Development through the Private Sector Series
Technical Note No. 48

December 2025

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Cover design: Greta Design

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Firm Resilience to Shocks and the Role of Credit Access in Colombia

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Abstract

This paper analyzes the resilience and recovery dynamics of Colombian micro, small and medium enterprises after the COVID-19 pandemic using firm-level survey data from 2020–2021. We examine heterogeneity by sector, size, and ownership (women-owned/led vs. others) and assess the role of credit access in supporting the recovery. Recovery was uneven: employment gains were modest while job losses persisted, with medium-sized firms rebounding more strongly than microenterprises. Services and industry led employment growth, commerce lagged, and firm digital adoption declined overall as we moved away from the pandemic. Using multiple recalibrations of propensity score matching, we find that credit access significantly improved firm outcomes, increasing the likelihood of workforce maintenance and growth (~5 p.p.) and economic resilience and growth (~6 p.p.). Effects were driven by those observed for women-owned/led firms (~13 p.p.) and SMEs (up to +11 p.p.), while microenterprises showed limited gains. Results underscore the importance of financial access and targeted policies to support vulnerable firms during systemic shocks.

JEL Classification: B21, C42, D04

Keywords: Microeconometrics, Quasi-experimental Methods, Propensity Score Matching

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The authors would like to thank Maria Cecilia Acevedo and Norah Sullivan for valuable comments and edits to this research work. We alone are responsible for any remaining errors. The views expressed in this working paper are those of the authors and do not necessarily represent those of FinDev Canada, the Inter-American Development Bank Group, their respective Boards of Directors or the countries they represent.

1. Introduction

One of the primary economic challenges posed by the COVID-19 pandemic in Latin America and the Caribbean was the risk that many businesses would not survive. Prior to the pandemic, businesses in the region exhibited varying levels of crisis preparedness and few firms had sufficient liquidity reserves to endure prolonged periods of inactivity. According to a survey conducted at the onset of the pandemic in Colombia, 82% of businesses reported they could only sustain operations for one to two months with their own resources (Deza and Beverinotti, 2020).

Despite this context, official data on business closures and insolvency filings in Latin America and the Caribbean revealed less severe outcomes than anticipated. According to IDB & CGD (2022), several factors explain these results. First, government support programs, including household subsidies, credit guarantees, and loan payment deferrals, enabled many businesses, especially micro, small and medium enterprises (MSMEs), to remain operational during the pandemic. Second, legal insolvency processes remained complex and costly, which may have led numerous businesses to avoid these mechanisms and opt for less formal exit alternatives. Finally, data quality issues may have contributed, as high informality in the region means official records may not accurately capture the total number of business closures.

This study analyzes resilience and recovery dynamics of Colombian firms following the COVID-19 pandemic. It is based on a sample of more than 10,000 MSMEs constructed using repeated cross-sectional data from a nationally representative MSME survey collected by the National Association of Financial Institutions (ANIF). We present evidence on how MSMEs were affected by the pandemic, what characteristics made firms more resilient to this large external shock, and what strategies they used to cope and recover. We are interested in uncovering any underlying heterogeneity; therefore, the analysis explores differences in results across economic sectors, firm size, and for women-owned/led MSMEs versus others.

MSMEs are considered an integral part of the Colombian economy. According to data reported by the Colombian Confederation of Chambers of Commerce, there were approximately 1.7 million MSMEs operating in the local economy in 2024 (Confecámaras, 2025). Moreover, MSMEs represent 99% of all businesses operating in the country, they support 79% of total employment and contribute to 40% of the gross domestic product (GDP) (BBVA Research, 2024). Following the peak of the COVID-19 pandemic, gross business creation data for Colombia (without accounting for closures) showed that microenterprises recovered their pre-pandemic creation levels by 2021, and the creation of small businesses increased in both 2020 and 2021, while medium-sized business creation remained below 2019 levels (Rojas-Suarez and Fiorito, 2022).

It is important to mention that the present study does not look at firm creation or destruction. The data we use only observes firms that were active in each round of the survey. Therefore, by quantifying how different groups of active firms (by sector, size, and whether it is women-owned/led) change their performance over time, we provide one approximation into their resilience and recovery dynamics as we move away from the start of the pandemic. We acknowledge that since we cannot directly observe attrition rates, there may be some potential upward bias generated in the measured performance of firms over time. In Section 4 we describe how we try to account methodologically for this time-varying bias.

The vulnerability of MSMEs to economic crises has been well-documented in the literature. Deza and Beverinotti (2020) highlight several factors contributing to the limited preparedness of these businesses to face economic shocks in the Andean region, including: (i) insufficient liquidity reserves; (ii) reliance on credit, as many SMEs depend heavily on supplier and customer credit to finance working capital; (iii) high fixed costs, where smaller businesses face high fixed costs relative to total costs, including labor and capital expenses, which must be covered even when revenues decline; (iv) limited access to credit lines, microenterprises face challenges accessing formal credit lines, limiting their ability to sustain operations during shutdowns while meeting financial obligations; and (v) property ownership, as most micro and small enterprises in the region operate in rented premises, making them more vulnerable to revenue declines, as many cannot afford rent payments during crisis periods.

These structural weaknesses underscore a broader challenge: restricted financial access not only exacerbates vulnerability during crises but also hinders firm ability to enhance productivity and sustain growth, as demonstrated by empirical evidence (Ferrando and Ruggieri, 2018; Motta, 2020). Access to finance is a critical determinant of firm performance. It ensures liquidity and operational continuity by enabling firms to pay workers and suppliers before revenues are realized (Chodorow-Reich 2014; Bacchetta, Benhima, and Poilly 2019), maintain inventories (Deloof 2003; Aktas, Croci, and Petmezas 2015), offer credit to customers (Brennan, Maksimovic, and Zechner 1988; Aktas et al. 2015), and undertake long-term investments that foster competitiveness (Fazzari, Hubbard, and Petersen 1988; Blalock, Gertler, and Levine 2008; Levine and Warusawitharana 2021). Finally, firms with better financial access demonstrate stronger resilience during crises such as the COVID-19 pandemic, and they are less likely to suffer drops in sales or face closure, particularly among SMEs with strong worker and supplier relationships (Amin and Viganola 2021; Powell and Valencia 2023).

In this analysis we go deeper into understanding the role that access to credit plays in firm resilience during economic crises, which is approximated by the data reported by firms regarding changes in their workforce and economic situation. Considering the data

available, we apply quasi-experimental methods exploiting a rich set of observable characteristics to compare firms that access credit versus those that do not. While we conduct a series of robustness checks to guarantee that the matching models are well specified and that results are not dependent on the choice of matching algorithm, we also acknowledge that we cannot fully account for unmeasured confounders. Thus, we interpret our results with caution and mainly as indicative of a robust correlation, acknowledging that a causality interpretation may be more limited in this case.

Uncovering gaps between enterprises owned/led by men and women is of particular importance as little research has been conducted on the impacts of COVID-19 and access to credit on women-owned/led businesses. Existing evidence analyzing the effect of the pandemic shows that women-owned/led firms experienced larger decreases in performance (Acevedo et al., 2023). According to a WTO study (2023), based on data collected in 2020 from 41,383 business leaders across 107 countries, digitalization is a key factor in enhancing businesses' adaptive capacity. However, the ability of digitalization to counter structural inequalities, such as differences in industry sectors and business size, remains limited, leaving women-led businesses at a significant disadvantage during the global crisis caused by the COVID-19 pandemic.

Our results indicate an uneven recovery across firms in employment, economic performance, credit demand, and digitalization. Employment gains rose modestly as the economy moved beyond the pandemic, yet job losses also increased, with medium-sized firms showing the strongest rebound and microenterprises experiencing persistent deterioration. Sectoral differences are pronounced: services and industry led employment growth, while commerce lagged behind. Credit demand shifted markedly toward larger firms in the later periods, suggesting that liquidity constraints continued to affect microenterprises despite pandemic credit relief programs. Digital adoption declined overall as in-person activity resumed; however, women-owned/led firms expanded their use of digital technologies, contrasting with reductions among other firms. The analysis further reveals that women-owned/led firms preserved jobs more effectively but faced greater relative deterioration in economic outlook. These patterns underscore structural vulnerabilities among smaller firms and highlight the critical role of firm size, sector, and ownership characteristics in shaping resilience and adaptation strategies.

Our findings also show that access to credit had a significant positive impact on firm recovery outcomes. Across the full sample, credit access increased the likelihood of maintaining employment by 4 percentage points (p.p.) and achieving workforce growth by 5 p.p. Similarly, firms with credit were 4 p.p. more likely to remain economically resilient and 7 p.p. more likely to grow. The largest effects were observed among women-owned/led firms, which recorded gains of 11–15 p.p. across growth and resilience indicators, while no significant impacts were detected for other firms. Impacts were also concentrated among larger firms, with SMEs reporting substantial improvements in growth and resilience (up to

+11 p.p.), whereas microenterprises exhibited no significant effects beyond workforce maintenance. Furthermore, treatment effects were markedly stronger in the second survey period, suggesting that credit benefits materialized as economic conditions improved or that these effects exhibit a lagged response. Furthermore, treatment effects were markedly stronger in the second survey period, suggesting that credit benefits materialized as economic conditions improved or that these effects exhibit a lagged response. All results are robust to multiple recalibrations of the propensity score matching algorithm.

