Anatomy of Firms' Margins of Adjustment: Evidence from the COVID Pandemic*

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Abstract

We trace the real effects of the pandemic shock on the universe of firms in Chile using a unique dataset. The rich administrative information that we use allows us to identify a set of stylized facts on firms' margins of adjustment in the wake of the shock and throughout the economy's recovery path along several dimensions: entry and exit, sales, suppliers' links, labor, investment, credit, and productivity. We document considerable heterogeneity in this adjustment across firm size and industry. Importantly, we also study the role of public policies aimed at supporting credit and protecting employment relations. Results point to significant adjustments by firms along several markets and margins (extensive and intensive) throughout the crisis and ongoing recovery. Policies that supported credit to firms and protected employment mitigated these adjustments and played a role in the recovery of firms' sales, their exit and re-entry decisions, and employment. A corollary of credit policies is a considerable increase in firms' leverage.

Keywords: Firms; Adjustment; COVID; Credit support policies; Employment protection policies.

JEL classification: D22; D24; F00; H81; J38.

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1 Introduction

This paper studies how firms adjusted to the COVID-19 pandemic, offering micro details on the well-known macro dynamics. The COVID shock generated the worst economic crisis in decades, with governments and central banks around the world responding with an array of policies to mitigate the adverse effects of the shock. Despite the threat of new variants of the virus, economic activity has recovered in most economies. Using a rich administrative dataset, we trace the real effects of the shock on the universe of formal firms in Chile throughout this V-shaped recession. We consider firm adjustment along several dimensions, such as entry and exit, sales, employment, links with suppliers, investment, and credit. We are also able to study productivity at the firm level. We emphasize the heterogeneous nature of the adjustment to the COVID shock across firm size and industry.

Our results point to significant adjustment by firms along several markets and margins (extensive and intensive). We find substantial heterogeneity in this adjustment, with more adverse effects centered on micro and small firms, and on firms in industries such as services, and restaurants and hotels. We document a large decline and a swift recovery in the number of firms reporting sales, as well as in sales themselves. Employment also experienced a large decline, and its recovery seems to be lagging that of sales. Firm investment displays substantial volatility, with a larger decline and a stronger recovery than that of sales. We also find an unusually high destruction of firm linkages with suppliers, with only a partial recovery. Firm access to domestic bank credit increased during the COVID pandemic. This countercyclicality of credit marks a change with respect to previous crises in Chile, when credit contracted. The expansion of credit, however, has generated a considerable increase in firm leverage. Finally, we also find an unusual behavior of total factor productivity (TFP), which increased during the COVID pandemic, unlike in previous recessions, when productivity decreased.

Public policies have played an important role in firm adjustment. We study two policies oriented to firms in Chile: a credit support policy, and a furlough scheme designed to protect labor relations. These policies were implemented quickly (around April 2020), unlike other policies, such as fiscal transfers to households and pension-fund withdrawals, which were implemented several months after the pandemic hit the economy. We find that both the credit support and employment protection policies mitigated firm adjustment and contributed to the recovery of sales, exit and re-entry decisions, and employment.

The paper is organized as follows. Section 2 describes the unique dataset that allows us to study firm adjustment in nearly all markets. Section 3 studies firm adjustment in the following markets: output, labor, suppliers, physical capital, and credit. It also describes the evolution of

firm-level productivity during the COVID pandemic. Section 4 turns to the role of policies. It describes firm access to these policies and evaluates their effects. Section 5 concludes.

2 Dataset

The firm-level data used in this project comes from merging five administrative dataset. This is possible thanks to a massive effort by the Central Bank of Chile in creating and maintaining a large repository of various anonymized micro datasets to support policy-making and research, through several agreements with State agencies that produce the data.

The first source of information employed is the Firm Production Dataset with firm-level information used for tax purposes on sales revenues, expenditures in intermediate goods, and investment in machinery and equipment. The dataset covers the universe of formal firms in Chile and is available since the mid 2000s. The source is the form F29 collected by the Chilean tax authority (Servicio de Impuestos Internos, SII).

The second source of information employed is the Firm-to-Firm Transactions Dataset with firm-level information on all private firm-to-firm transactions, disaggregated into value flows, prices, and products and services traded. The dataset covers the universe of formal firms in Chile and became mandatory for firms of all sizes since mid 2018. The source is the electronic invoice collected by SII.

The third source of information employed is the Firm-to-Bank Credit Transactions Dataset with firm-bank information on all credit flows transactions (at the bank-firm-loan level), including information on volume, interest rates and other credit details. This credit registry contains also firm level information on debt stocks consolidated at the banking sector. The dataset covers the universe of financial transactions between banks and firms in Chile and is available since 2012 for flows and since 2009 for stocks. The sources are forms D32 (flows) and C11 (stocks) collected by the Financial Regulatory Commission in Chile (Comisión para el Mercado Financiero, CMF).

The fourth source of information employed is the Matched Employer-Employee Dataset with firm-month level information on all formal labor contracts in Chile with detailed information on the contract (wage, start and end dates, etc.) and the ID of employees and firms. The dataset is avalable since 2005 and the source is the Chilean Administrator of Unemployment Insurance (Superintendencia de Pensiones).

The fifth source of information employed is the Credit & Employment Policies Dataset with firm-month level information on firms' access to credit support and employment protection policies in response to the COVID crisis. For the former, the information contains all credit

flows to firms with sovereign guarantees as part of the FOGAPE-COVID policy (to be explained in more detail below). For the latter, the dataset contains information on the contracts that were furloughed under the Employment Protection Law. The dataset is available since march 2020 and the source is the CMF (credit flows under FOGAPE-COVID) and the Superintendencia de Pensiones (furloughed employees).

Overall, the merged dataset that results from crossing the information along these five sources provides a unique tool of analysis to quantify the margins of adjustments in virtually all markets that firms interacted as the COVID pandemic unfolded, as well as the effects of the kind of policies implemented. We turn to such analysis in the next section.

3 Firms' Adjustment to the COVID Pandemic

This section documents how firms adjusted to the COVID shock. We organize the analysis by studying the margins of firms' adjustment along six markets: output markets (firm entry/exit and sales), labor markets (employment), suppliers markets (firm-to-firm linkages), physical capital markets (investment), and credit markets (firms' access to bank debt). We also document changes in productivity at the firm level, in response to the adjustment in these markets.

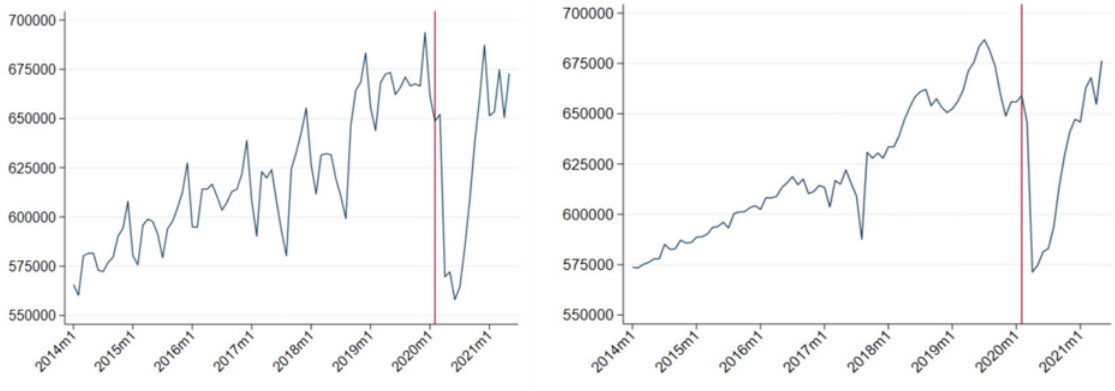
3.1 Output Market: Entry/Exit and Sales

Firms adjusted substantially in the output market, both at the extensive (i.e., entry/exit) and intensive (i.e., sales) margins. We also document substantial heterogeneity in the impact of the pandemic shock across firms of different size, sector, and other dimensions.

Figure 1 shows how the COVID shock affected the number of firms in the economy. Panels (a) and (b) plot the raw and seasonally adjusted number of firms reporting sales each month. The red vertical line marks February 2020, the last month with no COVID cases in Chile in that year. From March to June, the number of firms declined sharply—about 14%. Subsequently, the number of firms with positive sales recovered vigorously, so that by the end of 2020, firms reporting positive sales were at the pre-pandemic level. By May 2021, the number of firms was about 4% higher than pre-pandemic levels (February 2020). As the right panel shows, this recovery is not an artifact of seasonality in the number of firms.

The number of firms in the economy is the result of firms entering and exiting. Figure 2 documents how these gross flows evolved after the pandemic shock. Panel (a) shows the number of firms exiting each month. Our exit definition is not a legal one. Instead, we define a firm as exiting if it ceases to report sales for three or more consecutive months. Firm exit peaked in

Figure 1: Number of firms



(a) Raw series (b) Seasonally adjusted

Note: Red vertical line marks February 2020, the last month with no COVID cases in Chile in that year. A firm is a single tax ID with positive sales. Only firms in the National Accounts' directory of firms are considered. Source: Monthly tax form F29; and authors' own calculations.

April 2020, when roughly 10% of firms had exited.[1] Panel (b) shows the evolution of the number of new entrant firms, i.e., firms that report sales for the first time, and re-entering firms, which we define as firms that report sales after an exit spell, i.e., after not reporting sales for three or more consecutive months. The green dashed line in panel (b) shows that firm re-entry increases soon after exit peaks, whereas the blue line shows that the number of new firms reached a trough in April 2020, but recovered swiftly, reaching record numbers in the first semester of 2021.[2]

Figure 3 shows how gross flows—firm entry, re-entry and exit—interacted to determine the evolution of the number of firms, shown again in panel (a). In panel (b), black dots represent net entry of firms, expressed as the change in the number of firms with respect to February 2020, and the bars show the contribution of gross flows. Firm exit (red bars) is the main driver of net entry in the early months of the crisis, pushing down the number of firms. Around July, however, entry and re-entry begin pushing the number of firms up. The figure shows that about 2 of every 3 firms that exited re-entered at some point. The median duration of exit is 5 months in the period from March 2020 to May 2021.

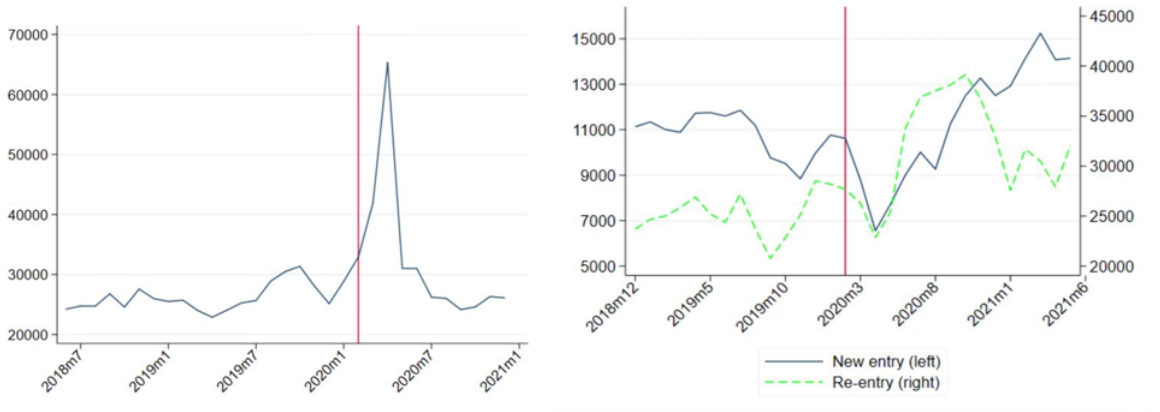
Figure 4 documents heterogeneity in net entry of firms along two dimensions—sector and size. Panel (a) shows the evolution of the number of firms in four key sectors: manufacturing, commerce, services, and restaurants and hotels.[3] The number of firms declined in all of these sectors. The decline of nearly 40% in the number of restaurants and hotels, however, dwarfs that in the other three sectors. In services, the number of firms declined nearly 20%, whereas

[1]This percentage is computed with respect to the number of firms reporting sales in February 2020.

[2]Note that firm exit (entry) also displays an increase (decrease) in late 2019, which is linked to the violent episode of social unrest experienced in Chile after protests broke on October 18.

[3]"Services" groups two sectors: personal services, and business services.

Figure 2: Firm entry and exit

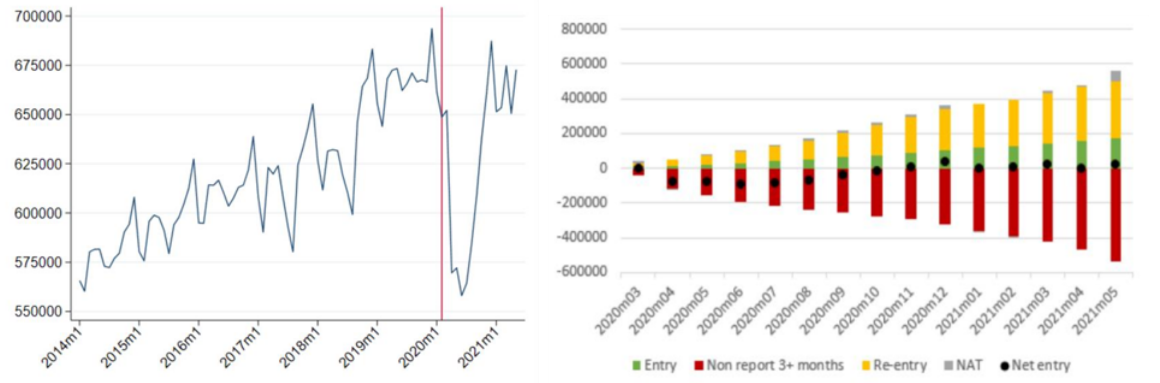


(a) "Exit:" 3+ months

(b) New entry and re-entry

Note: Number of firms. Exit is computed as firms that do not report sales for three or more consecutive months. Entry is computed as new firms, i.e., firms with a tax ID that shows up in the database for the first time. Re-entrant firms are those that were classified as exiting at some point, but resume reporting of sales. Source: Monthly tax form F29, and authors' own calculations.

