are equally affected by the pandemic shock on the supply side, $\eta_i = \eta_j, \forall i, j \in [m, n]$. In this particular scenario, the higher the number of active firms, the lower the likelihood that an active firm will have a higher profit compared to business-as-usual since the ability of an active firm to exercise its market power will be less likely. When the firms are not equally affected by the shock on the supply side, the effect of an increase in the number of active firms on the likelihood that profits will increase depends on the relative comparison between η_i and the shock that the additional active firms support, that is $\sum_{j=1}^{m} \eta_j$. The more the competitor's cost is affected relatively to the increase in the i-firm's cost, the greater the probability that the profit will increase with the number of active firms m.

We can now study the impact of the lockdown on the profits in isolation when at least one firm is not active $m < n$ comparing profits in the COVID-19 pandemic case with lockdown and the pandemic without lockdown.[8] The following lemma determines the latter.

Lemma 3. *The lockdown is detrimental for a firm which is not active. The lockdown is beneficial for a firm which is active if* $\epsilon > \bar{\epsilon} \equiv \frac{1+m}{n-m} \sum_{j=m+1}^{n} \eta_j - \sum_{j=1}^{m} \eta_j - (\alpha - c)$.

As already noted above, if firms are not able to participate to the market their profit will be nil. Excluded firms will, of course, lose compared to the COVID-19 pandemic case. When only one firm is active ($m = 1$), the lockdown is beneficial for the latter if and only if, $\epsilon > \frac{2}{n-1} \sum_{j=2}^{n} \eta_j - \eta_i - (\alpha - c)$. In other words, the lower the supply shock supported by the inactive competitors, the more likely the lockdown will be beneficial for the active firm.

In the case of COVID-19 without lockdown, the higher the marginal cost of production of competitors, the higher the profit of a firm. The lockdown has two effects on the profit of a firm that remains active: it reduces the number of firms and it can also allow inefficient firms (high marginal cost of production) to disappear. As we have seen, the presence of an inefficient firm is positive for the profit of a firm relative to the presence of an efficient firm. Moreover, the more the active firm faces an increase in production costs, the less it benefits from the lockdown. Indeed, the higher the marginal cost of production of this firm, the lower the firm's profit after the lockdown.

Turning back to the case where m firms are active with $1 < m < n$, we derive simple comparative statics. Deriving the right-hand side above with respect to m, we get $\frac{\partial \bar{\epsilon}}{\partial m} = \frac{(1+n)\left(\sum_{j=m+1}^{n} \eta_j - (n-m) \frac{\partial \sum_{j=1}^{m} \eta_j}{\partial m}\right)}{(m-n)^2}$. When this derivative is positive, it means that a reduction in the number of active firms increases the probability that the firm in question benefits

[8]Note that when all firms are active ($m = n$), the lockdown has obviously no effect.

from the lockdown. Notice that the derivative depends on the value of the cost shock experienced by the m-th firm and the average value of the shocks of firms that are no longer active with the lockdown. When the value of the cost shock borne by the m-th firm is smaller than the average value of the shocks of the firms that are no longer active with the lockdown, then the probability that the firm in question benefits from the lockdown increases.

These preliminary results highlight that some firms may benefit from the COVID-19 pandemic and/or the implementation of the lockdown while others may lose. We now want to understand whether the gains generated by the pandemic and the lockdown for some firms can compensate for the losses incurred by other firms. This is the objective of the next section.

5 Comparison between the gains and the losses

The question that interests us is the following: could the gains of some firms be used to offset the losses of the other firms? This is an important policy issue. To answer this question, we compare (i) the gains and losses generated by the lockdown and (ii) the gains and losses generated by both the pandemic and the lockdown.

It is obvious that the sum of the gains from COVID-19 and the lockdown are higher than the sum of the losses if and only if the sum of profits in the sector are higher in the lockdown and COVID-19 case than under the business-as-usual case (i.e. $\Sigma_{i=1}^{n}\Pi_i^L > \Sigma_{i=1}^{n}\Pi_i^B$). Similarly, the gains from the lockdown will be greater than the losses from the lockdown if the profits for the industry as a whole are higher in the case of lockdown and COVID-19 than in the case of COVID-19 alone (i.e. $\Sigma_{i=1}^{n}\Pi_i^L > \Sigma_{i=1}^{n}\Pi_i^C$).