The remainder of this paper is organized as follows: Section 2 details the firm-level data used in this research. Section 3 presents descriptive evidence looking at firm resilience and recovery dynamics. Section 4 presents a deeper analysis of the effects of credit access on resilience and recovery, including multiple robustness checks. Section 5 concludes and discusses policy implications.

2. Data

We use repeated cross-sectional data from the MSME Survey, collected by the National Association of Financial Institutions (ANIF) in Colombia. The entire dataset is a pooled sample consisting of 10,271 firms, with 5,691 firms sampled in 2021 and 4,580 firms sampled in 2022. The survey was conducted using a stratified sampling framework that took into consideration region, sector, and firm size for the final sample to be representative. The survey covers 7 regions and 117 municipalities and is limited to firms with fewer than 200 employees. The sampling frame was constructed using the firm directory curated by the *Departamento Administrativo Nacional de Estadística* (DANE). Firm classification by sector was done using ISIC codes and the survey focused on businesses in urban areas.

Table 1 presents a more detailed breakdown of the data. As can be seen, of the total number of firms, 5,691 are micro (< 10 employees), 3,410 are small (between 11 and 50 employees) and 1,124 are medium-sized (between 51 and 200 employees).[4] The sectors captured by the sample are as follows: 31.1% commerce; 27.5% industry; and 41.4% services. Additionally, 30.2% of the sample are women-owned/led firms.[5] Approximately 11% of the firms in the sample is considered informal based on whether they possess a tax identification number (NIT). Moreover, 84% of the firms reported having a business linkage such as an active business partnership with another entity (e.g., chamber of commerce, university, business association). Additionally, 68% of firms reported incorporating digitalization in their business model by engaging in one or more of the following activities: digital delivery of products; use of digital platforms to sell products; use of digital platforms to purchases inputs; sales via electronic commerce; or purchases via electronic commerce.

[4] The total number of firms that could be classified by size was 10,227. The remainder did not have the relevant data for classification.

[5] Women-owned/led firms are classified as firms that are either at least 50% owned by women, OR at least 20% owned by women, women comprise at least 30% of the board, and a woman is the primary decision-maker.

Table 1. Breakdown of Firm Data

	Sector			Size			Women-owned/led		Formality		Linkages		Digitalization		Total
	Commerce	Industry	Services	Micro	Small	Medium	No	Yes	No	Yes	No	Yes	No	Yes	
Region															
Antioquia	624	545	879	1148	664	224	1462	586	386	1662	461	1587	907	1141	2048
Caribe	518	421	660	911	533	150	1212	387	168	1431	407	1192	379	1220	1599
Bogotá	706	598	828	1092	763	268	1424	708	78	2054	342	1790	371	1761	2132
Central	307	285	447	542	361	131	693	346	32	1007	110	929	294	745	1039
Oriental	372	419	579	742	470	150	927	443	183	1187	337	1033	620	750	1370
Pacífica	308	215	365	563	245	78	629	259	138	750	168	720	260	628	888
Valle del Cauca	356	343	496	693	374	125	820	375	126	1069	189	1006	490	705	1195
Total	3191	2826	4254	5691	3410	1126	7167	3104	1111	9160	2014	8257	3321	6950	10271

Notes: 44 firms in the sample cannot be classified by size. Firm size is differentiated as follows: micro firms: < 10 employees; small firms: 11-50 employees; medium firms: 51-200 employees. Women-owned/led firms are classified as firms that are either at least 50% owned by women, OR at least 20% owned by women, women comprise at least 30% of the board, and a woman is the primary decision-maker. Formality is defined as whether or not they possess a tax identification number (NIT). Linkages refers to whether or not the firm has an active business partnership with another entity (e.g., business association, university). Digitalization refers to whether or not the firm incorporates digitalized processes into its business model by engaging in one or more of the following activities: digital delivery of products; use of digital platforms to sell products, use of digital platforms to purchases inputs, sales via electronic commerce or purchases via electronic commerce.

3. Descriptive Evidence on Firm Recovery Dynamics

This section provides descriptive evidence on firm recovery dynamics after the shock of the COVID-19 pandemic. In the first survey round, firms reported changes in employment levels and overall economic conditions between the second half of 2020 and the first half of 2021. In the second round, they reported similar changes between the first and second halves of 2021.

We calculate the percentage of firms that experienced positive changes (e.g., increases in employment or improvements in their economic situation) and those that reported negative changes. To examine heterogeneity, we compare results across firm size, sector, and whether the firm is women-owned or women-led. The presentation of results focuses on two dimensions of variation: (1) differences across categories (e.g., size, sector) within each survey round, and (2) changes across survey rounds.

3.1. Changes in Workforce

Figure 1 shows how the proportion of firms indicating positive changes in employment is statistically larger as we move away from the year of the pandemic, rising from 17% to 20%. However, the proportion of firms showing employment destruction (Figure 2) also rises over time, from 14% to 16%, suggesting that while some firms survived and recovered, others deteriorated even further or adjusted their business models in response to pandemic-induced economic contractions.

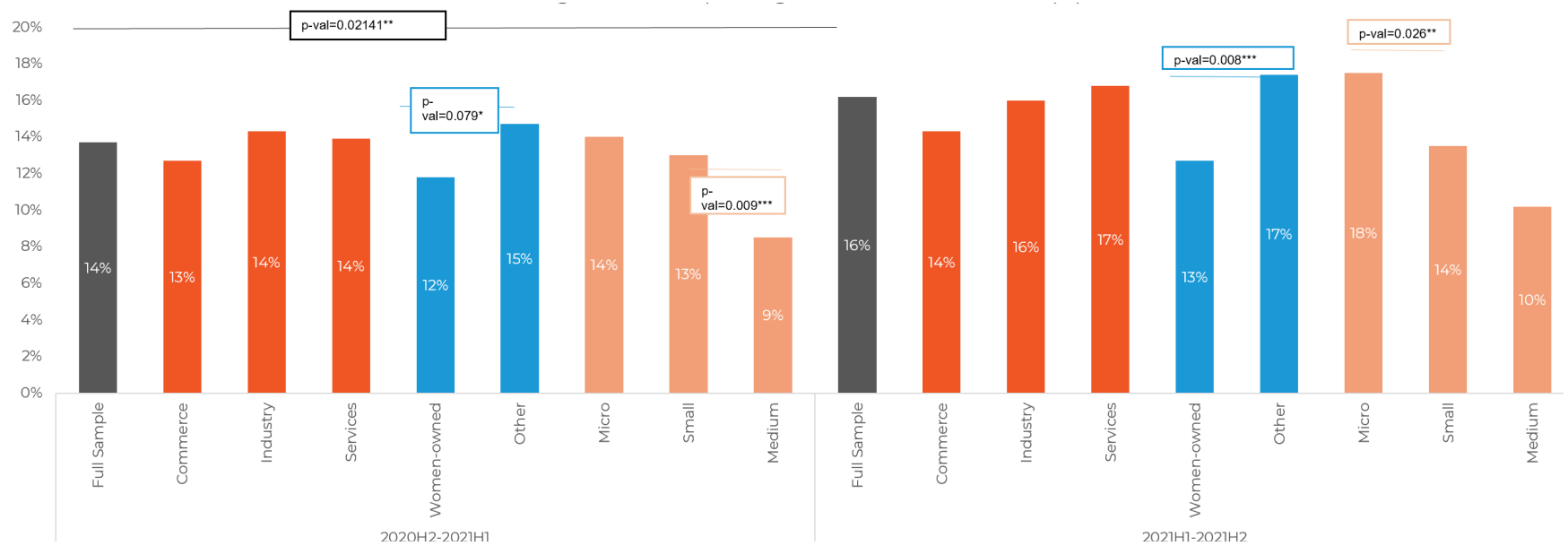
In terms of sector dynamics, the service and industry sectors seem to have experienced the greatest variations in employment, relative to the commerce sector. At the first half of 2021, firms reporting employment gains were significantly higher in Services (18%) and Industry (17%) than in Commerce (12%). For the next period, these sectors continue to report larger increases. The percentage of firms in the industry and service sectors reporting employment increase were 26% and 21% respectively (versus 13% for commerce, both differences are significant) (Figure 1). Employment cuts were not statistically different across sectors in both periods (Figure 2).

By firm size, the impacts of the pandemic in the workforce were larger in micro firms and the recovery has been stronger for small and medium enterprises. In terms of employment increases, the proportion of medium-sized firms that grew throughout 2021 rose from 32% to 48%. Small firms that grew rose from 24% to 36% and micro firms that grew fell from 16% to 13%. For employment losses, in the first survey round, micro and small enterprises report a larger decrease in employment when compared to medium enterprises (14% and 13%, respectively, versus 9%). As we move away from the pandemic, employment losses are substantially larger for microenterprises when compared to SMEs (18% versus 14% and 10% respectively). Across time, only the difference among micro firms reporting employment decreases between the first and second period was statistically significant (at the 1% level).

Figure 1: Increase in the Workforce, Overall, Sector, Women–owned Status, and Firm Size (%)

Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. Only statistically significant comparisons are annotated; unlabeled (within-period) contrasts are not significant at conventional levels. With the exception of the full samples, across-period comparisons are reported but not referenced in the above graphic. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01.