Figure 3: The role of entry, exit and re-entry in firm dynamics

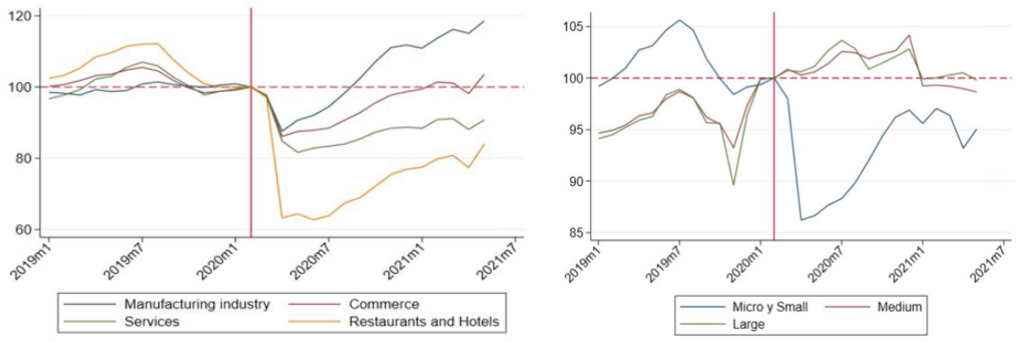


(a) Number of firms (not sa)

(b) Decomposition: Entry/exit/re-entry

Note: For panel (a), see the note to figure 1. In panel (b), black dots denote net entry of firms, expressed as the change in the number of firms with respect to February 2020. For the definition of gross flows (green bars refer to entry, red bars to exit, and yellow bars to re-entry), see the note to figure 2. Grey bars labeled NAT denote non-allocated turnover. These are a small fraction of firms that, given our definition of gross flows, cannot be classified as entering, re-entering, or exiting. Source: Monthly tax form F29, and authors' own calculations.

Figure 4: Number of firms by sector and size



(a) By sector (b) By size

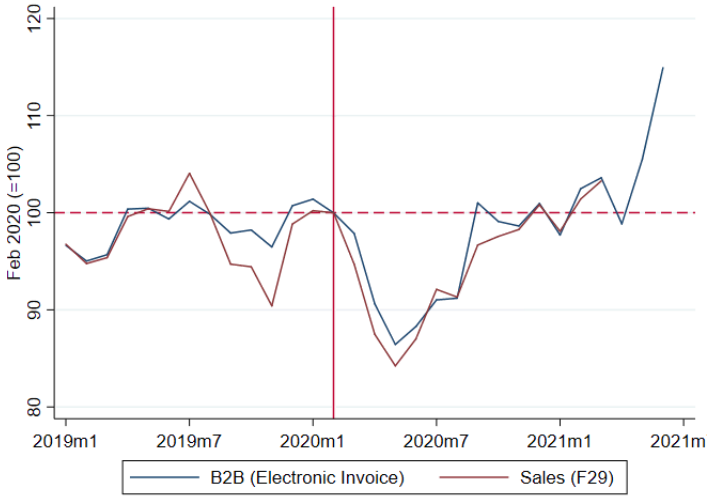
Note: Number of firms with positive sales every period, normalized to 100 in February, 2020. Seasonally adjusted. In panel (a), the services sector includes personal services, and business services. In panel (b), the classification of firms by size considers annual real sales, following the National Accounts guidelines. The thresholds are based on yearly sales expressed in a unit of account indexed to inflation, called *unidad de fomento* (UF). Micro firms: less than 2,400 UF. Small firms: 2,400-25,000 UF. Medium firms: 25,000-100,000 UF. Large firms: more than 100,000 UF. Based on inflation and market exchange rates at the time of writing, 25,000 UF are approximately equivalent to USD 950,000. Source: Monthly tax form F29 and authors' own calculations.

in manufacturing and commerce, the decline was about 10%. The latter two sectors have led the recovery in the number of firms, while restaurants and hotels, and services, remained below the pre-pandemic level in May 2021. Panel (b) shows the evolution of the number of firms of different size. The decline in the number of firms is completely driven by micro and small firms (firms with sales of less than approximately USD 950,000 in the previous year), with the number of medium and large firms hovering slightly above the pre-pandemic level throughout the sample.[4] The evolution of the number of micro and small, medium, and large firms during the pandemic shock differs from the episode of social unrest that Chile experienced in October 2019, when violent protests broke across the country. In that episode, the number of firms of all sizes declined.

We now study how firms adjusted at the intensive margin in the output market, i.e., how sales evolved during the pandemic shock. Figure 5 shows two measures of total sales, both adjusted for inflation, seasonality, and expressed as indices normalized at 100 in February 2020: the blue line shows firm-to-firm sales from the electronic invoice database, whereas the red line shows final sales from the F29 tax form. The two measures of sales are highly correlated and show a sharp decline with a trough in May of about 85% of the level in February, 2020, followed by a strong recovery that put sales at the pre-pandemic level by the end of 2020.

[4]To classify firms by size, we follow the National Accounts guidelines, which use thresholds of real annual sales based on a unit of account indexed to inflation, called *unidad de fomento* (UF). Micro firms: less than 2,400 UF. Small firms: 2,400-25,000 UF. Medium firms: 25,000-100,000 UF. Large firms: more than 100,000 UF. Based on inflation and market exchange rates at the time of writing, 25,000 UF are approximately equivalent to USD 950,000.

Figure 5: Performance of sales



Note: Total sales from two sources: the electronic invoice, which registers firm-to-firm sales (blue line), and the F29 tax form, which registers final sales (red line). Observations above the 99.9th percentile are winsorized. The resulting series are seasonally adjusted and normalized at 100 in February 2020 (vertical line).

The evolution of total sales masks substantial heterogeneity at the firm level. Figure 6 documents two dimensions of firm heterogeneity. Panel (a) shows heterogeneity across sectors. The behavior of sales is qualitatively similar to that of the number of firms (panel a in figure 4): sales in restaurants and hotels declined dramatically and remain below their pre-pandemic level in July 2021. Sales in services also declined substantially and remain below their pre-pandemic level. Sales in manufacturing and commerce, on the other hand, display swift and strong recoveries. Panel (b) shows heterogeneity in the performance of sales across firm size. Micro and small firms were the hardest hit by the COVID shock, with sales dropping about 20%. However, micro and small firms also experienced the strongest recovery, with sales reaching a level 30% higher than pre-pandemic in July 2021. Medium and large firms display less fluctuation, with sales declining and expanding less than micro and small firms in the contractionary and recovery phases. It is important to note that our results on firm size are not an artifact of industry effects, e.g., that most restaurants and hotels are small firms and, since this sector was badly hit, it drives the decline we see for small firms. In the ONLINE APPENDIX, we document that micro and small firms are the most affected within each of the four sectors we study.

Figure 7 studies the interaction of the extensive and intensive margins in the performance of sales. Panels (a) and (b) study the heterogeneity in the recovery of sales. They display the distribution of DAVIS AND HALTIWANGER 92 growth rates, computed as the difference in real sales between Feb-Apr 2019 and Feb-Apr 2021 (three month averages), divided by the average across these two periods. Panel (a) plots the unweighted distribution, whereas the distribution in panel (b) weights the growth rate of each firm by its average sales across the two periods. For

Figure 6: Sales: Heterogeneity by sector and size

(a) Sector (b) Size

Note: Seasonally adjusted real sales, normalized at 100 in February 2020. The service sector includes personal services and business services. For details on the classification of firms by size, see the note to figure 4. Sources: Electronic invoice; and authors' own calculations.

continuing firms, the growth rate lies in the (-2,2) interval, whereas exiting and entering firms have a value of -2 and 2, respectively. The blue distributions refer to the 2019-2021 period, which highlights the heterogeneity in the recovery of sales from the pandemic shock. As a benchmark, the orange distributions show the average distribution for the more normal periods 2016-2018, 2017-2019, and 2018-2020. Continuing firms in the 2019-2021 period display more heterogeneity than in normal times, with more mass of the growth rates in the tails of the distribution and less mass in the middle. This holds for the unweighted and weighted cases. The plots also speak about the extent of firm entry and exit. The unweighted distribution shows that more than 30% of the growth rates correspond to firms that enter and exit. Furthermore, there is more destruction and less creation in the recovery from the pandemic shock than in normal times. This result disappears in the weighed distribution, where we see little difference in entry and exit between the COVID pandemic and normal times. This suggests that small firms account for the bulk entry and exit, which is consistent with the results in panel (b) of figure 6.

Panel (c) of figure 7 shows the contribution of the extensive margin to the year-on-year growth rate of sales (black line). Even though we documented substantial adjustment on the extensive margin in the output market, the bulk of the *fluctuation* of sales over the pandemic shock is driven by incumbent firms (blue bars). Firms that enter, exit, and re-enter contribute little to the fluctuation of the annual growth rate of sales. In particular, note the small role of firm re-entry (green bars). Although re-entry is key for the recovery of the number of firms in the economy, re-entering firms contribute little to the recovery of sales. Finally, in panel (d) we study the performance of sales in re-entering and incumbent firms. In this analysis, we track the performance of a group of firms in each category, before and after the pandemic hit the economy.

Re-entrants are firms that exited (reported no sales for three or more consecutive months) after February 2020 and subsequently reported sales (blue line).[5] Total sales in re-entering firms are much more volatile than sales in incumbent firms (red line), reaching a trough nearly 60% lower than their pre-pandemic level. This decline is surely driven by many of these firms reporting no sales in the second quarter of 2020.[6] In sum, although re-entering firms are key for the evolution of the number of firms, and have highly volatile sales, they contribute little to the fluctuation of total sales, which is driven by incumbent firms.

3.2 Labor Market: Employment

Employment is another important margin of firms' adjustment to the pandemic shock. Figure 8 shows the evolution of total real sales and total employment, both seasonally adjusted and normalized at 100 in February 2020.[7] The decline in employment is larger and more persistent than that of sales, so that by the end of 2020, it remained below its pre-pandemic level. It is important to note that figure 8 shows effective employment, i.e., it excludes workers enrolled in the employment protection program (*Ley de Protección del Empleo* or LPE), a furlough scheme funded by the government, which we study in detail in section 4. This implies that the decline of nearly 20% of employment in figure 8 is partly due to job separation, but also due to workers enrolled in the LPE program.

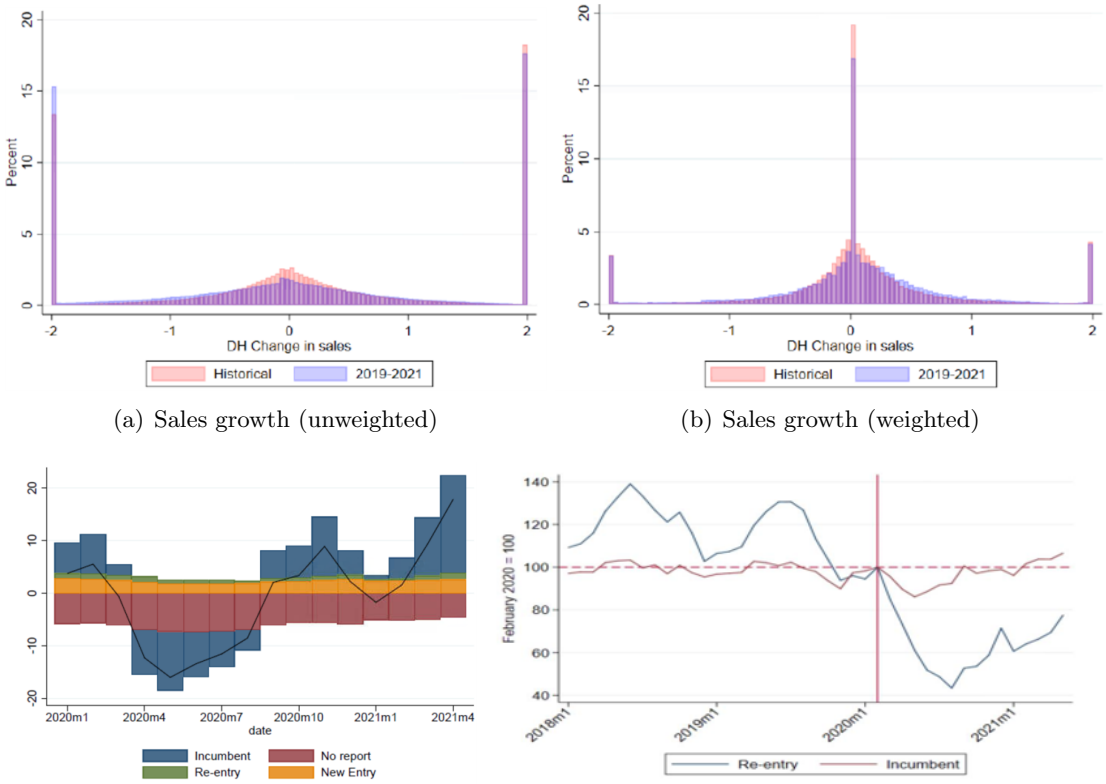
The total performance of employment masks substantial heterogeneity. Figure 9 documents two dimensions of firm heterogeneity analogous to those previously explored for the case of sales—sector and size. In terms of the four key sectors (panel a), effective employment declined dramatically in restaurants and hotels. Although it exhibits signs of recovery in the second half of 2020, it remains about 40% below its pre-pandemic level by the end of the year. The decline in employment in manufacturing, commerce, and services was similar—about 20%. However, employment in services has recovered much less vigorously than that in manufacturing and commerce. As in the case of sales, micro and small firms experienced the largest decline in effective employment, followed by medium and large firms (panel b). In the recovery phase, however, and unlike the case of sales, employment in micro and small firms persists below that of medium and large firms. By the end of 2020, employment in firms of all sizes was below their pre-pandemic level.

[5] We also require re-entering firms to report sales in January 2018, so as to avoid considering firms that may have opened only a few months prior to the COVID shock.

[6] We classify a firm as incumbent if, after February 2020, it does not cease to reports sales more than two consecutive months, and reported sales in January 2018.