The COVID-19 pandemic leads to a change in market size and production costs, whereas the lockdown implies a reduction in the number of firms. Two main effects need to be taken into account to understand how industry profits are affected by the pandemic and the lockdown: a concentration of the market but also a market exclusion of some firms. Since firms withstand heterogeneous shocks, the latter effect can lead to the exclusion of efficient firms (withstanding low supply shocks) and/or inefficient firms (withstanding high supply shocks). Thus, in addition to a concentration effect that leads to an increase in the sector's profits, the second effect of firm exclusion can be positive or negative on the sum of profits, depending on the nature of the evicted firms. For the sake of simplicity, we separately study two cases: first, the supply shocks are identical for all firms; second, the supply shocks are different for the active and inactive firms during the lockdown. The results obtained in these scenarios allow to highlight the main mechanisms at work and to determine the conditions under which the gains can offset the losses.

Case 1. The supply shocks are identical. Let us assume that for each firm i, with $i \in [1, n]$, $\eta_i = \bar{\eta}$. The superscript 1 refers to the case 1. The profit function in the business-as-usual case is given by equation 3. We rewrite the profit functions in the two other cases as follows:

$$\Pi_i^{C,1} = \left(\tfrac{\alpha+\epsilon-c-\bar{\eta}}{n+1}\right)^2, \tag{10}$$

$$\Pi_i^{La,1} = \left(\tfrac{\alpha+\epsilon-c-\bar{\eta}}{m+1}\right)^2. \tag{11}$$

We calculate the sum of the profits in the two cases and we deduce the following proposition.

Proposition 1. *Assume that the supply shocks are identical. Then:*

(i) It is always possible to compensate the losses induced by the lockdown with the gains generated by the lockdown.

(ii) It is possible to compensate the losses induced by COVID-19 and the lockdown with the gains generated by COVID-19 and the lockdown if $\epsilon > \left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}} - 1\right)(\alpha - c) + \bar{\eta}$.

Proof. Using equations (10) and (11), it is straightforward to show that $|m(\Pi_i^{La,1} - \Pi_i^{C,1})| > |(n-m)\Pi_i^{C,1}| <=> |m\Pi_i^{La,1}| > |n\Pi_i^{C,1}| <=> n > m$. Because $n > m$, it follows directly that it is always possible to compensate the losses induced by the lockdown with the gains generated by the lockdown (i). The result (ii) in Proposition 1 can be proven using equations (11) and (3). Indeed, $|m(\Pi_i^{La,1} - \Pi_i^{B})| > |(n-m)\Pi_i^{B}| <=> |m\Pi_i^{La,1}| > |n\Pi_i^{B}| <=> \epsilon > \left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}} - 1\right)(\alpha - c) + \bar{\eta}$. □

Let us comment Proposition 1. The gains from the lockdown will be greater than the losses from the lockdown if the profits for the industry as a whole are higher in the case of the lockdown and COVID-19 than in the case of COVID-19 alone (i). Since the shocks are identical, the lockdown does not imply a selection of efficient or inefficient firms. Thus, the lockdown has a single effect which is to reduce the number of firms. Therefore, the sum of the profits in the case of lockdown and COVID-19 are higher than in the case of COVID-19 alone. We conclude that, if supply shocks are identical, it is always possible to compensate the losses with the gains generated by the lockdown during the pandemic. This result is particularly important and highlights that to compensate for the losses generated by the lockdown, it seems legitimate and sufficient to collect the gains generated by the lockdown.

Compared to business-as-usual, COVID-19 and the lockdown induce three effects: a change in market size, an increase in the marginal costs of production of all firms and a reduction in the number of firms in the market. While the first effect can be positive or negative on the sum of industry profits (positive if size increases and negative otherwise), the second is always negative while the third is always positive. Thus, the ability to offset losses by gains depends on the balance of these three effects. We demonstrate that it is possible to compensate the losses with the gains generated by COVID-19 and the lockdown if the demand shock (i.e. ϵ) is above a threshold depending on the number of initial firms, active firms and supply shock $\bar{\eta}$.