Figure 2: Decrease in the Workforce, Overall, Sector, Women–owned Status, and Firm Size (%)



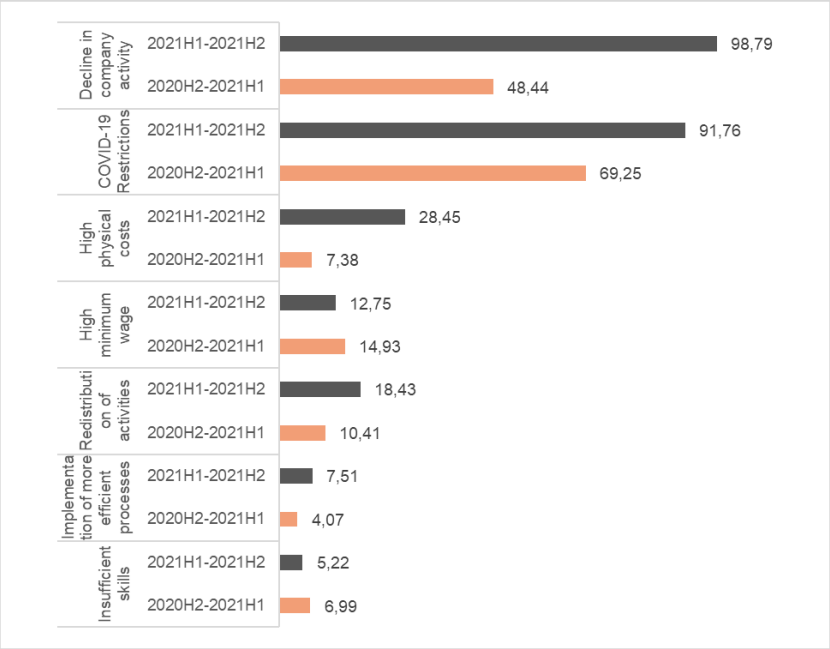
Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. Only statistically significant comparisons are annotated; unlabeled (within-period) contrasts are not significant at conventional levels. With the exception of the full samples, across-period comparisons are reported but not referenced in the above graphic. Significance codes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 1 refers to first half of the year and H2 refers to second half of the year.

The survey also enables an analysis of gaps in recovery between women-owned/led firms (WLF) and other firms.[6] While there are no statistically significant differences in employment creation between WLF and other firms, notable differences emerge in employment reduction. At the start of 2021, fewer WLF reported a decrease in employment compared to other firms (12% vs. 15%, a -3 p.p. difference, significant at the 1% level). This pattern persisted in the second period (13% vs. 17%, a 4 p.p. difference, also significant at the 1% level). Regarding changes over time, the variation in WLF reporting employment decreases between the two periods was not statistically significant, whereas the difference for other firms was significant at the 5% level. These findings align with existing literature suggesting that women-owned/led firms tend to preserve more jobs during economic downturns (Tunyi et al., 2023).

To better understand previous trends, we examine the reasons firms reported for reducing their workforce (Figure 3). At the start of 2021, the three most common reasons were COVID-related restrictions, a decline in company activity, and high minimum wages (69%, 48%, and 15% of firms, respectively). By year-end, the ranking shifted slightly: decline in company activity, COVID restrictions, and high physical costs (98%, 92%, and 28%, respectively). These patterns align with the expectation that firms emerging from a period of depressed economic activity would attribute workforce reductions more to sluggish recovery than to lockdown measures. The increase in firms citing higher physical costs as a cause for reducing their workforce may reflect that, after investing in digitalization during the pandemic, some companies redirected efforts toward physical investments as economic activity resumed, potentially reducing their reliance on labor. Further discussion on digitalization appears in Section 5.

[6] The percentage of women-owned/led firms in each sector is: 33% of commerce, 32% of industry, and 27% of services.

Figure 3. Factors Leading to a Decrease in Workforce



3.2 Changes in Economic Situation

The data also allow us to examine recovery dynamics by tracking how firms' perceptions of their overall economic situation evolved over time. Firms considered factors such as changes in sales, production volume, purchase orders, cost of sales, and investment. [7] Interestingly, the results in this section differ slightly from those reported earlier. The share of firms reporting an improvement (Figure 4) remained essentially flat across periods (from 45% to 46%), while the share reporting a worsening (Figure 5) increased from 15% to 21% (+6 p.p., a statistically significant difference at the 1% level).We argue that, because the economic environment during the pandemic peak was highly negative, the immediate improvements following that period were more noticeable to firms. As time passed, incremental improvements became less pronounced. Meanwhile, some firms reported worsening conditions, which may reflect increased competition as the economy transitioned to a post-pandemic steady state or declining demand for pandemic-driven business models.

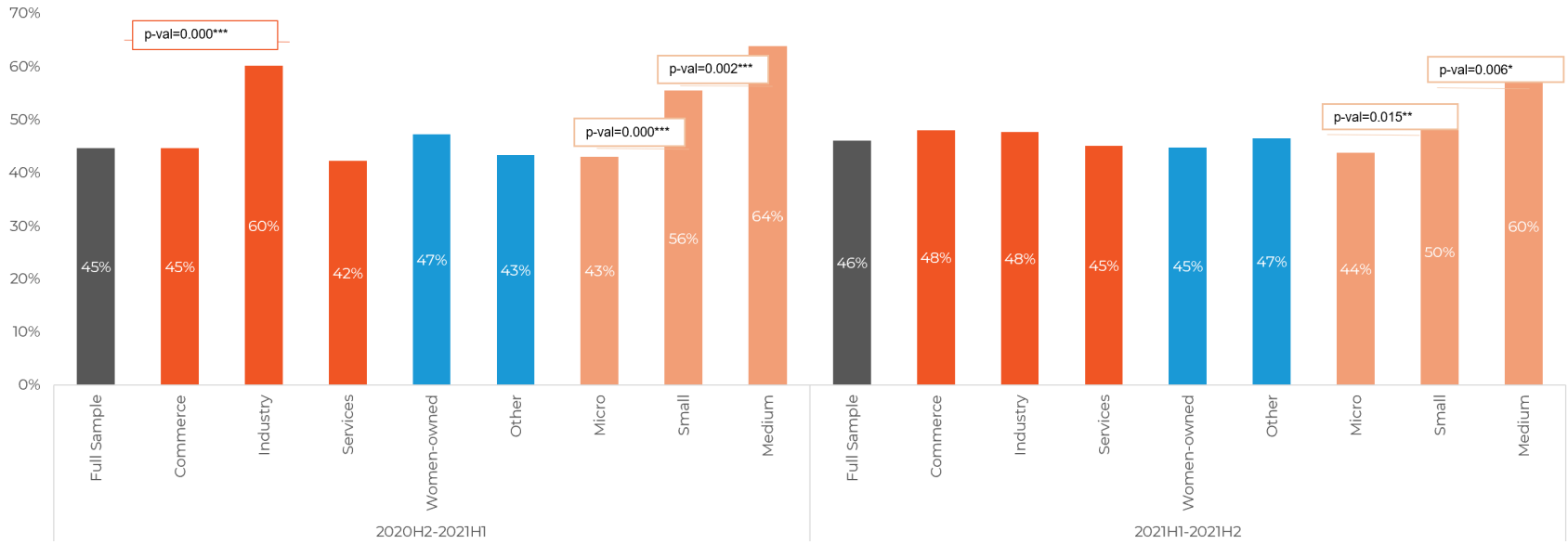
When we look across sectors, in the first period the worsening shares were: commerce 16%, industry 13%, and services 15% (difference significant at 5% level between commerce and industry firms). By the second period, worsening increased in all sectors—commerce 19%, industry 22%, and services 21%—while improvements were 48% in commerce, 48% in industry (down from 60%), and 45% in services (up from 42%). Thus, commerce and services did not decline in the "improved" category, whereas industry fell sharply. It would be useful

[7] Outcomes reported on general economic situation were highly associated with outcomes reported on these other variables (chi-squared p value = 0.000).

to dive into the numerical changes to see what the magnitude of change is; however, this is a limitation of the survey as numerical changes in economic variables are not available.