[7] The number of firms in the computation of total sales may differ from the number of firms in the computation of total employment, because not all firms that report sales in the electronic invoice database report employment in the employer-employee database.

Figure 7: Sales: Extensive and intensive margins



(a) Sales growth (unweighted)

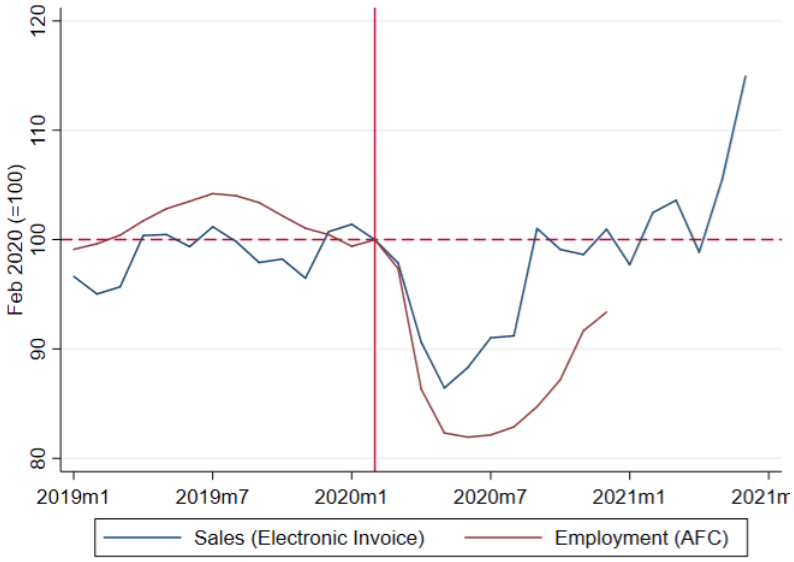
(b) Sales growth (weighted)

(c) Contribution of extensive margin

(d) Re-entrants and incumbents

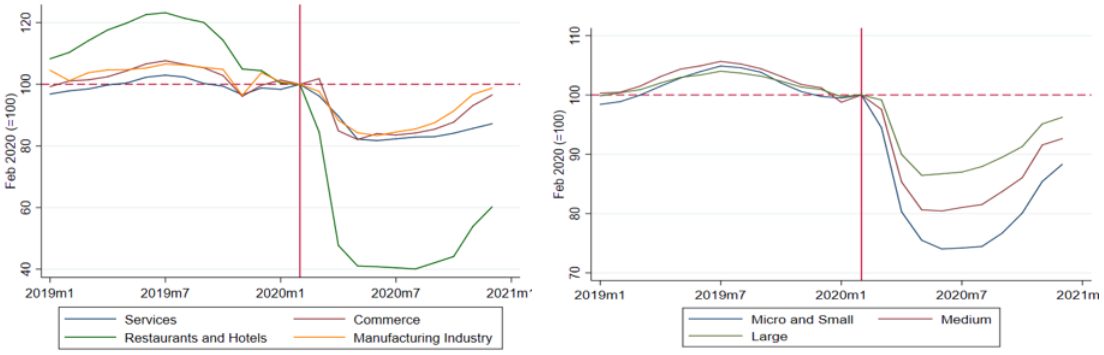
Note: Panel (a) shows the distribution of the growth rate of average real sales in Feb-Apr 2021 with respect to Feb-Apr 2019. The growth rate is computed as in DAVIS AND HALTIWANGER 92, i.e., as the change in real sales between the two periods divided by the average across the two periods. For continuing firms, the growth rate is bounded at $(-2, 2)$. For firms that exit and for new firms, the growth rate takes a value of -2 and 2, respectively. Panel (b) shows the distribution of the Davis-Haltiwanger growth rate weighted by average sales. Panel (c) shows the contribution of incumbent, entering (new entry), exiting (no report), and re-entering firms to the year-on-year growth rate of total real sales. Entering firms are 6-months old or younger. Exiting firms are defined as firms that have ceased to report sales for three consecutive months or more. Re-entering firms are firms that experienced an exit spell and resume reporting sales; a re-entering firm keeps that label during the firms 6 months after re-entering. Incumbent firms are all others. The decomposition is computed as follows: for each category, we add up the firm-level annual change in real sales (sales in firm i in period t minus sales in firm i in period $t-12$), and divide by the group total in $t-12$. This means that the contribution of, for example, entering firms, adds up firm-level changes and divides by total sales in firms that were entrants 12 months ago. Panel (d) tracks sales of firms that at any point after the pandemic hit the economy were classified as re-entering, as well as firms that after the pandemic hit did not suffer exit spells (incumbent) Re-entering firms are those that exited (i.e., reported no sales for three or more consecutive months) after February 2020 and subsequently reported sales; and reported sales in January 2018, so as to avoid considering firms that may have opened only a few months prior to the COVID shock. Incumbent firms are those that, after February 2020, do not cease to report sales more than two consecutive months, and reported sales in January 2018. Sources: Tax form F29 for panels (a)-(c); electronic invoice for panel (d); and authors' own calculations. JG: POR QUÉ NO HACEMOS TODO ESTO CON FE O TODO CON F29?

Figure 8: Performance of employment and sales



Note: For details on sales, see the note to figure 5. Employment refers to the total number of employer-employee relations in the employer-employee dataset, excluding workers enrolled in the employment protection program (LPE). Seasonally adjusted. Sources: Electronic invoice; employer-employee dataset (AFC); employment protection law (LPE) dataset; and authors' own calculations.

Figure 9: Employment: Heterogeneity by sector and size



(a) Sector (b) Size

Note: Seasonally adjusted employment, excluding workers enrolled in the employment protection program (LPE), normalized at 100 in February 2020.The service sector includes personal services and business services. For details on the classification of firms by size, see the note to figure 4. Sources: Employer-employee dataset (AFC); employment protection law (LPE) dataset; and authors' own calculations.

Figure 10 studies the interaction of the extensive and intensive margins in the performance of employment. As for the case of sales, panels (a) and (b) show the heterogeneity in the recovery of employment, by means of the distribution of the DAVIS AND HALTIWANGER 92 growth rates. The blue distributions compare average employment in Oct-Dec 2020 with Oct-Dec 2018, and thus, speak about heterogeneity in the recovery from the COVID pandemic. The orange distributions serve as a benchmark of "normal times." This benchmark averages the distributions of the periods 2015-2017, 2016-2018, and 2017-2019. Panel (a) displays unweighted distributions, whereas panel (b) refers to distributions in which each firm's growth rate is weighted by average employment across the two periods. For continuing firms, both panels show that in the COVID period (blue distributions), there is more mass in the left side of the distribution, i.e., a larger share of firms employs less workers than two years ago. In more normal times, there is a more mass on the right side of the distribution. In other words, the distribution of the growth rate of employment is shifted to the left, which is consistent with an economy where employment has not recovered its pre-pandemic level. For exiting and entering firms, in the unweighted distribution there is higher destruction and lower creation in the recovery from the COVID pandemic than in normal times. In the weighted distribution, we only see lower creation, which suggests smaller firms account for the bulk of employment destruction.

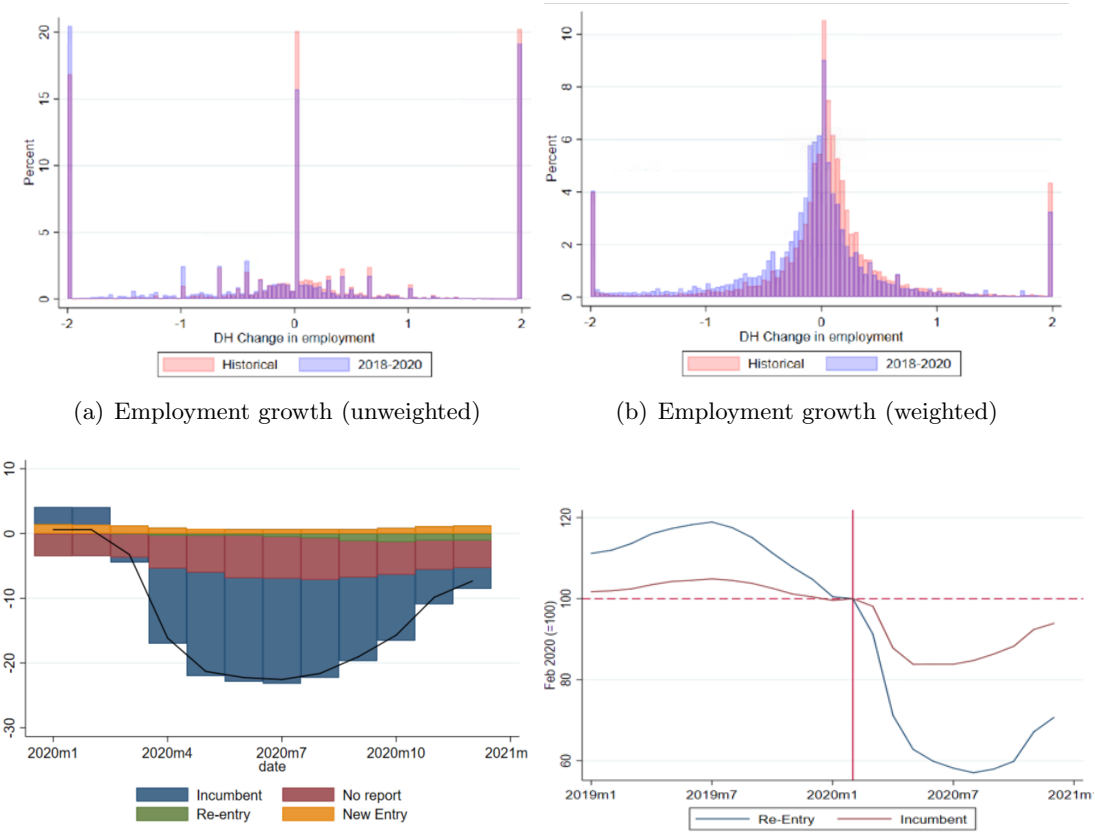
Panel (c) of figure 10 shows the contribution of the extensive margin to the year-on-year growth rate of employment (black line). As in the case of sales, the bulk of the fluctuation of employment is driven by the behavior of incumbent firms (blue bars). Exiting firms (red bars) are more important for the dynamics of employment than for the dynamics of sales, since their contribution to the decline of employment is much more visible than that of sales. Finally, panel (d) tracks the performance of employment in re-entering and incumbent firms. As in the analysis of sales (panel d of figure 7), we follow a group of firms in each category. As expected, effective employment in re-entering firms fared much worse than in of incumbent firms. However, re-entering firms are much smaller, which explains why they contribute little to the fluctuation of total employment.

3.3 Suppliers Market: Linkages between Firms

One important margin of adjustment of firms is the creation and destruction of relationships with suppliers.[8] Figure 11 shows the gross creation and destruction of links with suppliers over time and also the net creation, which is the gross creation minus the gross destruction. It shows that the net creation was zero before the pandemic and it became negative reaching a decline

[8]Given that we show aggregate numbers, it is equivalent to show this fact for supplier or buyers, given that the intermediate input market has to clear at the aggregate level.

Figure 10: Employment: Extensive and intensive margins



(a) Employment growth (unweighted)

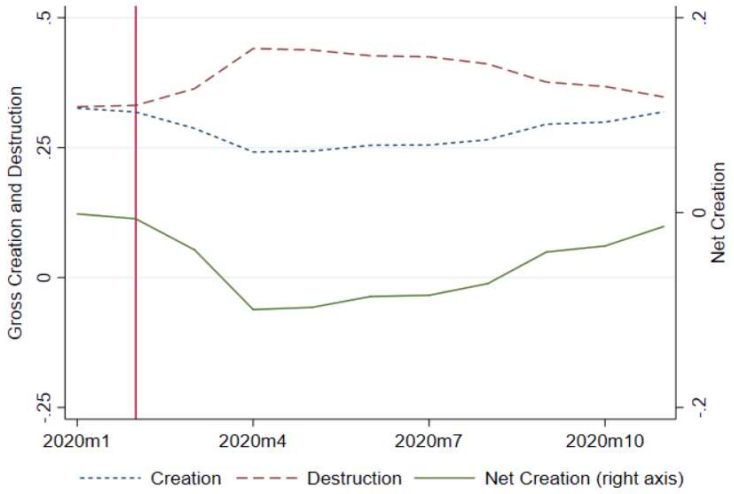
(b) Employment growth (weighted)

(c) Contribution of extensive margin

(d) Re-entrants and incumbents

Note: Employment excludes workers enrolled in the employment protection program (LPE). Panels (a) and (b) show the distribution of the DAVIS AND HALTIWANGER 92 growth rate of average employment in Oct-Dec 2020 relative to Oct-Dec 2018. Panel (a) refers to the unweighted distribution, whereas panel (b) refers to the distribution weighted by average employment. Panel (c) shows the contribution of incumbent, entering (new entry), exiting (no report), and re-entering firms to the year-on-year growth rate of employment. Panel (d) tracks employment of firms that at any point after the pandemic hit the economy were classified as re-entrants, as well as firms that after the pandemic hit did not suffer exit spells (incumbents). For details on the classification of firms in panels (c) and (d), see the notes to figure 7. Sources: Employer-employee dataset (AFC); employment protection law (LPE) dataset; and authors' own calculations.

Figure 11: Gross Creation and Destruction of Productive Linkages between Firms



Note: This graph documents gross creation and destruction (left axis) and net creation (right axis) of productive relationships of firms with their suppliers, expressed in 12-month growth. Firms belonging to the National Accounts Directory are included, except those linked to EGW and Public Administration. Red vertical line marks February 2020. Source: tax forms F29 and authors' own calculations.

Table 1: Links Destruction and Recovery

Links Destroyed in:	Share of Links Destroyed	Share of Links Recovered Afterwards
January	33	35
February	33	35
March	36	33
April	44	38
May	44	37
June	43	37
July	42	35
August	41	33
September	38	30
October	37	26
November	35	22

Note: This table documents the share of links destroyed each month and the share of links recovered afterwards

of around 10 percentage points in April 2020 and then a slow recovery back to zero net creation by the end of 2021. One can see that the decline in net creation is driven by both an increase in gross destruction and a decline in gross creation. Both contribute somewhat equally to the decline in net creation of linkages with suppliers.