Consider for a moment a positive demand shock, i.e. $\epsilon > 0$. An increase in such a shock increases the probability that total losses are offset by total gains. Indeed, an increase in the size of the market leads to an increase in profits under a pandemic and lockdown regime compared to a pandemic regime. Consider now a negative demand shock, i.e. $\epsilon < 0$. An increase in such a shock decreases the likelihood that total losses are offset because it will lead to a decrease in profits under a pandemic and lockdown regime. The rise of the supply shock ($\bar{\eta}$) decreases the probability that total losses are offset by total gains. Indeed, an increase in the supply shock implies a decrease in profits in the COVID-19 and lockdown case. An increase in the number of firms before the occurrence of COVID-19 increases the probability that total losses are offset by total gains (i.e. $\frac{\partial\left(\left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}}-1\right)(\alpha-c)+\bar{\eta}\right)}{\partial n} = -\frac{(m+1)(n-1)(\alpha-c)}{2\sqrt{m}\sqrt{n}(n+1)^2} < 0$). Indeed, the more firms there are initially, the lower the profits and therefore the lower the losses. Finally, a decrease in the number of active firms after the lockdown increases the probability that total losses are offset by total gains (i.e. $\frac{\partial\left(\left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}}-1\right)(\alpha-c)+\bar{\eta}\right)}{\partial m} = \frac{(m-1)\sqrt{n}(\alpha-c)}{2m^{3/2}(n+1)} > 0$) since the profits after lockdown will be higher.

Result (ii) of the Proposition 1 is just as important as result (i). Indeed, it shows that under certain conditions the total gains could offset the total losses generated. In other words, if the objective is to offset the losses generated by the same sector, it is not necessary to implement a 100% retroactive tax on excess profits to subsidise firms that have had losses since the excess profits are higher than the losses.

One can also note that under some specific conditions the gains generated by the lockdown that could be considered illegitimate would be sufficient to subsidise the losers of the crisis. Considering equations (11), (10) and (3), we observe that $|m(\Pi_i^{La,1} - \Pi_i^{C,1})| >$

$|(n-m)(\Pi_i^{Ln} - \Pi_i^B)| <=> \epsilon > \left(\frac{(m+1)}{\sqrt{m}\sqrt{n+m+2}} - 1\right)(\alpha - c) + \bar{\eta}$, with $\left(\frac{(m+1)}{\sqrt{m}\sqrt{n+m+2}} - 1\right) < \left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}} - 1\right)$. Here, the policy implication is the following: to redistribute resources between winners and losers it would be sufficient not to implement a tax on excess profits but a tax on the gains from the lockdown.

To understand under which conditions the compensation of losses by gains is possible, we study the effects of the pandemic and the lockdown on the total surplus of the considered sector. First of all, let us define the total surplus in our partial equilibrium economy as the sum of the firms' profits and the consumers' surplus. The latter is the sum of the differences between the willingness to pay and the market price. Given linear demand, it amounts to $(Q^k)^2/2$, with $k \in \{B, C, L\}$. We do not refer to welfare but to total surplus because we do not take into account the medical and social costs generated by COVID-19 but only the economic effects on a given sector in partial equilibrium. The notion of an increase in total surplus must of course be taken with great caution. It only means an increase in consumer surplus and profits in a sector without taking into account the health and social effects borne by the agents of this sector. With this in mind, we derive the following total surplus functions for the business-as-usual, COVID-19 pandemic and lockdown scenarios, respectively:

$$TS^B = \frac{n(n+2)(\alpha - c)^2}{2(n+1)^2}$$
$$TS^C = \frac{n(n+2)(\alpha - c - \bar{\eta} + \epsilon)^2}{2(n+1)^2}$$
$$TS^L = \frac{m(m+2)(\alpha - c - \bar{\eta} + \epsilon)^2}{2(m+1)^2}$$

We can now study how total surplus is affected by the COVID-19 crisis and by the lockdown. Let us define the following thresholds: $\tilde{\epsilon} = \left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}} - 1\right)(\alpha - c) + \bar{\eta}$, $\hat{\epsilon} = \left(1 - \frac{m+1}{(n+1)\sqrt{\frac{m(m+2)}{n(n+2)}}}\right)(c - \alpha) + \bar{\eta}$ and $\bar{\epsilon} = \bar{\eta}$, with $\hat{\epsilon} > \bar{\epsilon} > \tilde{\epsilon}$, given $n > m \geq 1$.