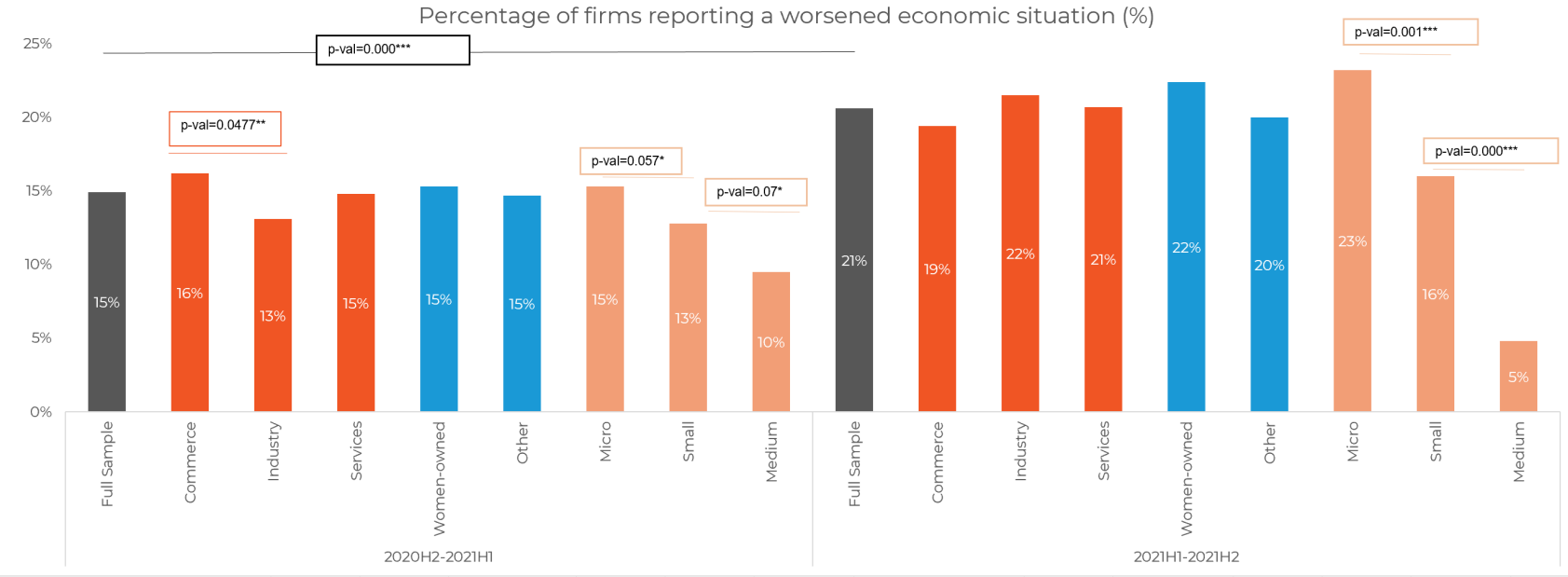
As previously mentioned, the average proportion of firms reporting a worsening in their economic situation increased (15% to 21%), driven by an uptick across all sectors: commerce (16% to 19%), industry (15% to 22%), and services (15% to 21%). Assessing differences over time, the rise in the proportion of industrial and commercial firms reporting a deterioration in economic situation was statistically significant (at the %1 level). With respect to firms reporting an improvement in their economic situation over time, commerce and services saw a small upswing from period 1 to period 2 (+ 3 p.p. for both) but neither of these were statistically significant. Industrial firms on the other hand saw a large decrease in the proportion of firms with positive economic outlook (-12 p.p., p=0.000). This potentially signifies heterogeneity across sectors in post-pandemic recovery dynamics.

Figure 4: Firms Reporting a Better Economic Situation, Overall, Sector, Women–owned Status, and Firm Size (%)



Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. Only statistically significant comparisons are annotated; unlabeled (within-period) contrasts are not significant at conventional levels. With the exception of the full samples, across-period comparisons are reported but not referenced in the above graphic. Significance codes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 5: Firms Reporting a Worsened Economic Situation, Overall, Sector, Women–owned Status, and Firm Size (%)



Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. Only statistically significant comparisons are annotated; unlabeled (within-period) contrasts are not significant at conventional levels. With the exception of the full samples, across-period comparisons are reported but not referenced in the above graphic. Significance codes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Analyzing changes by firm size, relatively larger firms are more likely to report their economic situation as unchanged or improving in both periods, suggesting better resilience to pandemic-related shocks relative to smaller firms. For better economic situation, the share rises with firm size: in the first period, small firms are more likely than micro firms to report improvement (+13p.p.) and medium firms exceed small firms (+8p.p.) —at 1% level of significance both differences; the same ordering holds in the second period. For worsened economic situation, the pattern reverses—incidence falls with size: in the first period, micro exceeds small (+2p.p.) and small exceeds medium (+3p.p.), with only marginal significance, whereas in the second period both contrasts are strongly significant (micro–small is 23% vs 16% and small–medium is 16% vs 5% respectively). Overall, larger firms are simultaneously more likely to report improvement and less likely to report deterioration within a given period, especially in the latter semester. Assessing the changes over time periods, the difference in the percentage of micro firms reporting a worsening in their economic situation (from 15% to 23%) was statistically significant (at the 1% level). Similarly, there was a statistically significant difference in the proportion of medium-sized firms reporting a deterioration of their economic situation (5p.p., at 5% level).

Disaggregating this data by women-owned/led firms, we observe that on perceptions on improvements WLF moved between periods from 47% to 45%, while other firms rose from 43% to 47%. On worsening economic conditions, it was the same for WLF and other firms in the first period (approx. 15%) and second period (approx. 21%). Assessing the changes over time periods, the difference in the proportion of WLF indicating worsening conditions from period 1 to period 2 was statistically significant (+ 7p.p.; at 1% level). The difference in other firms was also significant (+5p.p.; at 1% level). With respect to differences in the proportion of firms reporting improvement in economic situation across time periods, only the difference among non-WLF firms was significant (+4p.p.; at 10% level). Overall, this pattern suggests a relative deterioration among WLF in late 2021, even as many firms continued to report stability or gains.

3.3 Changes in Credit Demand

As previously shown, not all firms were able to navigate equally pandemic-related shocks. Firms can run into liquidity constraints when trying to adapt their business models to changing circumstances that accompany these shocks. Whether it is changing delivery channels, such as digitalizing internal processes or needing to cover fixed costs in a context of low demand, these strategic decisions usually come with relevant capital costs. This is where access to credit becomes pivotal for businesses to sustain their activities and grow when faced with challenging economic circumstances.

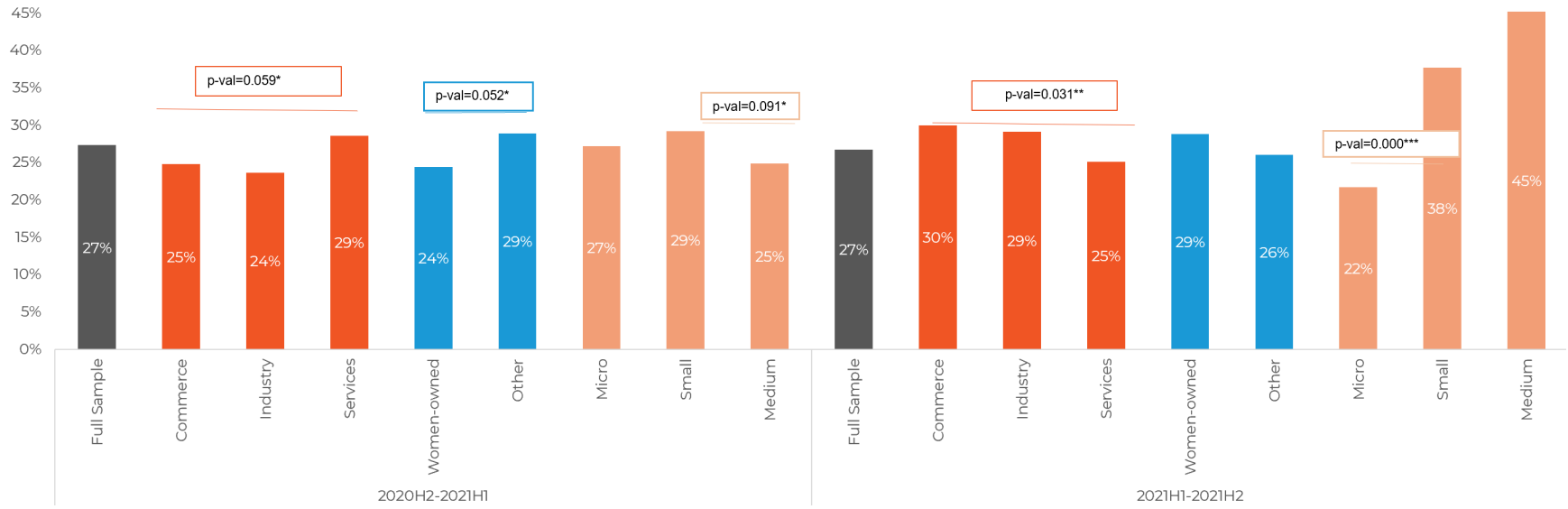
The survey allows for the examination of how demand for credit among MSMEs evolved over both periods. On average, 27% of firms demanded credit across both time periods.[8] Figure 6 shows that the demand for credit across economic sectors has been relatively similar. At the start of 2021, approximately, 29% of firms operating in services, +4p.p. than the commerce sector (25%), indicated they had requested credit. As we move toward the second part of 2021, the demand for credit inverses and the 30% of commerce firms demand credit, +5p.p. more than the services firms; these differences are significant. The variation in credit demand across time periods for commerce (25% vs 30%), industry (24% vs 29%) and services (29% vs 25%) were also all significant (p=0.022; p=0.026; p=0.083 respectively). Services was the only sector in which credit demand fell between period 1 and period 2.