One important aspect to understand is how much of the destruction was recovered afterwards.

Table 1 shows in Column 2 the share of links destroyed in a given month and in Column 3, among the total links destroyed in a month, the share that were recovered with the same link until the end of the year. Thus, for example, in April 2020, 44% of links were destroyed relative to April 2019 which represents 10 percentage points above relative to February 2020, before the pandemic started in Chile. Out of that 44%, 38% were recovered between May and December 2020. This is a relatively large fraction and it suggests that part of the recovery was driven by relationships that were able to rebuild after the initial shock.

3.4 Physical Capital Market: Investment

We now study firm adjustment in the market for physical capital, i.e., investment. Panel (a) of figure 12 shows the evolution of total real investment in machinery and equipment,[9] seasonally adjusted and normalized at 100 in February 2020, and compares it to total sales. Investment displays more volatility than sales, with a contraction nearly three times larger than that of sales when the pandemic hit the economy, but also a stronger recovery over the following months.

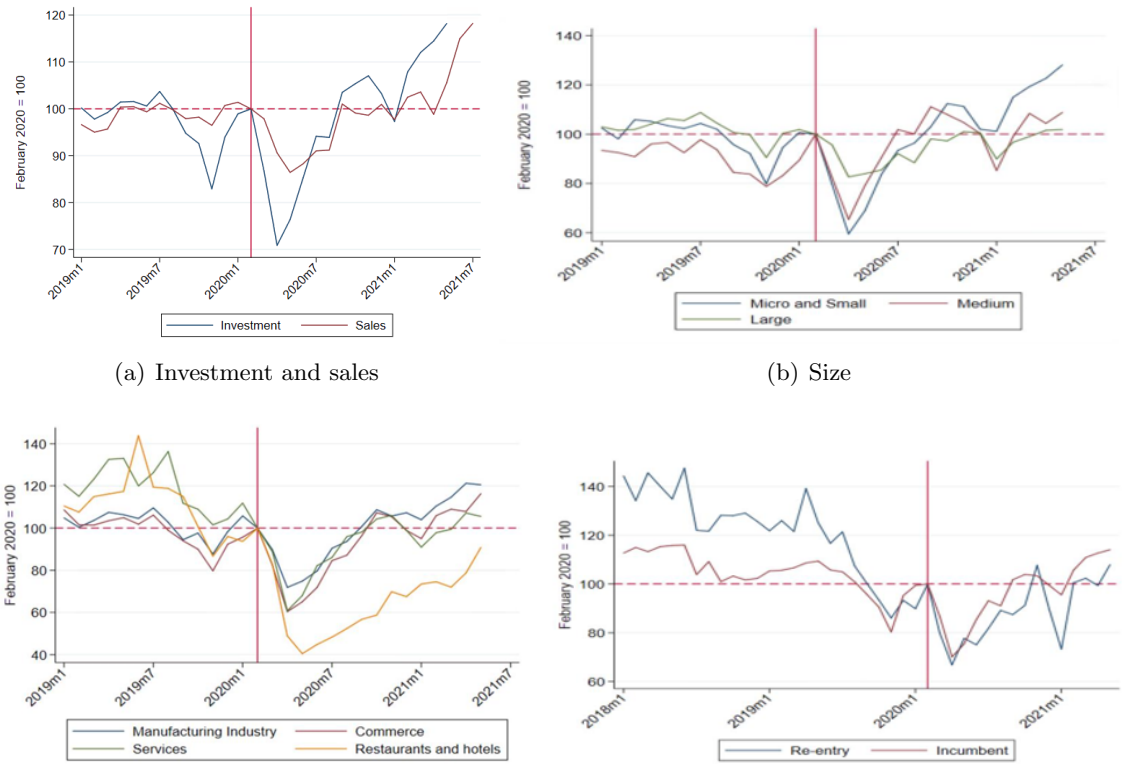
Panels (b), (c) and (d) of figure 12 show the heterogeneity in investment along firm size, sector, and incumbent status. Large firms experienced a substantially lower decline in investment than micro and small, and medium firms (panel b). The three groups of firms, however, have recovered their pre-pandemic levels, with investment in micro and small firms substantially above their pre-pandemic level. In terms of sectors (panel c), the behavior of restaurants and hotels again stands out due to size of the decline relative to the other three sectors. Investment in manufacturing, commerce, and services recovered relatively quickly to pre-pandemic levels. Investment among re-entering and incumbent firms (panel d) displays less heterogeneity than variables such as sales and employment (figures 6 and 9). Both groups of firms experienced a decline of roughly 30%, and have recovered pre-pandemic levels, with a faster recovery among incumbent firms.

3.5 Credit Market: Bank Debt

Access to financing is a key determinant of how firms adjust to shocks. This was particularly true for the COVID crisis. Panel (a) of figure 13 shows that domestic bank credit increased in the months that followed the impact of the COVID shock, with annual credit growth reaching a peak of about 10 percentage points higher than that in the month prior to the beginning of the crisis (February 2020). The countercyclicality of bank credit in the COVID crisis marks a stark contrast with two previous crises—the global financial crisis of the late 2000s and the

[9]The source of machinery and equipment investment is the tax form F29, which does not include information on building investment.

Figure 12: Heterogeneity in investment



(a) Investment and sales

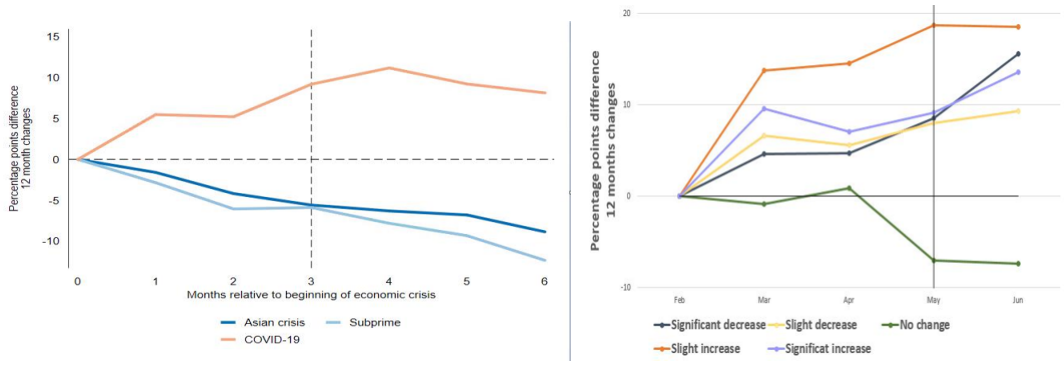
(b) Size

(c) Sector

(d) Re-entrants and incumbents

Note: The figure shows the evolution of real investment in machinery and equipment, which comes from tax form F29. Observations above the 99.9th percentile of the distribution are winsorized. Panel (a) compares total investment to total firm-to-firm sales (see the note to figure 5 for details on sales). Panels (b)-(d) show the evolution of investment according to firm size, sector, and incumbent status. The service sector includes personal services and business services. For details on the classification of firms by size, see the note to figure 4. For details on the classification of firms by incumbent status, see the note to figure 6. All the series are seasonally adjusted. Sources: Electronic invoice; tax form F29; and authors' own calculations.

Figure 13: Bank credit to firms



(a) Credit during crises (b) Credit and sales in 2020

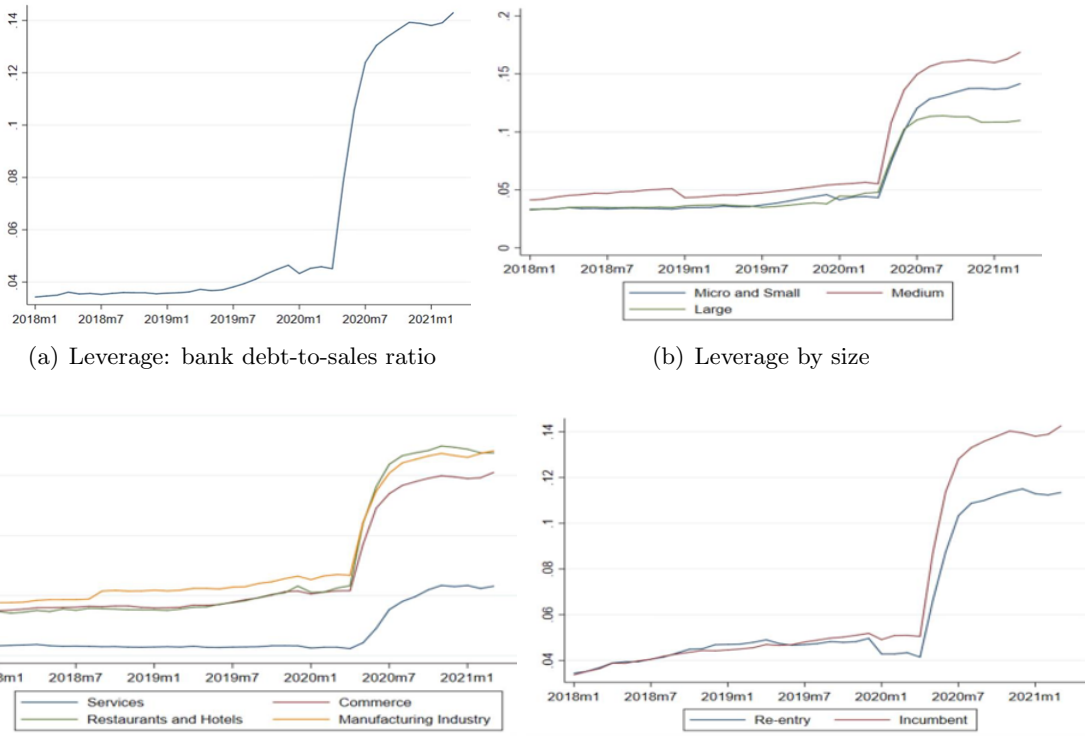
Note: Panel (a) shows the total stock of bank credit to firms each month, expressed as the difference, in percentage points, of the 12-month growth rate with respect to the the growth rate in the month in which the crisis begins. For the Asian and subprime crises, t=0 is the first month of negative GDP growth, according to the monthly GDP proxy IMACEC. For the COVID crisis, t=0 is February 2020. Panel (b) compares the change in the annual growth rate of bank credit, in percentage points, relative to that in February 2020, for five groups of firms classified according to the performance of sales growth. The classification considers the difference, in percentage points, of the annual growth rate of sales in April 2020 relative to that in February 2020. Firms that experienced significant changes in sales growth (decreases or increases) are those with changes of 20 to 100 percentage points. Firms that experienced slight changes in sales growth are those with changes of 1 to 20 percentage points. Firms classified as having no change in sales growth experienced changes of less than 1 percentage point. According to this classification, 46% of firms experienced a significant decrease in sales growth, 17% experienced a slight decrease, 3% experienced no change, 13% experienced a slight increase, and 21% experienced a significant increase. Sources: Financial Regulatory Commission; electronic invoice; and authors' own calculations.

Asian financial crisis of the late 1990s, when domestic bank credit contracted. Crucially, the countercyclical response of bank credit was driven by policies implemented by the central bank and the government, which we study in detail in section 4. Panel (b) of figure 13 describes how bank credit flowed to firms according to their sales performance. It shows annual bank credit growth relative to that in February 2020, expressed as a difference, in percentage points, for five groups of firms classified according to the 12-month growth rate of sales in April 2020 relative to that in February 2020. Firms with a significant decrease (increase) in sales experienced declines (increases) in the growth rate of sales of 20 to 100 percentage points. Firms with a slight decrease (slight increase) in sales experienced declines (increases) in the growth rate of sales of 1 to 20 percentage points. Firms classified as experiencing no change in sales growth saw changes of less than 1 percentage point.[10] The figure shows a widespread increase in credit growth and, importantly, with credit flowing to highly affected firms.

The substantial increase in domestic bank credit is, naturally, associated to higher firm leverage. Figure 14 shows the evolution of the bank debt-to-sales ratio, a common indicator of leverage. Importantly, we fix the denominator, so that changes in the ratio reflect changes in

[10]The classification of firms according to the performance of sales uses data on firm-to-firm sales from the electronic invoice. The fraction of firms that fall within each category is as follows. Significant decrease: 46%; slight decrease: 17%; no change: 3%; slight increase: 13%; significant increase: 21%.

Figure 14: Leverage



(a) Leverage: bank debt-to-sales ratio

(b) Leverage by size

(c) Leverage by sector

(d) Leverage for re-entrants and incumbents

Note: Leverage is measured as the ratio of the stock of bank debt each to real sales for the 12-month period covering October 2018 to September 2019, so as to avoid the social unrest episode of October 2019. By fixing the denominator, changes in leverage reflect only changes in the stock of debt, and not the sharp decline in sales during the pandemic. Panel (a) shows the evolution of total leverage, i.e., the ratio of the total stock of bank debt to historic sales. Panels (b)-(d) show the evolution of leverage by firm size, sector and incumbent status. The service sector includes personal services and business services. For details on the classification of firms by size, see the note to figure 4. For details on the classification of firms by incumbent status, see the note to figure 6. Sources: Financial Regulatory Commission; electronic invoices; and authors' own calculations.

the stock of debt, rather than the sharp decline in sales. Specifically, we compute the stock of debt each period as a ratio of total real sales for the 12-month period covering October 2018 to September 2019, so as to avoid the social unrest episode of October 2019. Panel (a) shows the evolution of total leverage, i.e., the total stock of bank debt as a ratio of total sales. In a few months, leverage tripled, increasing by more than 9 percentage points.

Panels (b)-(d) in figure 14 document how, in this dimension, not much heterogeneity is found. Panel (b) shows that leverage in large firms increased somewhat less than that of medium and micro and small firms. Panel (c) shows that all four sectors we study experienced the roughly tripling of leverage documented in the aggregate. This is the case even for the services sector, which displays low historical levels of leverage. Finally, panel (d) shows that incumbent firms experienced a larger increase in leverage than re-entering firms.