In Table 1 we compare the gains generated by COVID-19 and the lockdown with the the losses induced by COVID-19 and the lockdown, and total surpluses according to the shock on demand.

Table 1: Comparison of the gains and the losses and comparison of the total surpluses according to the shock on demand.

	$\epsilon < \tilde{\epsilon}$	$\epsilon \in [\tilde{\epsilon}, \bar{\epsilon}[$	$\epsilon \in [\bar{\epsilon}, \hat{\epsilon}[$	$\epsilon \geq \hat{\epsilon}$
Compensation of losses with gains	no	yes	yes	yes
Comparison between TS^B and TS^C	$TS^B > TS^C$	$TS^B > TS^C$	$TS^B \leq TS^C$	$TS^B < TS^C$
Comparison between TS^B and TS^L	$TS^B > TS^L$	$TS^B > TS^L$	$TS^B > TS^L$	$TS^B \leq TS^L$
Comparison between TS^C and TS^L	$TS^C > TS^L$	$TS^C > TS^L$	$TS^C > TS^L$	$TS^C > TS^L$

The advantage of Table 1 is that it allows us to compare the level of demand shock needed for the gains to cover the losses with the levels that generate an increase in total surplus from either the COVID-19 or the lockdown or both. First, we note that when the supply shocks are identical, introducing a lockdown always depreciates the total surplus. Indeed, by reducing the number of companies, the lockdown increases the market power of companies and generates a dead-weight loss of the total surplus. Let us now focus on the comparison of the total surplus between the business-as-usual case and the COVID-19 case. In such a symmetric case, the comparison of the total surplus depends on the comparison of the total output. When the demand shock is positive and greater than the supply shock, output in the COVID-19 case is greater than in the business-as-usual case and thus total surplus in the COVID-19 case is greater than in the business-as-usual case. Let us now turn to the comparison of total surplus between the business-as-usual case and the lockdown case. By combining the two effects detailed above, we can easily understand that in order to obtain a higher total surplus in the lockdown case than in the business-as-usual case, the shock to demand must be important ($\epsilon > \hat{\epsilon}$), that is a demand shock sufficiently greater than the shock to supply. Finally, we can compare this threshold with the one that makes the gains compensate the losses. Since $\hat{\epsilon}$ is larger than $\tilde{\epsilon}$, we conclude that the ability to offset losses against gains does not require an increase in total surplus.

Case 2. Two kinds of firms: online and offline. Let us now assume that the shock is not the same for all firms. Think for instance to the effects of COVID-19 and a lockdown policy on online and offline firms operating in the same sector. The costs of both types of firms will be affected differently by the COVID-19 pandemic. The lockdown will also prevent offline firms from producing. The superscript 2 refers to this second case. More precisely, we consider the case in which the shock on the active firms (η_a) will be different from the shock on the inactive firms (η_{na}). Of course, this is a simplification of reality because each firm suffers a different shock. However, for the sake of analytical tractability we consider that η_a (η_{na}) is the same for all active (inactive) firms. We define the profit functions as follows:

$$\Pi_{i,a}^{C,2} = \left(\frac{\alpha + \epsilon - c + (m - n - 1)\eta_a + (n - m)\eta_{na}}{n + 1} \right)^2, \tag{12}$$

$$\Pi_{i,na}^{C,2} = \left(\frac{\alpha + \epsilon - c + m\eta_a - (1 + m)\eta_{na}}{n + 1} \right)^2, \tag{13}$$

$$\Pi_i^{La,2} = \left(\frac{\alpha + \epsilon - c - \eta_a}{m + 1} \right)^2. \tag{14}$$

For simplicity we consider that $\eta_{na} = \eta_a + x$, with $x \in \mathbb{R}$. Positive individual production quantities require the following: $q_i^{La} > 0$, $q_{i,a}^C > 0$ and $q_{i,na}^C > 0$ that is $\epsilon > (c - \alpha) + \eta_a$, $\epsilon > (c - \alpha) + \eta_a + x(m - n)$ and $\epsilon > (c - \alpha) + \eta_a + x(1 + m)$, respectively.