When demand for credit is examined through the lens of firm size, we see that it has recovered substantially for small and medium enterprises as we move away from the pandemic. In the first period, demand is 27% for micro, 29% for small, and 25% for medium firms. In the second period, the gap widens sharply: 22% for micro, 38% for small, and 45% for medium firms. The difference in credit demand for micro firms (27% vs 22%), small firms (29% vs 38%) and medium-sized firms (25% vs 45%) between period 1 and period 2 were significant (all at the 1% level). These results may be driven by multiple factors. On the one hand, larger firms are experiencing stronger recoveries, as shown by the growth in their workforce presented above, and as such requesting further credit to support these expansions. On the other hand, while access to credit was relaxed during the peak of the pandemic due to public relief programs (ECLAC, 2021), it could be that micro firms go back to suffering additional credit constraints, such as being priced out of loans due to collateral requirements, interest rates or lower debt service capacity (Presbitero & Rabellotti, 2016; Mooney et al., 2022).

Finally, Figure 6 also shows a larger increase in credit demand among women-owned/led firms—rising from 24% to 29%—while "other" firms move from 29% to 26%. The first-period gap (24% vs. 29%) is marginally significant (p=0.052). Neither difference in credit demand between period 1 and period 2 were significant among either group.

[8] For firms that do not request credit, Figure 11 in the Appendix shows a full breakdown of reasons. As it can be seen, in 2021 10% of firms said they did not apply for credit because of high financing costs and 5% self-selected out of the credit application processes over the perceived notion that banks will preemptively deny them.

Figure 6: Credit Demand, Overall, Sector, Women–owned Status, and Firm Size (%)



Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.

3.4 Changes in Digitalization of Firms

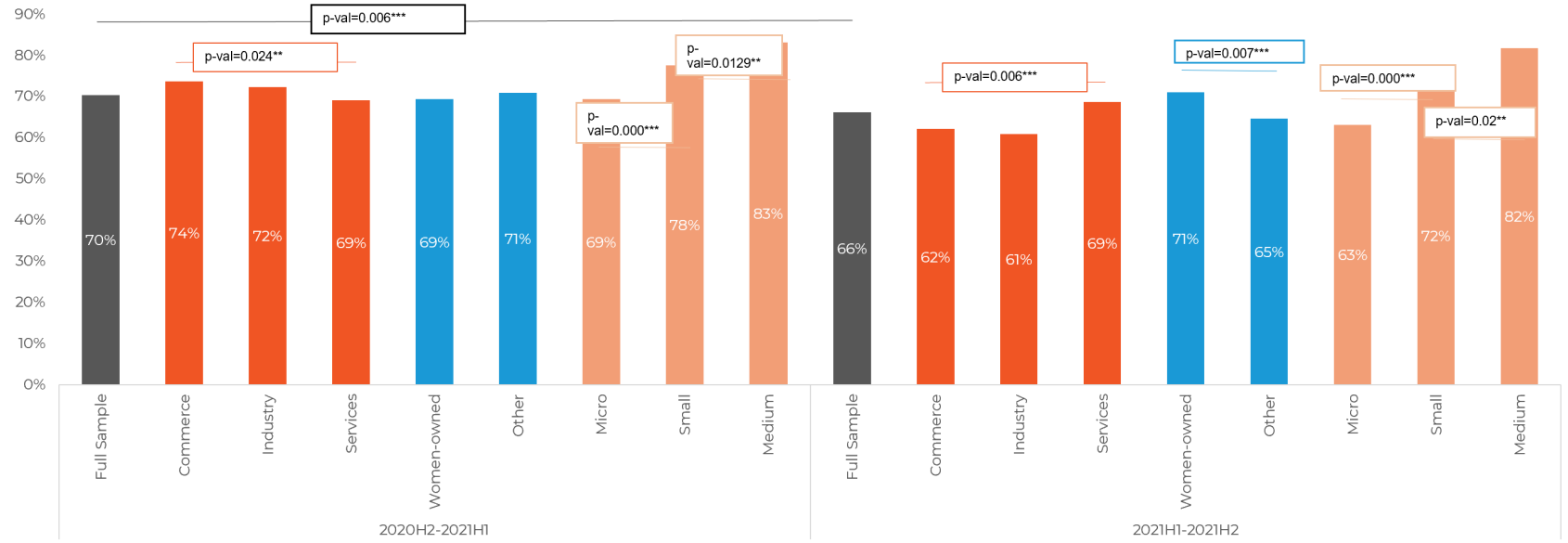
Differences in digital technology uptake among firms is one of the driving factors behind changes in their workforce and economic situation over time. This was especially relevant during and post-pandemic, as digitalization showed to be one of the most potent resiliency mechanisms allowing some firms to continue some or all of their activities despite lockdown restrictions (IDB, 2022). In the context of the survey, digitalization is defined as engaging in one or more of the following activities: digital delivery of products; use of digital platforms to sell products; use of digital platforms to purchases inputs; sales via electronic commerce; or purchases via electronic commerce.

Figure 7 shows that the use of digital technologies declined slightly in the full sample (70% to 66%, a significant difference of -4p.p.) as firms moved away from the height of the pandemic (mid-2020). This could be indicative of changing consumer habits as pandemic-related lockdown measures loosened and businesses refocused on processes better suited for in-person transactions. By sector, commerce fell from 74% to 62% and industry from 72% to 61%, while services remained essentially unchanged at 69% (commerce exceeded services in both periods significantly). The differences in the use of digital technologies between period 1 and period 2 for commerce and industry were both statistically significant (at 1% level).

Comparable trends can be observed when disaggregating the data by firm size. Micro and small firms reduced adoption by 6p.p each (69% to 63% and 78% to 72%), whereas medium firms edged down only 1p.p (83% to 82%), indicating that larger firms scaled back less (size contrasts are significant in both periods; see p-values in the figure). Similarly, the differences in the use of digital technologies between period 1 and period 2 for micro and small firms were both statistically significant (at 1% and 5% level respectively).

Interestingly, as Figure 7 shows, women-owned/led firms increased their digital uptake (69% to 71%) while “other” firms decreased (71% to 65%), widening the gap in the second period| (p=0.007). Only the difference in the use of digital technologies between period 1 and period 2 for non-WLF firms (71% vs 65%) was significant (at 1% level).

Figure 7. Digitalization, Overall, Sector, Women–owned Status, and Firm Size (%)



Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.

4. Measuring the Impacts of Access to Credit on Firm Resilience

4.1. Empirical Strategy

This section goes deeper into estimating how credit access may have facilitated firm resilience and recovery after the COVID-19 pandemic. For this, we specify a base model as follows:

$$Y_{ijst} = \alpha_i + \alpha_j + \alpha_s + \alpha_t + \beta X_{ijst} + \gamma Z_{ijst} + \epsilon_{ijst}$$

Where Y_{ijst} is a set of outcome variables of interest being considered for firm *i operating* in region *j,* in sector *s*; in year *t*. α_j captures region-specific shocks where the firms are located, α_s captures sector-specific heterogeneity, and α_t is a time fixed-effect that captures yearly shocks that affect all firms. X_{ijst} is a binary variable that takes the value of 1 if the firm received credit. Z_{ijst} is a vector of firm-specific characteristics including firm age, whether it is women-owned/led, formality (via tax registration), size (micro vs SME), and use of digitalization[9]. Additionally, we include in the control variables if the firm benefits from any business linkages (e.g., business associations, universities, chambers of commerce). Hence, β is the estimated parameter of interest, captures the average effect of accessing credit on the firm outcomes being considered. All parameters estimated are robust to heteroskedasticity.

We estimate the credit effect using several outcome variables including **workforce resilience** (i.e., if the firm reports it did not experience a decrease in the number of workers during the observable period). **Workforce growth** is also used as an outcome variable (i.e., if the firm reports it experienced an increase in the number of workers during the observable period). Two other outcome variables considered are **economic resilience** (i.e., when firms do not report experiencing a decline in their general economic situation) and **economic growth** (i.e., only when firms report experiencing a positive change in their economic situation).[10] While some of these outcome variables may be correlated, we are interested in understanding whether credit allowed firms to survive versus actively grow in the aftermath of the pandemic using different measures of performance.

Calculating an unbiased estimate of the effect of credit can be confounded by the self-selection that occurs in the credit application process, e.g., more resilient firms are successfully screened when applying for credit perhaps because they have better financial records or growth prospects and therefore the sample of firms that access credit is potentially skewed. To reduce this concern, we employ a propensity score matching (PSM) algorithm to produce groups of firms that access credit (treated) and

[9] As defined before, digitalization is defined as the use of digital platforms for the sale of products or the purchase of inputs, electronic commerce for online sales or procurement, or digital product delivery.

[10] The variables economic resilience and economic growth are used as generalized outcomes because more granular outcome variables are not available across all observations. For example, only commercial firms report decreases in sales and only industrial firms report changes in production. Nonetheless, we confirm that the outcome variables economic resilience and economic growth are correlated with these more granular outcomes via association tests ($p = 0.000$).

those that do not (control) that are as similar as possible in observed covariates and that have similar probability distributions in terms of access to credit. Following the methodology of Kreif, et al. (2013), we adopt a common parametric model to generate propensity scores using logistic regression expressed as:

$$p(X_{ijst}, \eta) = \frac{e^{\eta^T X_{ijst}}}{1 + e^{\eta^T X_{ijst}}}$$

Where η is a vector of parameters and is approximated using maximum likelihood estimates $\hat{\eta}$ using observable characteristics T_{ijst} and X_{ijst}, where T_{ijst} is the treatment status of firms. Once propensity scores are calculated we use a 1:3 nearest neighbor approach to conduct matching and construct our treatment and control groups. This ratio is validated in the literature as a good empirical strategy for managing the precision-bias tradeoff in observational studies (Rassen et al., 2012).