3.6 Productivity

To understand the effect of the pandemic on firm-level and aggregate productivity and its connections with the previous margins of adjustment, we estimate total factor productivity (TFP) following state-of-the-art estimation procedure by Ackerberg et al. (2015). In particular, we estimate the following production function:

$$\log y_{it} = \log A_{it} + \alpha^L \log l_{it} + \alpha^K \log k_{it} \tag{1}$$

where i indexes a firm, t indexes a year, y_{it} is value added, l_{it} is number of workers, k_{it} is the stock of capital and A_{it} is firm-level TFP, which we estimate. Following Ackerberg et al. (2015), we find that $\alpha^L = 0.9$ and $\alpha^K = 0.1$, which are in line with previous estimates with Chilean data (Gandhi et al., 2020). To go from firm-level TFP to aggregate-level, we weight with value-added.

Figure 15 shows that TFP increased during 2020 by 4.7%. The figure shows that all inputs declined during 2020, but value-added declined relatively less than labor, and thus measured productivity increased. This increase in productivity masks, however, substantial heterogeneity. Figure 16 shows in Panel (a) that around 56% (38%) of firms saw their productivity decrease (increase) by an average of around 30% (40%). Panel (b) shows the heterogeneity across size. The productivity of small firms declined, whereas the productivity of medium and large firms increased. Finally, Panel (c) shows the heterogeneity across sectors. Productivity increased in commerce and manufacturing, but decreased in services, hotels and restaurants, and construction. Taking stock, the productivity increased from 2020 is driven by medium and large firms, commerce and manufacturing.

While previous figures show heterogeneity across groups, they do not exploit firm-level heterogeneity. To explore more this level of heterogeneity, we correlate -at the firm-level- productivity growth with growth of different observables that affect productivity. In order to isolate between industry variation, we extract industry-level averages. For comparison, besides 2020, we show these correlations for 2019, a non-crisis year, and 2009 a crisis year due to the global financial crisis. Figure 17 presents the results. Panel (a) shows that, perhaps surprisingly, the correlation between productivity and value added growth is basically the same for 2009 and 2019, and very similar in 2020, except for the upper tail of productivity growth, that had a relatively weaker growth of value added. Panel (b) shows a different pattern in each year. First, 2020 represents a downward shift of the correlation relative to 2019. This implies that for a given change in employment, productivity increased more in 2019. One can also note that for the firms with negative productivity growth, there was almost no increase in employment in 2020.

Figure 15: Aggregate Productivity Growth in 2020

Note: This figure presents the aggregate productivity growth between 2020 and 2019 and the aggregate growth of each of the variables that are used to measure productivity. Thus, the red, green and yellow bar sum up to the blue bar. When going from firm-level variable to these aggregates, we weight with value-added of each firm. Source: authors' own calculations.

Finally, the shape of the correlation for 2009 is different relative to 2020. In 2009, the firms that increased productivity substantially (above 30%), did so with a larger decline in employment than firms in 2020. On the other hand, for firms with a smaller increase in productivity, employment declined less in 2020 relative to 2009. In other words, the correlation between productivity and employment growth became flatter in 2020 relative to 2009.

Panel (c) shows the correlation between productivity and investment growth. One can see that the correlation is close to zero in 2019 (and even slightly negative for positive productivity growth), whereas it is positive in 2020. It is also positive in 2009, although with a downward shift, suggesting that investment had an overall better performance in 2020 relative to 2009. Finally, we explore the relation between productivity growth and the growth of linkages between firms, both with suppliers and buyers. We find that there is a positive correlation between productivity growth and the growth of number of buyers and suppliers that firms have in 2020. In 2009, these correlation are almost zero. This suggests that the capability of recovering buyers and suppliers in 2020 was important for productivity growth.

Figure 16: Heterogeneity of Productivity Growth in 2020

(a) Productivity Changes

(b) Size

(c) Sector

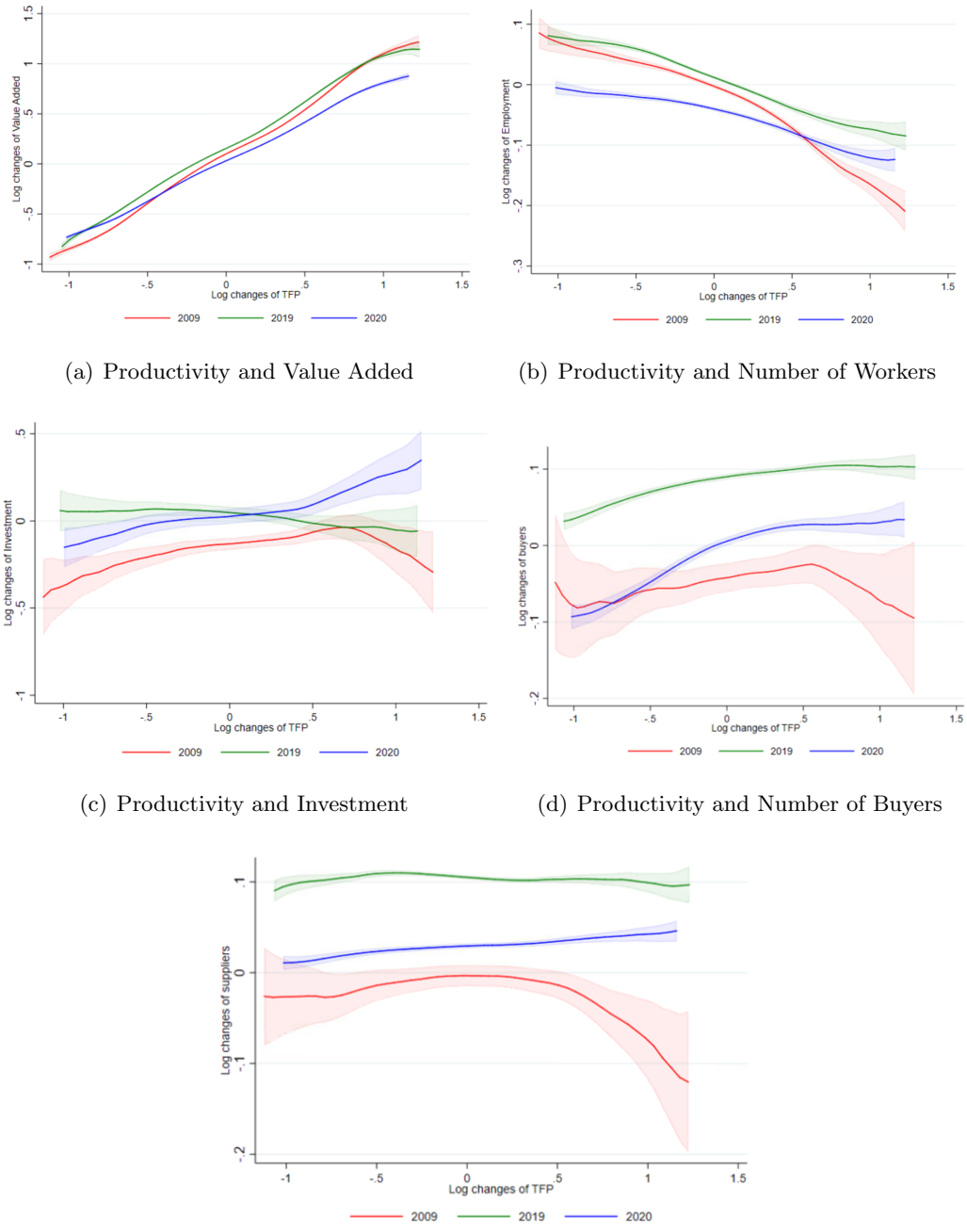
Note: This figure presents the aggregate productivity growth between 2020 and 2019 and the aggregate growth of each of the variables that are used to measure productivity, for different groups of firms. Panel (a) divides firms into three groups according to their productivity growth. If their productivity fell by more than 3% they are considered as "Fall", if it increased by more than 3%, they are considered as "Increase", otherwise they are considered as "Unchanged". Panel (b) divides firms by size, small firms are those who sell less than 25.000 UF, medium firms sell between 25.000 UF and 100.000 UF, and large firms sell more than 100.000 UF. Panel (c) divides firms by sector, between Services, Commerce, Construction, Industry and Restaurants and Hotels. The remaining sectors are included in "Others". Numbers in parenthesis represent the share of value added of each group. As in Figure 15, the aggregate measures are weighted using firm-level value added. Source: authors' own calculations.

4 The Role of Policies

This Section studies the role of two policies that were oriented to firms in Chile at the onset of the COVID crisis between March and May of 2020. One aimed at supporting credit to firms while the other targeted to protect employment at the firm.

We begin by documenting access to these two policies in terms of how many firms voluntarily accessed the programs, when they did so, and the intensity with which they did it. We also continue to track the heterogeneity in access across firms' sector, size, and incumbent status. We present further evidence in terms of outcomes related to accessing these programs on exit, re-entry, sales, employment, and investment.

Figure 17: Productivity and Observables Growth in 2020, 2019 and 2009



(a) Productivity and Value Added

(b) Productivity and Number of Workers

(c) Productivity and Investment

(d) Productivity and Number of Buyers

(e) Productivity and Number of Suppliers

Note: This figure presents correlations between firm-level productivity growth between 2020 and 2019 (X axis) and the growth of different observables. The correlations are shown non-parametrically with local linear regressions. Source: authors' own calculations.

While these were the two main policies implemented to support firms in Chile due to COVID, and the first line of defense as the crisis unfolded, there were other policies mostly aimed at supporting households via e.g. fiscal transfers and early pension withdraws. Importantly, these additional policies were enacted throughout the second half of 2020, after the two policies that

we study here were implemented. This is crucial for properly identifying the effects of the policies that we study on firms' outcomes.

4.1 Access to Credit Support (FCIC-FOGAPE)

On March 16, 2020, two weeks after the first COVID case was identified in Chile, the Central Bank of Chile announced it was lowering its monetary policy rate to 50 bp, its effective lower bound. Importantly, a separate set of unconventional policies to counteract the economics effects of COVID were also announced. At the core of these measures was a new credit facility (FCIC in its spanish acronym) aimed at providing liquidity to commercial banks at very low rates for up to 4 years, conditional on banks providing loans to small and medium size firms. Throughout the COVID time, FCIC provided nearly US40 billions in loans to banks.

A few weeks after this, on abril 2020, a complementary policy to FCIC was launched by the Chilean government through FOGAPE-COVID, a state-backed fund that would provide sovereign guarantees of up to 85% of commercial bank loans to firms. The recapitalization of the fund by USD3,000 millions provided guarantees for loans of up to USD24,000 millions.[11] The combination of these two credit support policies provided resources and incentives for banks to lend to firms affected by the COVID shock.

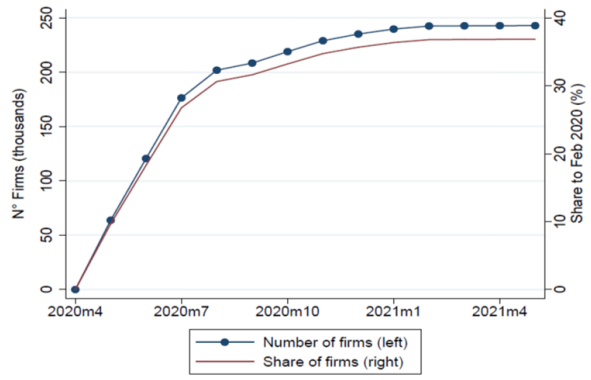
Panel (a) in figure 18 documents firm access to FOGAPE-COVID loans. There was widespread access to this program. By the end of 2020, close to 250.000 firms (40% of all firms in February 2020 with positive sales) obtained at least one loan through this program. Importantly, access was equally strong among firms that were performing relatively well and those that were being highly impacted by the crisis. Panel (b) shows that credit flowed largely to firms with significant decreases in sales only comparable to those with significant increases. Lastly, Panel (c) shows that the lion's share of the program was provided in the first two months of the implementation of the FCIC-FOGAPE joint programs in May and June, with flows that amounted to about 3% and 2% of GDP, respectively.

Figure 19 documents the heterogeneity in access across firms. Loans were given relatively more to firms in commerce and manufacturing, and mostly to micro and small, incumbent firms. In terms of flows, FOGAPE-COVID loans were directed more to commerce and manufacturing too, and they were evenly distributed across firm sizes. Lastly, most were given to incumbent firms.

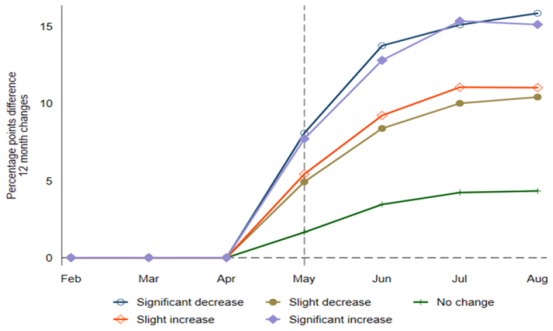
While a formal evaluation of the extent to which access to FOGAPE-COVID loans systematically correlated with firms' margins of adjustment will be made at the end of this Section,

[11] The sovereign credit guarantees program, FOGAPE, dates back to 1980. Before the COVID crisis and the recapitalization the fund had only USD100 millions in capital.