As for the previous case, we calculate the sum of the profits and we deduce the following proposition:

Proposition 2. *Assume that the supply shocks are different for active and inactive firms, that is $\eta_a \neq \eta_{na}$. Then:*

(i) When $\eta_a < \eta_{na}$, it is always possible to compensate the losses induced by the lockdown with the gains generated by the lockdown.

(ii) When $\eta_a > \eta_{na}$ and $n > (1+2m+2m^2)/m$, it is always possible to compensate the losses induced by lockdown with the gains generated by the lockdown. When $\eta_a > \eta_{na}$ and $n < (1+2m+2m^2)/m$, it is possible to compensate the losses induced by lockdown with the gains generated by the lockdown if and only if the shock on demand is such that $\epsilon > (c-\alpha) + \eta_a - \frac{(1+m)(1+m(2+n))x}{mn-1}$.

(iii) It is always possible to compensate the losses induced by COVID-19 and lockdown with the gains generated by COVID-19 and lockdown if $\epsilon > \left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}} - 1\right)(\alpha - c) + \eta_a$.

Proof. Using equations (12), (13) and (14), it is straightforward to show that $|m(\Pi_i^{La,2} - \Pi_{i,a}^{C,2})| > |(n-m)(\Pi_i^{Ln} - \Pi_{i,na}^{C,2})| <=> \epsilon > (c-\alpha)+\eta_a - \frac{(1+m)(1+m(2+n))x}{mn-1}$. When $\eta_a < \eta_{na}$ (i.e. $x > 0$) the condition that makes $q_{i,na}^C > 0$, that is $\epsilon > (c-\alpha) + \eta_a + x(1+m)$ guarantees that $\epsilon > (c-\alpha) + \eta_a - \frac{(1+m)(1+m(2+n))x}{mn-1}$ is always satisfied and result (i) holds for all parameters' value. When $\eta_a > \eta_{na}$ (i.e. $x < 0$) the condition that makes $q_{i,a}^C > 0$, that is $\epsilon > (c-\alpha)+\eta_a+x(m-n)$, guarantees that it is possible to compensate the losses induced by the lockdown with the gains generated by the lockdown when $n > (1+2m+2m^2)/m$. When $n < (1+2m+2m^2)/m$, it is possible to compensate the losses induced by the lockdown with the gains generated by the lockdown if and only if $\epsilon > (c-\alpha)+\eta_a - \frac{(1+m)(1+m(2+n))x}{mn-1}$, as claimed in the result (ii). The result (iii) in Proposition 2 can be proven using equations (14) and (3). Indeed, $|m(\Pi_i^{La,2} - \Pi_i^B)| > |(n-m)\Pi_i^B| <=> |m\Pi_i^{La,2}| > |n\Pi_i^B| <=> \epsilon > \left(\frac{(m+1)\sqrt{n}}{(n+1)\sqrt{m}} - 1\right)(\alpha - c) + \eta_a$.

□

The first remark we can make is that the condition under which the total gains offset the total losses is the same as in the previous case. Indeed, in the lockdown case, the active firms, the online ones, all have the same production cost. Second, the compensation of the losses due to the lockdown by the gains generated by the lockdown is not always possible, whereas in the case where all the production shocks are symmetrical it was. This difference comes from the fact that in the case of the COVID-19 without lockdown the profits of the online firms and the offline firms are different. As we have discussed previously, two main effects need to be taken into account to understand how industry profits are affected by the pandemic and the lockdown: a concentration of the market but also an exclusion of the market of some firms. Here, the offline firms are excluded from the market.

First, we demonstrate that when the shock for the online firms is lower than the shock for the offline firms, it is always possible to compensate the losses induced by the lockdown with the gains generated by lockdown. Indeed, when the inactive firms are less efficient than the active ones, their profits under the COVID-19 case are lower than what they would get if all the shocks were identical. Moreover, the profits in the lockdown case, when offline and online firms are asymmetrically impacted, are the same as if all shocks were identical to the ones of the offline firms. Using Proposition 1, we deduce that it is possible to offset the losses with the gains generated by lockdown.