It is important to acknowledge that the propensity score matching relies only on observed variables but cannot account for unmeasured confounders. Moreover, there is the risk of potential bias if the propensity score model is mis-specified, which means it leads to poor matching and overlap, and can also be sensitive to the choice of matching algorithm. To reduce these concerns, we report a series of balance tests using both standardized mean differences and variance ratios on firm observable characteristics for treatment and control groups and look carefully at the common support region (i.e., the overlap between treatment and control groups). In addition, we run multiple robustness checks changing the specification or choice of the matching algorithm to verify that this does affect the results (See Section 6).

Overall, we interpret our results with caution and mainly as strong correlation estimates, acknowledging that a causality interpretation is more limited in this case.

4.2 Main Results

We start by presenting balance tests to showcase how the matching algorithm implemented helps to achieve overlap across observable characteristics. Table 2 presents the differences in the standardized means and variance ratios for a large set of covariates between treatment and control groups. In tandem, Figure 8 in the appendix graphically depicts the propensity score matching results. With respect to the balance test, all of our covariates have standardized differences close to 0 and variance ratios close to 1 which are an indication of good balance (Zhang et al., 2019). With all balance tests and propensity score distribution overlap analyses yielding positive results,[11] we can be reasonably confident in the regression estimates, with the caveat that we are only controlling for observable characteristics and there may be unobservable characteristics driving access to credit.

The results suggest that credit access increased the likelihood of workforce resilience (i.e., employment was not negatively impacted) during the pandemic by 4 p.p. and

[11] Additional propensity score plots for subsequent sub-samples examined in this section can be found in the Appendix, Figures 15 and 16.

employment growth by 5 p.p. Likewise, firms that accessed credit were 4 p.p. more likely to be economically resilient and 7 p.p. more likely to grow (i.e., experience sustainability or growth in sales, production, etc.). It is important to stress that these estimates are based on experiences during a pandemic-stricken economy and should not be extrapolated to represent the effect of credit when negative shocks are not present or when different shocks happen. It is important to keep in mind that the COVID-19 pandemic was a very unique shock that had substantial impacts on almost all sectors in the economy.

One of the sub-samples of interest are women-owned/led firms. As previously discussed, credit demand among this segment of firms increased disproportionally more than the average firm during the pandemic. Prior evidence suggests that providing access to credit to women may result in larger welfare gains or impacts given the higher barriers to credit they face (Arraiz, 2023).[12] As displayed in Table 4, when we look at the differential impacts between the subset of firms that are women-owned/led and those that are not, we see that average effects are driven by the effects observed among women-owned/led firms. In particular, the estimated effects for women-owned/led firms are larger and statistically significant for almost all outcomes, while there are no detectable effects on other firms (balance tests for both sub-samples can be found in the Appendix, Tables 10 and 11).

While there are no significant effects of access to credit for women-owned/led firms on maintaining their workforce, those that access credit were 11 p.p. more likely to see employment growth, 12 p.p. more likely to be economically resilient, and 15 p.p. more likely to experience economic growth. We also compute the difference in estimates across groups to see if there are heterogeneous treatment effects, observing that the treatment effect was approximately 10 pp. higher (Table 4 Columns (3) (5) & (7)) for women-owned/led firms relative to other firms in terms of employment growth, economic resilience, and economic growth. There was also no discernable difference in the likelihood of achieving workforce resilience between the two groups. One possible explanation that arises from credit markets is that women-owned/led firms are more diligent when it comes to loan repayment and are therefore less likely to incur penalties and hence maximize the net positive effect of credit access (IDB Invest, 2023).

In terms of firm size, calculations suggest that treated micro firms are 7 p.p. more likely to maintain their workforce relative to non-treated micro firms; however, there is no statistically significant differences in terms of employment growth, economic resilience or economic growth (Table 5). This could be indicative of the fact that micro firms are already operating with very tight capacity especially in terms of their workforce, and additional working capital is absorbed simply to maintain current levels of output during negative shocks. It could also be due to other barriers, beyond finance, that prevent micro firms continuing growing, such as limited access to markets, lack of skilled labor,

[12] For example, within 2 years of accessing credit, women-owned/led firms experienced a 41% increase in sales growth compared to an average of 19% among all firms that accessed credit at the same time. This aligns with our results in Table 4.

inadequate infrastructure, or unfavorable regulatory environments, among others. In contrast, SMEs were approximately 10 p.p. more likely to report employment growth, 7 p.p. more likely to report economic resilience, and 11 p.p. more likely to report economic growth. These findings suggest that credit access benefited mostly firms with more than 10 employees (i.e., larger than micro) as the recovery progressed.

Lastly, we compare the two survey cohorts (Period 1: 2020H1-2020H2; Period 2: 2020H2-2021H1). As shown in Table 6, we see that the treatment effects of credit are much more pronounced in the second period. This result holds true across all outcome variables: workforce resilience, workforce growth, economic resilience, and economic growth. Additionally, we see that in the first period, firms that accessed credit were performing worse relative to the control group in terms of workforce and economic resilience. One potential explanation is that relatively weaker performance triggered demand for credit in the first place. The larger impacts of credit on the second period could be a result of better economic conditions in the second period, which gave more space or opportunities for firms to grow conditional on credit access. The result also aligns with the literature on credit access in the region where there is lag in the detectable positive effect that credit access has on firm performance (Arraiz, 2023). While we do not observe the same firms over time, it is plausible that those that had access to credit and were surveyed in the second period, also had access to finance in the first period given the credit support programs widely available during the pandemic.

Table 2. Balance Test (Full Sample)

	Standardized Differences	Variance Ratio	Obs
Age	0.036	0.936	2780
Age squared	0.003	1.021	2780
Women-owned/led	0.025	1.021	2780
Micro	0.027	1.004	2780
Linkages	0.011	0.979	2780
Formality	0.012	0.957	2780
Digitalization	-0.002	1.003	2780
Sector			
Industry	0.014	1.016	2780
Services	-0.023	0.994	2780
Commerce	0.012	1.010	2780
Region			
Antioquia	-0.023	0.971	2780
Caribe	-0.005	0.991	2780
Bogotá	-0.007	0.992	2780
Central	0.023	1.067	2780
Oriental	-0.016	0.960	2780
Pacífica	0.018	1.059	2780
Valle del Cauca	0.032	1.114	2780
Time			
2020H2-2021H1	-0.141	1.005	2780
2021H1-2021H2	0.141	1.005	2780

Notes: Standardized mean difference is a commonly used statistic to examine the balance of covariate distribution between treatment and control groups. Differences close to 0 indicate good balance. Similarly, variance ratios close to 1 indicate good balance.[13]

[13] See Zhang et al. (2018).

Table 3. Effect of Credit on Firm Outcomes

	Workforce Resilience		Workforce Growth		Economic Resilience		Economic Growth	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Treatment vs Control				
Treatment	0.040**	(0.020)	0.050**	(0.021)	0.044**	(0.020)	0.068***	(0.024)
Treatment Mean	0.831	(0.006)	0.277	(0.008)	0.819	(0.006)	0.473	(0.008)
Control Mean	0.791	(0.005)	0.226	(0.006)	0.776	(0.006)	0.404	(0.007)
				Panel B: Baseline Characteristics in Treatment vs Control				
Firm-level variables								
Age	0.041	(0.010)	0.041	(0.010)	0.041	(0.010)	0.041	(0.010)
Age-squared	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)
Women-owned/led	0.236	(0.094)	0.236	(0.094)	0.236	(0.094)	0.236	(0.094)
Micro	-0.388	(0.092)	-0.388	(0.092)	-0.388	(0.092)	-0.388	(0.092)
Linkages	0.117	(0.120)	0.117	(0.120)	0.117	(0.120)	0.117	(0.120)
Formality	0.227	(0.197)	0.227	(0.197)	0.227	(0.197)	0.227	(0.197)
Digitalization	-0.103	(0.102)	-0.103	(0.102)	-0.103	(0.102)	-0.103	(0.102)
Observations	2,780	2780	2,780	2780	2,780	2780	2,780	2780
Region FE	YES	YES	YES	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1. Standard Errors in parenthesis. Errors robust to heteroskedasticity.

4.3 Robustness Checks

To rule out the possibility that findings presented above are dependent on the matching conditions applied, we use two recalibration strategies: changing the number of potential neighbors in the matching process while keeping the caliper distance fixed; and keeping the number of neighbors fixed while changing the caliper distance. In terms of nearest neighbors, we reran the matching algorithm increasing the number for neighbors from 3 to 5 and then 7 while keeping the caliper distance constant at 0.25. Note that a good rule of thumb for selecting an optimal caliper distance is approximately one-quarter of the standard deviation of the logit of the propensity score (Austin, 2011). In the case of our algorithm, this value is 0.13; however we use 0.25 as it is the minimum specified distance for which the dataset could accommodate the matching process. Correspondingly, the smallest amount of the neighbors that the matching algorithm would accommodate was 3. This was the minimum acceptable value in line with best practice that suggests optimal matching is usually between 1-2 (Austin, 2010). We increase the span of neighbors by 2 and 4 which aligns with bandwidths used in the literature to validate variance-bias trade-off when estimating treatment effects (Ibid). We also keep the number of neighbors constant at 3 and increase the caliper distance by two & threefold, respectively.[14]

As shown in Table 7, our estimates of the effects of credit using the entire sample remain positive and statistically significant across all permutations (with the exception of Workforce Resilience at 3 neighbors and caliper size of 0.75). We repeat this process using the same sub-samples of women-owned/led and micro firms. Across the board, our robustness checks yield similar outcomes whereby the estimated effects remain positive and statistically significant across various recalibrations for women-owned/led firms and they are mostly not significant for micro firms (Tables 8 & 9). One point to note is that the matching algorithm was unable to accommodate 5 and 7 neighbors in the women-owned/led firm sample hence these values are not reported in the robustness checks.