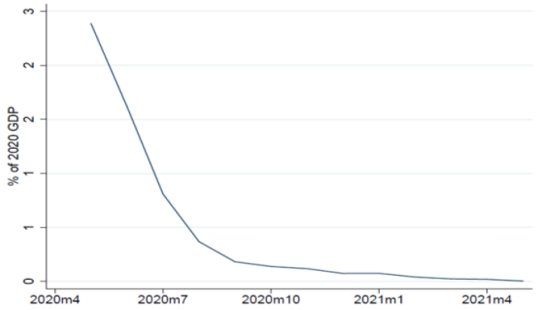
Figure 18: Firm access to bank loans under the FOGAPE program



(a) Firms with FOGAPE loans



(b) FOGAPE and sales



(c) FOGAPE flows

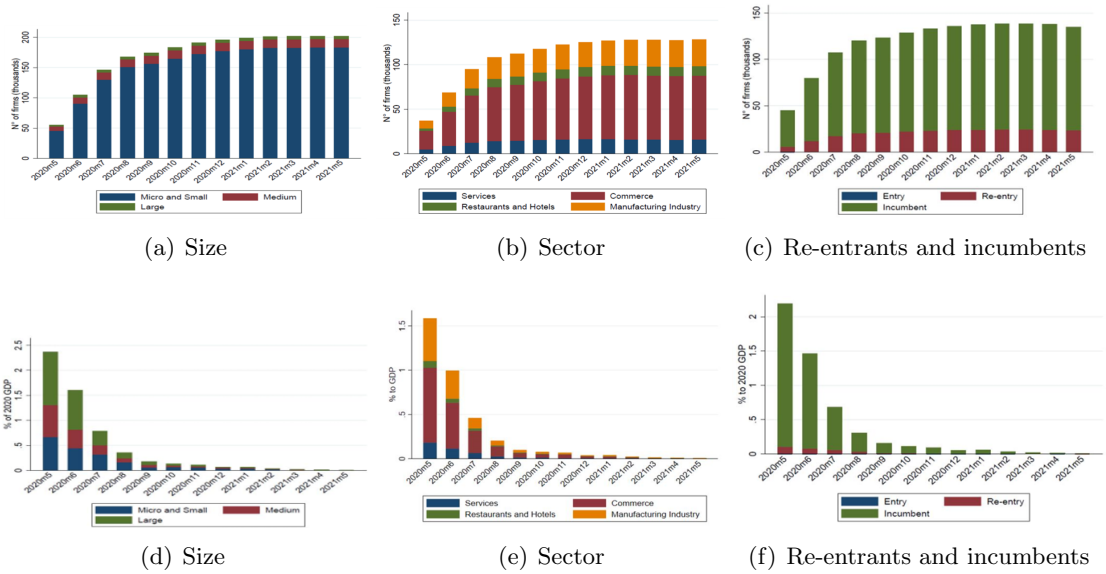
Note: Panel (a) shows the cumulative number of firms that that had received a FOGAPE loan. Panel (b) compares the change in the annual growth rate of FOGAPE loans, in percentage points, relative to that in April 2020, the month prior to implementation of FOGAPE-COVID program, for five groups of firms classified according to the performance of sales growth. The classification considers the difference, in percentage points, of the annual growth rate of sales in April 2020 relative to that in February 2020. Firms that experienced significant changes in sales growth (decreases or increases) are those with changes of 20 to 100 percentage points. Firms that experienced slight changes in sales growth are those with changes of 1 to 20 percentage points. Firms classified as having no change in sales growth experienced changes of less than 1 percentage point. Panel (c) shows the evolution of bank credit under the FOGAPE-COVID program, as a share of 2020 GDP. Sources: Financial Regulatory Commission, and tax form F29 and authors' own calculations.

figure 20 presents a first set of descriptive statistics along those lines. The figure presents the dynamics of sales and investment by grouping firms into two groups: those that did not get FOGAPE-COVID loans and those that did. Results indicate that firms that accessed loans from the credit support program had an initial sharper decline in sales and investment of about 10% to 20% for these two variables respectively, relative to the group that did not access. Interestingly, firms that obtained FOGAPE-COVID loans recovered more rapidly in those two dimensions relative to the other group.

4.2 Access to Employment Protection (LPE)

In April 2020 the Employment Protection Law (LPE for its Spanish acronym) was passed by Congress and became another landmark program in the set of policies aimed at supporting firms

Figure 19: Heterogeneity in firm access to FOGAPE loans

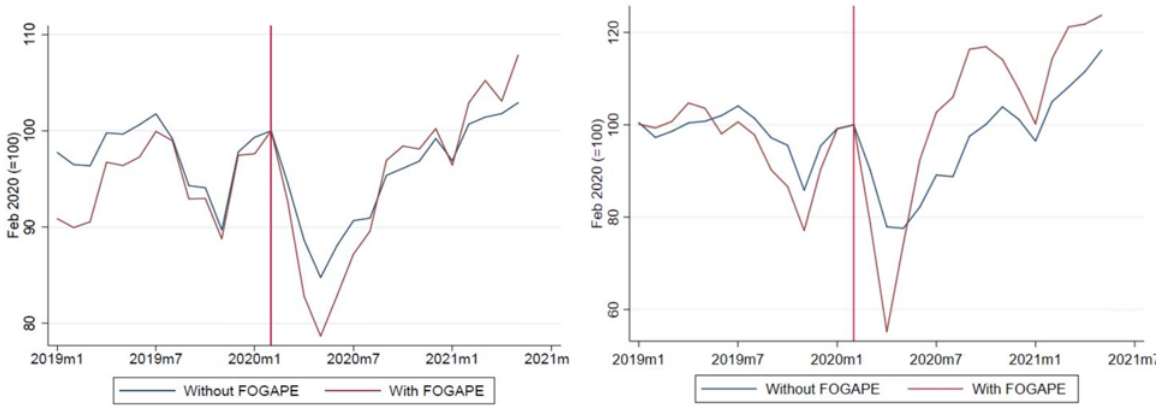


(a) Size (b) Sector (c) Re-entrants and incumbents

(d) Size (e) Sector (f) Re-entrants and incumbents

Note: Panels (a)-(c) show the cumulative number of firms that had accessed a loan under the FOGAPE-COVID program, by firm size, sector, and incumbent status, respectively. Panels (d)-(f) show the evolution of bank credit under the FOGAPE-COVID program, as a share of 2020 GDP, by firm size, sector, and incumbent status. For details on the classification of firms by size, see the note to figure 4. The services sector includes personal services and business services. For details on the classification of firms by incumbent status, see the note to figure 6. Source: Financial Regulatory Commission and authors' own calculations.

Figure 20: Performance of sales and investment in firms that accessed FOGAPE loans

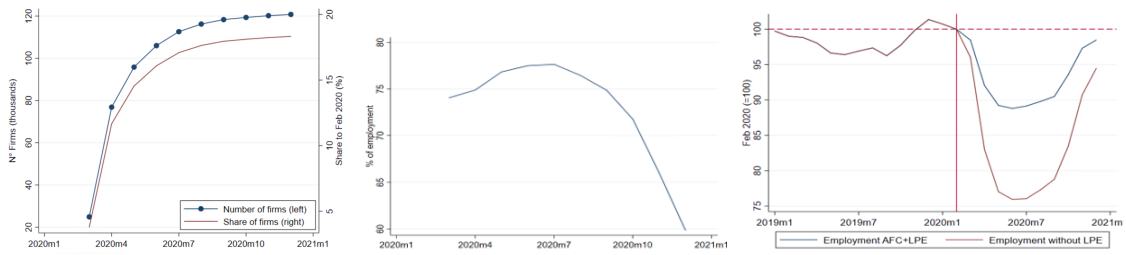


(a) FOGAPE-COVID and sales (b) FOGAPE-COVID and investment

Note: The two groups presented split Sales and investment of firms that, on one hand, accessed bank credit under the FOGAPE-COVID program in any month starting in May 2020, when the FOGAPE-COVID program began ("With FOGAPE") and those that never accessed loans through this program ("Without FOGAPE"). All series are seasonally adjusted. Sources: Financial Regulatory Commission, tax form F29, and authors' own calculations.

and, in particular, the relationships they have formed over time with their employees. LPE would provide firms a legal way to furlough some or all employees fast and easily. Importantly, the program was also cost effective for the firms as it had to pay only a small fraction of benefits while

Figure 21: Firm access to employment protection program (LPE)



(a) Firms in LPE (b) Intensity in use of LPE (c) Employment and LPE

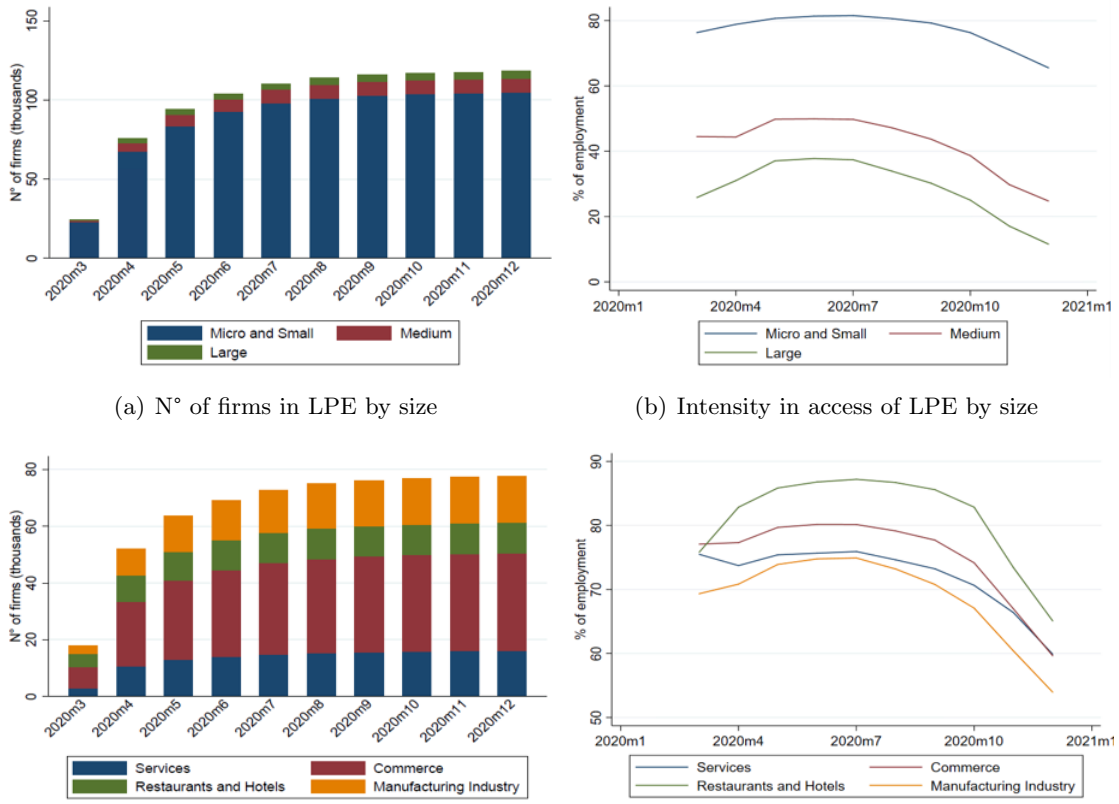
Note: In panel (a) we consider the cumulative number of firms that at one point had at least one worker enrolled in LPE. Panel (b) shows the fraction of the payroll enrolled in LPE among firms that accessed the policy. In panel (c) the blue line refers to total employment relations in the employer-employee database; the red line computes effective employment by excluding workers enrolled in LPE. Both series are not seasonally adjusted. Sources: Employer-employee dataset, employment protection program (LPE) dataset, and authors' own calculations.

the employee would continue having a fraction of her salary (debited from the unemployment insurance fund). Fully reinstating employees back to work was also an expedite and costless process. Thus LPE gave firms important room to maneuver and scale back production without incurring in costly layoffs, while giving them also the chance to scale up quickly and without incurring in hiring costs once the economy recovered.

LPE was also a policy that experienced widespread access by firms, though relatively less than FOGAPE-COVID. As can be seen from panel (a) in figure 21, the largest access took place in April 2020, the month it was launched, and by the end of 2020 nearly 120.000 firms (20% of all firms in February 2020 with positive sales) had enrolled at least one worker in the program. Conditional on accessing the program, the high intensity in its use was also a distinctive characteristic. Panel (b) shows that, for an average firm that accessed LPE, the share of employees in LPE reached nearly 80% by mid 2020 and stayed higher than 60% throughout the period of analysis. Importantly, LPE allowed total employment to fall less due to the COVID shock. Panel (c) adds employees in LPE to the measure of effective employment (presented in Stylized Fact 3). At the trough of the crisis in June 2020, about 10% employment was lost relative to pre-COVID if one includes workers in LPE, while the fall is nearly 25% if one looks only at effective workers.

Figure 22 documents how heterogeneous access to LPE was. It was largely concentrated in micro and small firms where, conditional on accessing this program, the typical firm had more than 80% of workers furloughed in LPE. Access to LPE has been largely concentrated in commerce and manufacturing firms. Among the firms that accessed LPE, those in the restaurants and hotels sector enrolled a larger fraction of their payroll, close to 90% of the labor force in the average firm in this sector.