Second, we show that when the shock for the online firms is higher than the shock for the offline firms and the number of active firms is sufficiently low regarding to the initial number of firms, it is always possible to compensate the losses induced by the lockdown with the gains generated by the lockdown. Indeed, since the number of active firms is low, the active firms can exercise more market-power and get higher profits.

Third, we determine that when the shock for the online firms is higher than the shock for the offline firms and the number of active firms is not sufficiently low regarding to the initial number of firms, it is possible to compensate the losses induced by the lockdown with the gains generated by the lockdown if the shock on demand is sufficiently large. The greater the demand shock, the greater the profit obtained by the active companies.

Finally, we show that when the supply shocks are different it is always possible to compensate the losses induced by the pandemic and the lockdown with the gains generated by the pandemic and the lockdown if the demand shock is larger than a threshold dependent on the number of initial firms, active firms during the lockdown, and supply shocks.

Robustness: Let us now discuss about the robustness of our results. We will mainly discuss about the shape of the demand function and the kind of competition. We are interested in how the result that gains can offset losses is affected by relaxing the linear demand and competition à la Cournot. Let us start with the linear demand assumption. As demonstrated by Seade (1985), Kimmel (1992) and Février and Linnemer (2004), when the demand function is general and the elasticity of the demand slope is sufficiently high, an increase in the marginal cost of all firms induces an increase in profits. To get the intuition, consider an isoelastic demand function. If the elasticity of demand is sufficiently weak, the increase in the mark-up will be higher than the output reduction and profits increase. Such a result cannot be obtained with a linear demand. In such a case, profits decrease as marginal costs increase. Thus when demand is isoelastic, shocks may help firms coordinate to raise prices and increase firms' profits. This additional effect would reinforce our results that gains can offset losses because gains would a priori be greater when demand elasticity is low. Let us now turn to different kinds of competition. Assume two firms competing à la Hotelling. If the two firms are very close, either geographically or in terms of product differentiation, profits will be very low because the firms will compete particularly fiercely on price. If one of them is no longer active because of the lockdown, the other will have a monopoly and will make significant profits. It is clear that the gains will offset the losses.

Finally, we can wonder how compensation is affected if other policies are put in place, such as price regulation. For instance, during the first wave of the pandemic in France, the price of hydro-alcoholic gels was regulated. Regulating price reduces the profits under the two cases considered in the paper: the Covid case and the lockdown case. Regulating price does not compulsory lead to zero profit but leads to a lower profit. However, such regulation prevents firms from exercising their market power fully. Thus the reduction in profits relative to the unregulated case will be greater in the lockdown case. We conclude that price regulation would limit the scope for an excess profit tax.

6 Discussion and policy implications of adopting an excess profits tax

Our theoretical model suggests that the pandemic has generated gains for a few firms which could be used to offset the losses of the others. These results support the view of Avi-Yonah (2020) to "revive the excess profits tax". The following discussion provides historical backgrounds for this exceptional tax and considers how this tax can be calculated, its scope, level and duration, and whether it is legitimate.

6.1 The excess profits tax in the years surrounding World War I and II

The excess profits tax is an extra tax levied on profits above a specified rate of profit. It was initially designed to tax the proportion of profits considered as abnormal because deriving from the war, an external event. It was first implemented by Denmark and

Sweden in 1915 to tax the excessive profits of firms supplying Germany. These exporters substantially benefited from the fact that the other trade routes leading to Germany were cut off. Between May 1915 and September 1916, 11 other countries adopted this excess profits tax, in chronological order Italy, Germany, Austria, Russia, Canada, Netherlands, France, Spain, New Zealand, Switzerland and the US (Stamp, 1917).

In these countries, profits corresponding to the normal pre-war level were taxed at the regular corporate tax rate. For the profits above the normal pre-war level, the tax rate was much higher. For instance, it was up to: 50% for France, 80% for the UK, 95% for the US, and 100% for Canada. Two methods were used to identify the normal pre-war profit and the excess profit: the average profits method and the invested capital method. As documented by Plehn (1920), with the first method the normal pre-war profit was calculated as an average of the two to three years preceding the war. Any profit above this average during the war was considered as excess profit. To consider the possibility of an increase in capital during the war which could explain and justify a higher profit, a second method consisted in providing the new capital with the rate of return of the pre-war capital and to tax the excess over the pre-war amount. If a new firm was created during the war an arbitrary rate of return was suggested.