Standards errors generated from our baseline estimation process are robust to heteroskedasticity. To validate the robustness of our results, we also recalculate standard errors using the methodology outlined by Arpino (2018), where errors are computed based on the number of matches. The results remain consistent with the ones presented above and can be found in Table 12 of the Appendix.

Finally, we implement a number of placebo tests by randomly assigning a treatment category to a proportionate sub-sample of firms in the sample as those that accessed credit in the data and re estimating all models again with these simulated samples. The full results of these tests can be found in the Appendix (Table 13) and confirm that key results are maintained almost in all specifications.

[14] As demonstrated in Austin (2011) via Monte Carlo simulation, doubling and tripling the caliper distance can serve as a sufficient robustness check for a PSM algorithm without rendering estimates entirely confounded by bias.

Table 4. Treatment Effects: Women-owned/led vs Other Firms

	Workforce Resilience		Workforce Growth		Economic Resilience		Economic Growth	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Treatment vs Control in women-owned/led firms (n=867)								
Treatment	0.045	(0.032)		(0.032)		(0.035)	0.153***	(0.034)
			0.112***		0.121***			
Treatment Mean	0.844	(0.011)	0.301	(0.014)	0.824	(0.012)	0.499	(0.015)
Control Mean	0.799	(0.009)	0.189	(0.010)	0.703	(0.011)	0.346	(0.012)
Panel B: Treatment vs Control in Other firms (n=1913)								
Treatment	0.041	(0.024)	0.018	(0.024)	0.024	(0.021)	0.050*	(0.027)
Treatment Mean	0.832	(0.007)	0.268	(0.009)	0.825	(0.008)	0.475	(0.010)
Control Mean	0.791	(0.006)	0.250	(0.007)	0.800	(0.007)	0.425	(0.008)
Difference in Treatment Effect	0.003	(0.018)	0.094***	(0.021)	0.097***	(0.019)	0.103***	(0.024)

*** p<0.01, ** p<0.05, * p<0.1. Errors robust to heteroskedasticity. Estimated models reported in this Table include the same set of baseline covariates and fixed effects as in the base model presented in Table 3.

5. Conclusions

Using Colombian firm-level data from 2020–2021, this paper examines the unequal recovery trajectories of firms by sector, size, and ownership (women-owned/led vs. others) following the COVID-19 pandemic. It also provides evidence that access to credit significantly enhanced resilience and growth among MSMEs, with heterogeneous effects across firm characteristics.

Results show that firm recovery following the pandemic was highly uneven across employment, economic performance, credit demand, and digitalization. Employment gains rose slightly, but job losses also increased, with medium-sized firms rebounding most strongly and microenterprises continuing to struggle. Sectoral differences were clear: services and industry led employment growth, while commerce lagged. Credit demand shifted toward larger firms over time, indicating persistent liquidity constraints for microenterprises despite relief programs. Digital adoption declined overall as in-person activity resumed, yet women-owned/led firms increased their use of digital technologies, contrasting with declines among other firms. Although women-owned/led firms preserved jobs more effectively, they faced greater deterioration in economic outlook.

Access to credit significantly improved firm recovery outcomes. First, across the full sample, credit access increased the likelihood of maintaining employment by 4 p.p. and achieving workforce growth by 5 p.p. Similarly, firms with credit were 4 p.p. more likely to remain economically resilient and 7 p.p. more likely to grow. Second, women-owned/led firms benefited disproportionately: those accessing credit were 11 p.p. more likely to expand employment, 12 p.p. more likely to be economically resilient, and 15 p.p. more likely to grow compared to peers without credit, with no statistically significant impacts in the rest of the firms. Third, microenterprises showed limited gains; credit improved workforce maintenance (+7 p.p.) but had no significant effect on growth or resilience, likely reflecting structural constraints beyond finance. In contrast, SMEs experienced substantial improvements across all outcomes (up to +11 p.p.). Treatment effects were stronger in the second survey period, suggesting that credit benefits materialized as economic conditions improved or exhibited lagged effects. Results are robust to multiple recalibrations of the propensity score matching algorithm.

The evidence presented in this study underscores the critical role of credit access in enhancing firm resilience and recovery during systemic shocks such as the COVID-19 pandemic. However, the uneven distribution of benefits across firm size, sector, and ownership characteristics calls for targeted policy interventions. Microenterprises faced persistent liquidity constraints despite relief programs, while SMEs and women-owned/led firms captured the largest benefits from credit access, underscoring structural disparities in financial inclusion. These findings call for targeted financial policies or interventions that expand access for vulnerable segments.

Development finance institutions play a key role in this regard. By providing financial and non-financial solutions to local financial institutions, they help ensure that these entities can serve consumer demand while remaining financially viable and/or continue to meet regulatory requirements even during times of crisis.

In addition, new financial products and credit approval schemes may be needed to reach these vulnerable populations, such as collateral-free lending schemes, partial credit guarantees, and streamlined application processes, among others. Technical assistance and financial literacy programs can also help address barriers faced by vulnerable populations when requesting or managing credit.

The decline in digital adoption observed in this study as in-person activity resumed also highlights the need for sustained digitalization incentives, such as grants, tax credits, and infrastructure investments, to enhance competitiveness and resilience. This may be particularly relevant among smaller firms.

Beyond firm-level interventions, policymakers should prioritize financial sector deepening and crisis preparedness through regulatory reforms that enable flexible lending and public-backed guarantee programs to mobilize private capital. Finally, dynamic monitoring systems and adaptive policy frameworks are also necessary to track credit uptake and firm performance in real time, ensuring timely recalibration of interventions as economic conditions evolve. Together, these measures can strengthen private sector resilience, foster inclusive growth, and position firms to withstand future systemic shocks more effectively.

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Appendix I

Figure 8. Propensity Score Balance Plot (Full Sample)