Figure 22: Heterogeneity in access to employment protection (LPE)



(a) N° of firms in LPE by size

(b) Intensity in access of LPE by size

(c) N° of firms in LPE by sector

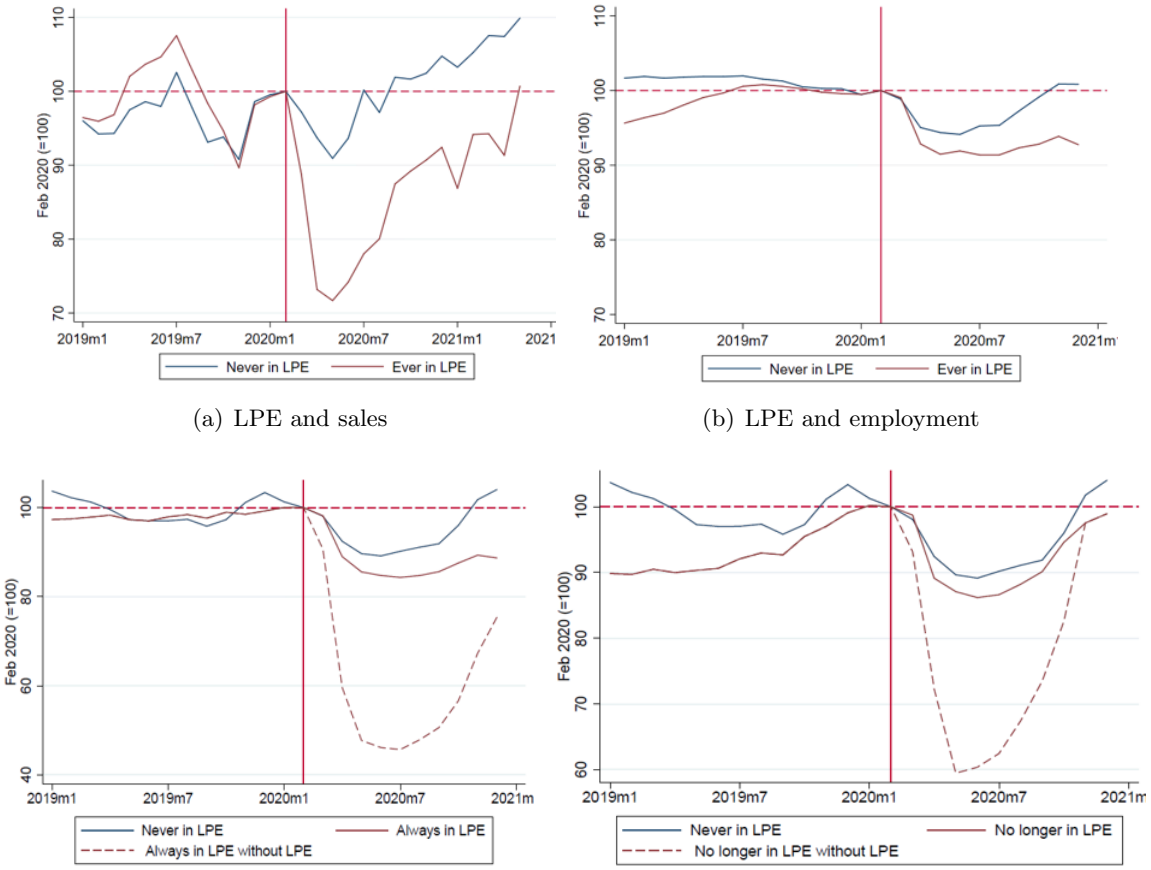
(d) Intensity in access of LPE by sector

Note: Panels (a) and (c) show the cumulative number of firms with at least one worker enrolled in LPE at any point in time by firm size and sector, respectively. Panels (b) and (d) show the fraction of the payroll enrolled in LPE among firms that accessed the policy, by firm size and sector, respectively. For details on the classification of firms by size, see the note to figure 4. The services sector includes personal services and business services. Source: Employer-employee dataset, employment protection program (LPE) dataset, and authors' own calculations.

In Figure 23, we identify firms that accessed LPE through March and December and those that did not access it in this period, and track their performance before and after the crisis in terms of sales and employment. Among firms that accessed LPE, sales dropped substantially more, with a trough in May 2020 of about 70% less sales compared to pre-COVID, while that of firms that did not enroll employees in LPE saw their sales fall only to about 90% of their pre-COVID levels, and displayed a relatively faster recovery. Indeed, recovery of sales in firms that did access the policy lagged behind those that did not. In contrast, the decline in total employment across the two types of firms was much more similar as documented in panel (b), suggesting that LPE did help absorb some of the effects on employment from the large shock in sales, a hypothesis that will be explored more formally in the next subsection.

A caveat in the analysis of panel (b) comes from the fact that, among the group of firms that accessed LPE at the onset of the program, we do not differentiate between firms that continued

Figure 23: Performance of firms that accessed employment protection (LPE)



(a) LPE and sales

(b) LPE and employment

(c) Employment in firms that stayed in LPE

(d) Employment in firms that left LPE

Note: Panels (a) and (b) show the evolution of sales and total employment, respectively, in firms that accessed LPE in any month during the period March-December 2020. Total employment includes workers enrolled in LPE, and the series in both panels are seasonally adjusted. Panel (c) shows the evolution of employment in firms that enrolled workers in LPE in March, April or May 2020 and had at least one worker enrolled each month until December. Solid and dashed red lines refer to total employment, and employment excluding workers enrolled in LPE, respectively, in these firms, whereas the blue line considers total employment in firms that did not access the LPE program at any point during 2020. Panel (d) shows the evolution of employment in firms that enrolled workers in March, April or May 2020 and had no workers enrolled by November, at the latest; and have positive sales in Nov and Dec. All figures in panels (c) and (d) are not seasonally adjusted. Sources: tax form F29, employer-employee dataset, employment protection program (LPE) dataset, and authors' own calculations.

in LPE throughout the 2020 and those that terminated access to the program before the end of the year. The lower panels in figure 23 zoom only at firms that accessed LPE at the start of the crisis (Mar-May 2020). While the left panel looks at employment in firms that continue to access the LPE policy, those to the right have stopped at least since November 2020. In both cases, real employment (not in LPE) has recovered considerably. For the firms on the left panel it went from a fall of near 40% that of pre-COVID levels to 80%. For the case of firms on the right panel, the recovery went from 60% levels of employment relative to pre-COVID to recovering levels of employment seen before the pandemic.

To zoom in on employee transitions from LPE to non-LPE within the firm, table 2 documents

the status of workers within firms that had accessed LPE at the onset of the policy and through May 2020 (included). It reports the share of these employees that continued to be in LPE, those that had already been reinstated in the same firm and those that had left the firm. It is remarkable to see that, by December 2020, more than 75% of employees were still with the firm they worked for at the time it decided to access LPE, with 53% back to work, and the remaining 23% continued in LPE.[12]

Table 2: Transition of workers that enrolled in LPE in March-May 2020

	2020						
	June	July	August	September	October	November	December
In LPE	94.1%	89.5%	82.1%	75.3%	65.2%	40.5%	23.5%
Back to work in the same firm	4.4%	7.1%	11.3%	15.8%	22.4%	41.1%	52.6%
Other	1.5%	3.4%	6.6%	8.9%	12.5%	18.4%	23.9%

Note: We track the status of the pool of workers whose firm enrolled them in LPE between March and May 2020 throughout the rest of the year. "In LPE": workers enrolled in LPE; "Bach to work in the same firm": workers recalled to the firm they worked for in Mar-May; "Other": workers that may be out of the labor force, unemployed, or working for a firm other than the one they were working for when they enrolled in LPE. Source: Employer-employee dataset, and authors' own calculations.

Table 3 completes the analysis by considering the extent to which firms accessed LPE and FOGAPE-COVID policies simultaneously. Among firms that accessed any of the two policies in March-June 2020 (second row), 31% accessed LPE only, 41% accessed FOGAPE-COVID only, and 28% accessed both. For each of these three sets of firms, we compute the median annual growth of sales at the start of the crisis (Mar-Apr). Firms that suffered the sharpest decline in sales growth (49%) accessed LPE only, while those that were relatively less affected (16% median decline in sales growth) accessed FOGAPE-COVID only. The median firm that accessed both programs experienced an initial decline of sales growth of about 39%. These results hold when we consider access to these policies throughout 2020 (first row).

Table 3 also provides information in terms of size and sectors. Sales drop were dominated by micro and small firms across three groups of firms, with medium and large firms being relatively less impacted. Notably, these two types of firms that only accessed FOGAPE-COVID loans displayed an average increase in sales of about 9-10%. In terms of sectors, commerce and restaurants hotels are the ones that were mostly impacted among firms accessing LPE.

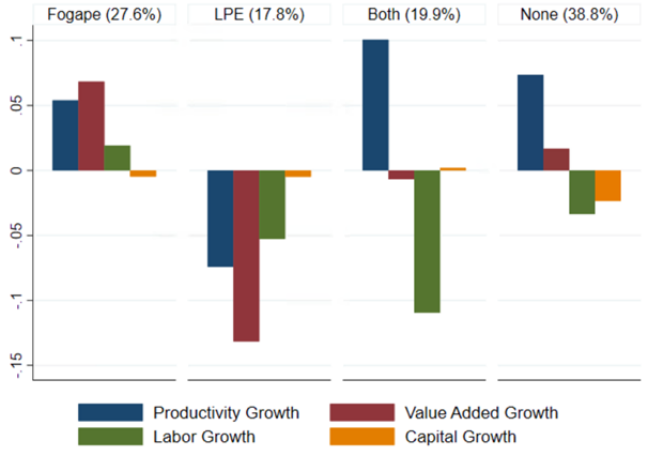
[12]Employees that neither continue in LPE nor are back to work in the same firm are either unemployed or have started working at another firm.

Table 3: Firm access to employment protection (LPE) and credit guarantee (FOGAPE) policies

	Employment protection (LPE) only			Credits guarantee (FOGAPE) only			LPE and FOGAPE		
	Number of firms	Share of firms	Median sales growth	Number of firms	Share of firms	Median sales growth	Number of firms	Share of firms	Median sales growth
2020	50566	25.6%	-45.4%	106324	53.9%	-17.6%	40552	20.5%	-37.8%
Mar-Jun 2020	42488	30.9%	-49.2%	56290	40.9%	-16.3%	38723	28.2%	-38.9%
Micro and Small	38435	32.1%	-52.0%	49560	41.4%	-21.0%	31709	26.5%	-45.0%
Medium	2531	20.4%	-23.6%	4962	39.9%	9.1%	4933	39.7%	-16.3%
Large	1522	28.3%	-14.5%	1767	32.9%	9.7%	2081	38.8%	-12.7%
Services	6373	42.4%	-44.5%	4308	28.6%	-24.6%	4366	29.0%	-35.6%
Commerce	14163	27.4%	-51.8%	23769	46.0%	-14.8%	13710	26.5%	-40.4%
RRHH	4967	42.4%	-68.3%	2280	19.5%	-56.5%	4469	38.1%	-67.9%
Manufacturing Industry	5486	28.2%	-39.6%	7682	39.5%	-15.3%	6303	32.4%	-31.0%

Note: The first row considers firm access to these policies throughout 2020. The second row focuses on access in March-June 2020, the period when most firm accessed these policies. Rows 3-5 show access in March-June 2020 by firm size. For details on the classification of firms by size, see the note to figure 4. Rows 6-9 show access in March-June 2020 by firm sector. Services include personal services and business services. Median sales growth refers to March-April 2020, the initial period of the COVID shock. To compute median sales growth in Mar-Apr of each group of firms, we begin by computing, for each firm, average annual sales growth in March-April; we then compute the median across firms. Source: Electronic invoice, employer-employee dataset, employment protection law (LPE) dataset, Financial Regulatory Commission, and FOGAPE credits dataset.

Figure 24: Heterogeneity of Productivity Growth for Different Policies



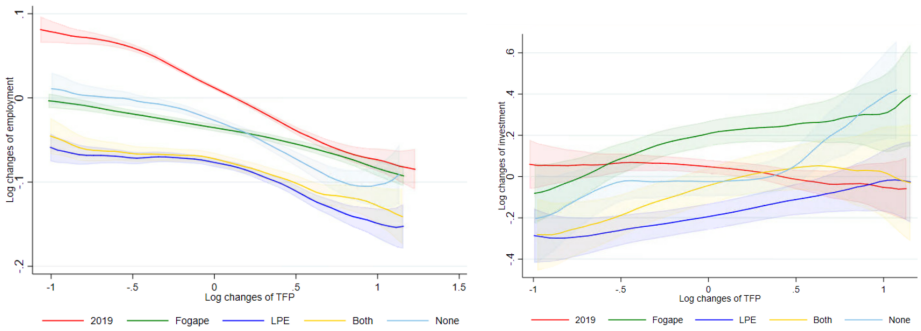
Note: This figure presents the aggregate productivity growth between 2020 and 2019 and the aggregate growth of each of the variables that are used to measure productivity, for different groups of firms. Firms are divided into four groups, depending on the policies they used between March and June 2020. Numbers in parenthesis represent the share of value added of each group. As in Figure 15, the aggregate measures are weighted using firm-level value added. Source: authors' own calculations.

4.3 Policies and Productivity

We also study whether the correlations between productivity growth and observables are related to the policies that were implemented. We divide firms into four groups. The ones that took only the credit guarantee policy (FOGAPE-COVID), the ones that took only the employment protection program (LPE), the ones that took both and the ones that took neither. To benchmark these correlations, we compare them to 2019. Figure 25 shows in Panel (a) that firms that enrolled in LPE had a lower growth of effective employment, for every productivity growth, relative to firms that took the credit guarantees. This suggests that LPE worked as a buffer to adjust real employment, something that will be further explored in the next subsection. Panel (b) shows that firms that took the credit guarantee saw a much stronger correlation between productivity growth and investment growth. This suggests that the policy helped firms expand investment and that this in turn helped firms expand productivity.

Lastly, the largest increase in measured productivity was recorded among firms that accessed both policies. Notably, for this group of firms such increase in productivity was the result of a large drop in effective employment with a mild fall in value added, suggesting that policies may have allowed firms to adjust (labor), mitigate the drop in value added, with important effects in their productivity.

Figure 25: Productivity and Observables Growth for Different Policies



(a) Productivity and Number of Workers (b) Productivity and Investment

Note: This figure presents correlations between firm-level productivity growth between 2020 and 2019 (X-axis) and the growth of different observables. The correlations are shown non-parametrically with local linear regressions. Source: authors' own calculations.

4.4 Effects of Policy Support

We turn now to a more systematic assessment of the impact of public policies on firms' margins of adjustment amid the COVID shock in Chile. The policies considered are the two analyzed in the previous section: credit support policies via FOGAPE-COVID, and the employment protection in LPE.

4.4.1 Model

The generic model considered in our baseline specification is as follows:

$$y_{i,T} = \alpha_{t(i)} + \alpha_{s(i)} + \alpha_{a(i)} + \alpha_{m(i)} + \beta_1 * POL_{i,T-1} + e_i, \tag{2}$$

where $y_{i,T}$ is an outcome variable that captures a margin of adjustment of firm i in period T; and $POL_{i,T-1}$ is the main explanatory variable, capturing access by that firm in period *T-1* to one of the policies considered. Additional covariates considered are $\alpha_{t(i)}$, $\alpha_{s(i)}$, $\alpha_{a(i)}$, and $\alpha_{m(i)}$ which control for firm size, sector, age, and municipality, respectively. Finally, e_i is the residual of the regression.