6.2 Toward a pandemic excess profits tax

Calculation and Rate

The pre-pandemic profit could be calculated as an average of the years 2017-2019. The profit of 2020 and 2021 corresponding to the pre-pandemic average would be taxed at the regular statutory tax rate whereas the profit above the pre-pandemic average would be considered as excess profits and would be heavily taxed. In a report submitted to the

French National Assembly, an excess profits rate of 50% is considered to be reasonable and in line with historical standards. Avi-Yonah (2020) suggests a higher rate of 95% with the possibility to reduce this tax by credits for wages for each employee hired during the pandemic. If under certain conditions our model shows that total gains are higher than losses within the same sector and that a 100% tax on excess profit might not be necessary, in practice some sectors only experience losses (such as transportation by air). Hence, once within sector losses are offset by gains, what remains from the extra gains could be used to offset losses of another sector.

Scope

Our theoretical model distinguishes the gains coming from the pandemic *per se*, i.e. without an intervention from the government, from gains coming from unfair competition due to the lockdown. This exercise has the merit to assess whether a tax on the excess profits resulting from those two different scenarios is legitimate. For the excess profits of online companies generated by the lockdown, it can be argued that the rise in market share of those firms was abnormal as it was facilitated by the closure of offline competitors which were considered as non-essential by several governments. Taxing heavily these abnormal profits to offset the losses of firms which were forced to close seems reasonable. The legitimacy of heavily taxing excessive gains coming from changes in consumption due to the pandemic is less obvious. If the pandemic is assimilated to a war, as some politicians have suggested, then any excess profits traceable to pandemic conditions could be subject to an excess profits tax. This would entail for instance the trade of hygiene products and vaccines aimed at protecting against the virus. But what about the other unusual profits happening during the pandemic? Like during the World War I and II, a difficulty is to draw a line between pandemic (war) profits and other abnormal profits. As discussed by

Plehn (1920) and Adams (1918), if the first companies to be taxed were manufacturers of ammunitions in the US or companies exporting goods to Germany in Denmark and Sweden, soon, for easiness, the excess profits tax applied to all the "trades or business of whatever description". For practicality, the origin of excess profits could thus be ignored, and the latter could be taxed on the grounds of "pandemic profiteering". To avoid disincentivising companies from innovating, a tax credit for Research and Development could be granted (when Research and Development is not funded by public money).

A temporary and retroactive "COVID-19 recovery contribution"

The legitimacy and acceptance of such a tax rely on its name, its duration, and its retroactive character. In a survey conducted by Klemm and Mauro (2021), covering a sample of 2,519 US adult residents, participants were more inclined to support a temporary tax when it is labelled "COVID-19 recovery contribution" as compared to other labels such as "tax", "solidarity tax", "COVID-19 recovery tax", "contribution", or "solidarity contribution". Regarding its duration, the options suggested by the setting of our theoretical model lie between a one-off windfall tax or a short-lived tax. Historically, the excess profits tax was not a one-off tax. It lasted for a few years and ended with the war. An abnormal profit is deemed abnormal as compared to a profit obtained in normal times. Thus, if this tax were to be adopted due to this unprecedented pandemic, it would have to stay in place at least as long as the crisis lasts.[9]

Comes then the question of the legitimacy of a retroactive tax since excess profits made in 2020 and 2021 could be taxed. Retroactive taxes are not uncommon, at least across OECD countries, and they have not been deemed to deny due process. For instance, the

[9] Adams (1918) and the IMF (2021) discuss the possibility of a permanent excess profits tax though, which would be based upon excess over a "fair return on investment" for instance.