We consider two types of outcome variables in $y_{i,T}$. The first kind captures the extensive margin, namely i) firm exit, proxied through a binary varibale that takes the value of 1 if the firms reports no sales; and ii) firm reentry proxied as a 1 if it subsequently reports positive sales after having exited at the onset of COVID. On the intensive margin, the variables we study are annual growth rate of employment and investment. We use probit models when the outcome variable captures an extensive margin, and standard OLS on variables of the intensive margin.

When quantifying access to policies we also capture extensive and intensive margins. For the case when $POL_{i,T-1}$ is FOGAPE-COVID the extensive margin is simply captured through a dummy variable that takes the value of 1 if the firm borrowed from banks through this credit support program or 0 otherwise. The intensive margin of this program is proxied with the change in the stock of debt of the firm scaled by historical sales. When $POL_{i,T-1}$ is LPE the extensive margin is also a dummy variable that takes the value of 1 if the firm had at least one employee under this employment protection program or 0 otherwise. The intensive margin of this program is proxied as the ratio between the number of workers under LPE over the total number workers of the firm.

The timing dimension is key to our identification strategy (see Figures 26 and 27 below). When studying exit decisions (extensive margin) or growth in employment and investment (intensive margins), we break up the timing into three subperiods. First, an initial period *T-2* when the COVID shock occurs and impacts sales of firms, which takes place during March and April, 2020, as was documented earlier. This allows us to split firms into two groups in the two subsequent periods: those with positive annual growth in sales in these two months relative to the same months of 2019, and those with negative growth. Our analysis is conducted on the latter set of firms, which roughly accounts for 2 out of every 3 firms in the economy.

The second subperiod (*T-1*) covers May and June, 2020, when, as documented in the previous section, the largest increase in access to both policies took effect. Lastly, outcomes are evaluated in a third subperiod (T) which takes in the month of July.

When studying re-entry decisions (extensive margin) we break up the timing into two subperiods only. First, an initial subperiod (*T-1*) when firms exit for the three consecutive months between April and June, 2020, i.e we do not observe sales for this period. Among the subset of firms that fall into this case, outcome in the subsequent period (T) is evaluated whether the firm re-enters or not. Again this latter period is July.

It is worth stressing again that additional policies to support households went into effect since August, 2020. This is why we prefer to keep the outcome subperiod only in July in order to minimize contamination of the effects of the two policies studied due to other programs that took effect later on.

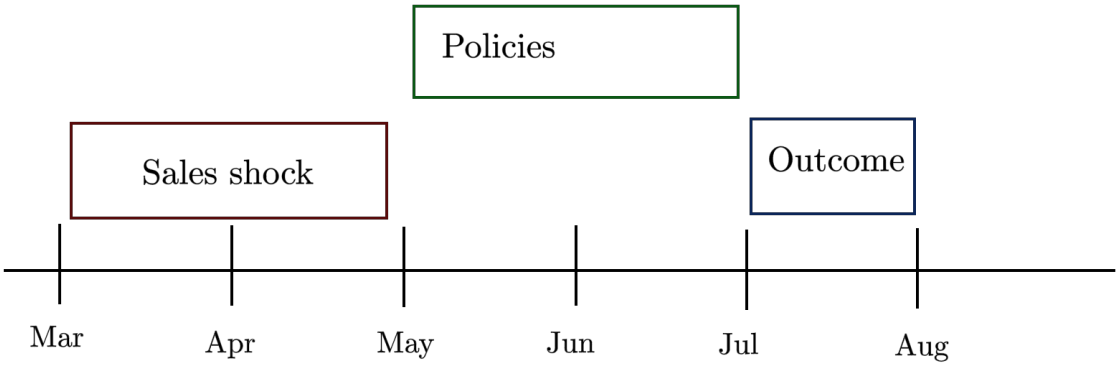


Figure 26: Timing used when analyzing Exit, Employment and Sales

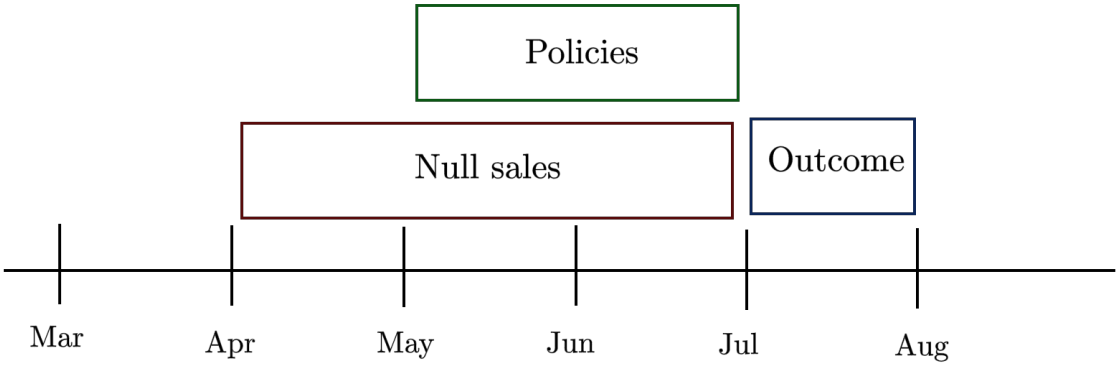


Figure 27: Timing used when analyzing re-entry

4.4.2 Data and Descriptive Statistics

The firm level information used in our baseline specification goes through various filters. First, we consider only firms which had at least one month of positive sales since 2018. Second, we restrict our sample to firms who had positive sales during March or April 2019, since we classify firms according to their sales annual growth rate. Third, because we want to exclude firms that exited the market prior to the COVID shock, we keep only those who never exit or which exited the market after February 2020. We also winsorize some variables at 99% and 95% in order to abstract from outliers[13].

A list of summary stats of the variables in this exercise are available in the tables below (Tables 4 5). The final sample is made of 529.159 firms. From those, 94% reported sales in

[13]In particular, we winsorize debt growth at 5% and 95%, and employment growth at 99%

July 2020 while the rest (6%) did not. Furthermore, 73% of them accessed to FOGAPE-COVID loans and 14% exited between April and June, 2020, out of which only 1% re-entered in July. The sample of firms upon which access to LPE is evaluated in our baseline specification is smaller -with 285.099 firms- due to the fact that, for this particular analysis, we further impose as restriction that a firm needs to have at least one employee. From this subset of firms, 27% of firms participated with at least one employee in the LPE program.

In the subperiod where we evaluate outcomes (T), annual growth in employment was -12%, -0.001% in investment. The intensive measure that captures access to credit -change in the stock of debt to historical sales- increased by 2%. Lastly the average share of employees in LPE program was 18%.

Table 4: Summary stats - Binary variables

	Nº firms		Percentage	
	0	1	0	1
No report during July 2020	497,557	31,602	94%	6%
Fogape access from March to June 2020	385,665	143,494	73%	27%
LPE access from April to June 2020*	208,042	77,057	73%	27%

Table 5: Summary stats - Continuous variables

	Average	SD	Nº Obs
Employment growth rate between July 2019 and 2020*	-12%	55	224,383
Investment change between July 2019 and 2020 over historical sales	-0%	6	529,159
Change in debt stock between June and Feb 2020 over historical sales	2%	5	529,159
Percentage of LPE ratio in July 2020*	18%	30	226,099

Note: Employment and LPE: We report the number of firms from a subset that previously reported at least one employee since 2018. Sources: Financial Regulatory Commission; Tax form F29; Employer-employee dataset (AFC) and employment protection law (LPE) dataset.

The summary stats for the reentry variable are summarized as follows (see Table 6). There are a total of 76,697 firms that exit during April, May and June 2020, out of which 11% re-enter in July.

Table 6: Summary stats - Reentry

		0	1	Sub-total	Do not exit	Total
Reentry	N° firms	68,392	8,305	76,697	452,462	529,159
	Percentage	13%	1%	14%	86%	100%
		(89%)	(11%)	(100%)		

Note: Source: Employer-employee dataset (AFC) and employment protection law (LPE) dataset.

4.4.3 Results

Results for the probit regressions on the extensive margin are summarized in Table 7 where the first two columns report results for the probability of no report and the last two columns present results for the probability of re-entry. The two rows present results for the intensive and extensive margins associated to access to FOGAPE ("Change in debt stock" and "Dummy Fogape", respectively).[14]

Both margins of FOGAPE access are systematically correlated with a subsequent lower probability of not reporting sales. We find that increasing the change in debt stock over sales by 1 % between end of February and June has an average marginal effect of reducing the probability of not reporting sales in July by 0.04%. This implies that a one SD movement in the change of the debt stock is correlated with a reduction of the probability of no report by 0.2%. This is not a trivial number since the unconditional probability of no report is 5.97%.

The dummy variable that captures access to FOGAPE between the program's inception and June has an even stronger correlation with a decrease in no report in July of 0.5%. This implies that accessing FOGAPE is correlated with an average reduction in the probability of not reporting sales from 5.97% to 5.5%.

Results further indicate that both margins capturing access to FOGAPE are systematically linked to subsequent higher probabilities of re-entering (as proxied by sales). Indeed, firms that exited between March and June (i.e did not report sales), saw their probability of re-entry (start reporting sales) in July augment by 0.04% (0.2%) when the change in their debt stock to sales increased by 1% (one SD). Likewise, access to FOGAPE raised the probability to renter in July by 1.3%. Once more, these are economically relevant as the unconditional probability of reentry was 10.8%.

[14]We do not report results on the extensive margin using since this particular policy was designed to protect employment rather than avoid operational continuity of firms.

Table 7: Extensive Margin

	No Report		Reentry	
FOGAPE				
Change debt stock	-0.040 ***		0.035 ***	
	(0.0085)		(0.0246)	
Dummy Fogape		-0.005 ***		0.013 ***
		(0.0013)		(0.0035)
N. Obs	354,729	354,729	76,419	76,419

Note: The table shows the impact of public policies on no report probability and reentry probability, under probit specification with fixed effects. The explanatory variables are related to credit: Change debt stock measures the change in firm's debt stock between June 2020 and February 2020 over historical sales and Dummy Fogape indicates whether had access to Fogape during April, May or June 2020. The average marginal effects of 1% change debt stock imply a reduction (increase) of 0.04% in the probability of no report (reentry). Accessing Fogape has an average marginal effect of reducing the probability of no report by 0.5%, whereas augments the probability of reentry by 1.3%. Sources: Financial Regulatory Commission; tax form F29; and authors' own calculations.

Table 8 presents results for the two intensive margin outcomes that we study -employment and investment-. They indicate that access to the two policies studied are systematically correlated with adjustments in both variables, though the evidence is stronger for employment.

Regarding employment, first notice that constant terms in the regressions are negative, implying that on average firms destroyed employment in July by an annual growth that varies between 15% to 28%. Hence, positive estimated coefficients associated to both policies indicate that they correlated with a dampening of this destruction. A 1% (one SD) increase in debt stock change over sales between February and June dampened the decrease in employment in July by 0.3% (1.3%); and getting a FOGAPE-COVID credit in that period was linked to a relatively lower decrease in employment of approximately 1.9%.

Furthermore, access to LPE up to June is associated with a relatively large dampening in employment fall in July of about 20%. Furthermore, a 1% (one SD) increase in the ratio of LPE to total workers mitigates total employment decrease by 0.1% (4.4%).

Results for investment are less robust. Only the change in the stock of debt is statistically related to a dampening in the negative growth displayed by investment in July. Neither the FOGAPE dummy nor any of the two margins in LPE are associated to changes in investment. This is perhaps not too surprising as neither of the two policies were targeted to support investment and, instead, had other goals such as to help firms stay afloat while protecting employment.

Table 8: Intensive Margin

	Employment				Investment			
Change debt stock	0.254 ***				0.003 **			
	(0.0235)				(0.0012)			
Dummy Fogape		0.019 ***				0.000		
		(0.0032)				(0.0002)		
Ratio LPE			0.146 ***				-0.000	
			(0.0041)				(0.0002)	
Dummy LPE				0.204 ***				-0.000
				(0.0028)				(0.0002)
Constant	-0.203 ***	-0.202 ***	-0.154 ***	-0.277 ***	-0.000 ***	-0.000 ***	-0.000 **	-0.000 *
	(0.0014)	(0.0015)	(0.0016)	(0.0017)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
N. Obs	145,884	145,884	132,583	145,884	354,745	354,745	142,613	183,955
R2	0.051	0.05	0.031	0.083	0.002	0.002	0.003	0.002
Adj R2	0.048	0.048	0.029	0.081	0.001	0.001	0	0

Note: The table shows the impact of public policies on employment and investment growth rates, under OLS with fixed effects. The explanatory variables are related to credit or employment: Change debt stock measures the change in firm's debt stock between June 2020 and February 2020 over historical sales, Dummy Fogape indicates whether had access to Fogape during April, May or June 2020, Ratio LPE refers to the number of workers under LPE over the total number of workers in a firm during March, April, May or June 2020, and Dummy LPE evaluates if a firm used LPE during the same time period. The impact of 1% change debt stock on employment (investment) is an increase of 0.3% (0.003%). Employment increases 1.9% if the firm access Fogape, or 20% if it access LPE. Augmenting by 1% the ratio of workers in LPE increases total employment by 0.1%. Sources: Financial Regulatory Commission; Tax form F29; Employer-employee dataset (AFC) and employment protection law (LPE) dataset.

Summing up, gaining access to FOGAPE in the early phase of COVID is correlated with lower chances of not reporting sales in subsequent months, a higher probability of re-entry if a firm had stopped reporting sales, and a dampening in employment decrease. Likewise, early access to LPE did correlate with subsequently lower levels of job destruction.

5 Conclusion

This paper offers a complete and detailed account of how firms adjusted to the COVID pandemic, adding substance to the standard macro view of the shock. Our analysis exploits a rich administrative dataset for Chile that allows us to trace the real effects of the shock on firm-level output, employment, investment, access to credit, links with suppliers, access to credit, and productivity. The substantial and heterogeneous adjustments we find are influenced by policies. In particular, we find that credit support and employment protection policies contributed to mitigate the adverse effect of the pandemic on firms along several dimensions, such as their decisions on exit and re-entry, sales, and employment.