US Congress justifies them by indicating that *"taxation is neither a penalty imposed on the taxpayer nor a liability which he assumes by contract. It is a way of apportioning the cost of government among those who in some measure are privileged to enjoy its benefits and must bear its burdens. Since no citizen enjoys immunity from that burden, its retroactive imposition does not necessarily infringe due process, and to challenge the present tax it is not enough to point out that the taxable event, the receipt of income, antedated the statute"* (Welch v. Henry, 305 U.S. 134, 146-47 (1938)[10]) The European Court of Human Rights states that a retroactive tax is acceptable if it *"strikes a fair balance between the demands of the general interest of the community and the requirements of the protection of the individual's fundamental rights"* (Spadea and Scalabrino v. Italy (1995)[11]). As a recent example of a retroactive tax, with the French Finance Act 2014, firms with turnover exceeding 250 million were subject to an increase of the exceptional contribution on corporate tax from 5% to 10.7% and this new rate applied to the fiscal year 2013. The advantage of a retroactive tax is that it is not distortionary. It would avoid additional tax planning practices or postponement of production and sale activities by firms, especially if it is short-lived.

Transfers to losing firms

During the World War I and II, additional revenues obtained via the excess profits tax were used to help fund the heavy wartime expenditures of governments and supporting firms in difficulties was not a priority (Billings and Oats, 2014). Most participating governments had a centrally planned economy where firms had to comply with the planners? instructions, and prices and wages were administered (Roser, 2016). As firms were mobilised for war production, one concern emerged in the US though, being that small firms could not secure government defence contracts and suffered disproportionately more from

[10] https://www.law.cornell.edu/supremecourt/text/305/134

[11] http://www.fairhuurvoorverhuurders.nl/files/evrm/spadea-and-scalabrino-versus-italy-1995.pdf

labour shortages and price controls as compared to larger companies. In 1942, a bill was introduced to create a “Smaller War Plants Division? within the “War Production Board? to ensure a better representation of small firms within the federal government and to offer assistance to struggling firms if needed (Bean, 1994). However, as documented by Bean (1994), this support was generally not necessary. If labour and material shortages were an issue for a number of firms, only a minority (about 4%) were not able to secure government contracts. Globally, US small firms did well during the second World War with an increase of their profits and rate of return on investment while their number was increasing.

In contrast, during the pandemic, substantial support from governments of developed and emerging countries was implemented to prevent large scale bankruptcies which could have leaded to massive unemployment and the collapse of the economy as discussed by Elenev et al. (2020). This support mainly materialised via grants, loans, tax breaks, and support for jobs with furlough scheme. The criteria considered for a firm to be eligible vary substantially from on country to another, across time and across sectors. Governments, facing a trade-off between the risk of dead-weight and complexity, have generally evolved in their firm support policy, depending on the trends of the sanitary crisis, toward more targeted criteria. As documented by the French report of the General Inspection of Finances on the supports provided to companies Coeur (2021), at the end of the first pandemic year, providing grants to employers to retain and continue to pay staff in furlough corresponded to 1.1% of the GDP in France, 2.5% of the GDP in the UK and 0.6% of the GDP in Germany. Loans to companies corresponded to 5.5% of GDP in France, 3.2% of GDP in the UK, 1.3% of GDP in Germany, 8% of GDP in Italy and 7.2% of GDP in Spain. More specifically for France, the total support received by companies during the first year of the pandemic corresponded to 206 billion euros, i.e. 9% of the French GDP. Those transfers to losing firms which are financed by borrowing and are still necessary two years after the beginning of the pandemic are contributing to a global public debt reaching its highest level in recorded history (Gaspar and Gopinath, 2020). Our model suggests that those transfers to losing firms could be directly financed by the excess profits tax collected on the winners from the pandemic. This would contribute to address two critical issues related to the pandemic: to have a policy response to the pandemic that is not leading to a debt becoming unsustainable and, very much aligned with the objective of the excess profits tax in wartime, to curb "pandemic profiteering? to contribute to social harmony.

7 Conclusion

The collapse in economic activity brought by the COVID-19 pandemic crisis raises the question of using exceptional forms of contributions which could be implemented to support the financing needs of nations and social cohesion. By analysing the gains and losses made by firms during the COVID-19 pandemic and by comparing them to the business-as-usual case and to the extreme lockdown one, we infer that the extraordinary profits made by the few could be used to compensate, at least partially, for the losses made by the many.

Our results suggest that excess profits earned by firms during the pandemic could be heavily taxed. Regular profits, corresponding to pre-pandemic levels, would be taxed at the standard statutory tax rate. In addition to alleviating the public debt burden, the excess profits tax could discourage firms to engage in non-competitive behaviours.

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