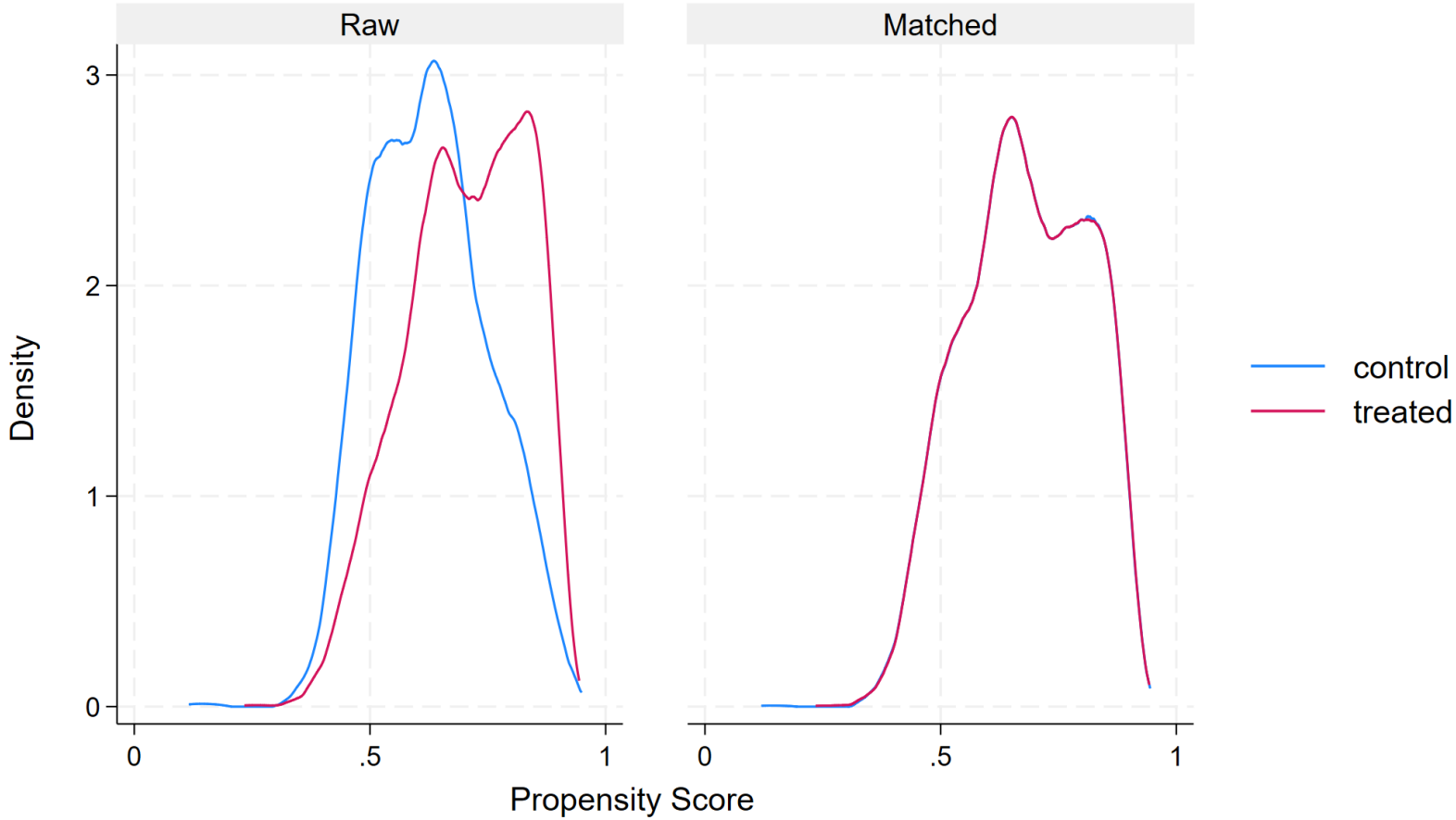


Table 5. Treatment Effects: Micro Firms vs SMEs

	Workforce Resilience		Workforce Growth		Economic Resilience		Economic Growth	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Treatment vs Control in Micro firms (n=1285)				
Treatment	0.067**	(0.029)	0.002	(0.023)	0.000	(0.029)	0.031	(0.031)
Treatment Mean	0.806	(0.009)	0.172	(0.009)	0.775	(0.010)	0.421	(0.012)
Control Mean	0.738	(0.009)	0.170	(0.008)	0.775	(0.009)	0.390	(0.010)
				Panel B: Treatment vs Control in SME firms (n=1495)				
Treatment	0.071***	(0.026)	0.096	(0.031)	0.066***	(0.024)	0.140***	(0.032)
Treatment Mean	0.859	(0.008)	0.365	(0.011)	0.860	(0.014)	0.532	(0.012)
Control Mean	0.788	(0.007)	0.269	(0.008)	0.793	(0.014)	0.392	(0.009)
Difference in Treatment Effect (B-A)	0.004	(0.018)	0.094***	(0.018)	0.067***	(0.017)	0.109***	(0.022)

*** p<0.01, ** p<0.05, * p<0.1. Errors robust to heteroskedasticity. Estimated models reported in this Table include the same set of baseline covariates and fixed effects as in the base model presented in Table 3.

Table 6. Treatment Effects: Period 1 vs Period 2

	Workforce Resilience		Workforce Growth		Economic Resilience		Economic Growth	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Panel A: Treatment vs Control in Period 1 (2020H1-2020H2) (n=1380)					
Treatment	-0.085***	(0.020)	-0.067	(0.066)	-0.045**	(0.020)	0.039	(0.051)
Treatment Mean	0.802	(0.009)	0.234	(0.010)	0.819	(0.008)	0.426	(0.011)
Control Mean	0.887	(0.007)	0.301	(0.009)	0.864	(0.007)	0.387	(0.009)
			Panel B: Treatment vs Control in Period 2 (2020H2-2021H1) (n=1400)					
Treatment	0.127***	(0.030)	0.078	(0.030)	0.086***	(0.028)	0.101***	(0.034)
Treatment Mean	0.864	(0.008)	0.312	(0.011)	0.823	(0.009)	0.533	(0.012)
Control Mean	0.737	(0.009)	0.234	(0.008)	0.736	(0.008)	0.432	(0.009)
Difference in Treatment Effect (B-A)	0.212***	(0.016)	0.145***	(0.019)	0.131***	(0.017)	0.062***	(0.021)

*** p<0.01, ** p<0.05, * p<0.1. Errors robust to heteroskedasticity. Estimated models reported in this Table include the same set of baseline covariates and fixed effects (with the exception of time fixed effect) as in the base model presented in Table 3.

Table 7. Robustness Checks (Full Sample)

	Full Sample (n=2780)				
	Neighbors=3 Caliper Distance=0.25 (1)	Neighbors=5 Caliper Distance=0.25 (2)	Neighbors=7 Caliper Distance=0.25 (3)	Neighbors=3 Caliper Distance=0.5 (4)	Neighbors=3 Caliper Distance=0.75 (5)
	Dependent Variable= Workforce Resilience				
Treatment	0.040**	0.046**	0.046**	0.040**	0.028
	(0.020)	(0.019)	(0.019)	(0.020)	(0.018)
	Dependent Variable= Workforce Growth				
Treatment	0.050**	0.050**	0.050**	0.050**	0.042*
	(0.021)	(0.020)	(0.020)	(0.020)	(0.021)
	Dependent Variable= Economic Resilience				
Treatment	0.044**	0.055***	0.051***	0.044**	0.040**
	(0.020)	(0.018)	(0.018)	(0.020)	(0.020)
	Dependent Variable= Economic Growth				
Treatment	0.068***	0.083***	0.082***	0.068***	0.084***
	(0.024)	(0.022)	(0.022)	(0.024)	(0.022)

*** p<0.01, ** p<0.05, * p<0.1. Standard Errors in parenthesis. Errors robust to heteroskedasticity.

Table 8. Robustness Checks (Women-owned/led only)

	Full Sample (n=867)				
	Neighbors=3 Caliper Distance=0.25 (1)	Neighbors=5 Caliper Distance=0.25 (2)	Neighbors=7 Caliper Distance=0.25 (3)	Neighbors=3 Caliper Distance=0.5 (4)	Neighbors=3 Caliper Distance=0.75 (5)
	Dependent Variable= Workforce Resilience				
Treatment	0.045	n.a.	n.a.	0.045	0.022
	(0.032)			(0.032)	(0.032)
	Dependent Variable= Workforce Growth				
Treatment	0.112***	n.a.	n.a.	0.112***	0.084**
	(0.032)			(0.032)	(0.019)
	Dependent Variable= Economic Resilience				
Treatment	0.121***	n.a.	n.a.	0.121**	0.096**
	(0.034)			(0.034)	(0.041)
	Dependent Variable= Economic Growth				
Treatment	0.153***	n.a.	n.a.	0.153***	0.117***
	(0.034)			(0.023)	(0.043)

*** p<0.01, ** p<0.05, * p<0.1. Standard Errors in parenthesis. Errors robust to heteroskedasticity. Matching algorithm does not resolve with 5 and 7 neighbors.

Table 9. Robustness Checks (Micro only)

	Full Sample (n=1286)				
	Neighbors=3 Caliper Distance=0.25 (1)	Neighbors=5 Caliper Distance=0.25 (2)	Neighbors=7 Caliper Distance=0.25 (3)	Neighbors=3 Caliper Distance=0.5 (4)	Neighbors=3 Caliper Distance=0.75 (5)
	Dependent Variable= Workforce Resilience				
Treatment	0.067**	0.051*	0.051*	0.067**	0.061**
	(0.029)	(0.029)	(0.031)	(0.029)	(0.029)
	Dependent Variable= Workforce Growth				
Treatment	0.002	0.002	0.004	0.002	0.001
	(0.023)	(0.224)	(0.022)	(0.024)	(0.024)
	Dependent Variable= Economic Resilience				
Treatment	0.000	0.016	0.024	0.000	0.000
	(0.029)	(0.030)	(0.029)	(0.028)	(0.027)
	Dependent Variable= Economic Growth				
Treatment	0.031	0.028	0.021	0.031	0.025
	(0.031)	(0.032)	(0.022)	(0.031)	(0.030)

*** p<0.01, ** p<0.05, * p<0.1. Standard Errors in parenthesis. Errors robust to heteroskedasticity.

Table 10. Balance Test (Women-owned/led firms only)

	Standardized Differences	Variance Ratio	Obs
Age	0.002	0.913	867
Age squared	-0.020	0.980	867
Micro/Small	-0.041	0.986	867
Linkages	-0.060	1.136	867
Formality	0.000	1.000	867
Digitalization	-0.035	1.048	867
Sector			
Industry	0.078	1.095	867
Services	-0.027	0.990	867
Commerce	-0.043	0.972	867
Region			
Antioquia	0.025	1.036	867
Caribe	-0.049	0.908	867
Bogotá	0.003	1.003	867
Central	0.064	1.191	867
Oriental	-0.044	0.905	867
Pacífica	-0.001	0.998	867
Valle del Cauca	0.006	1.023	867
Time			
2020H2-2021H1	-0.099	1.005	867
2021H1-2021H2	0.099	1.005	867

Notes: Standardized mean difference is a commonly used statistic to examine the balance of covariate distribution between treatment and control groups. Differences close to 0 indicate good balance. Similarly variance ratios close to 1 indicate good balance. Regressions include time, sector and region fixed effects.

Table 11. Balance Test (Micro firms only)

	Standardized Differences	Variance Ratio	Obs
Age	-0.123	0.643	1285
Age squared	-0.151	0.456	1285
Women-owned/led	-0.062	0.943	1285
Linkages	0.014	0.981	1285
Formality	0.021	0.940	1285
Digitalization	-0.018	1.015	1285
Sector			
Industry	0.011	1.014	1285
Services	-0.008	0.997	1285
Commerce	- 0.002	0.999	1285
Region			
Antioquia	-0.053	0.934	1285
Caribe	-0.041	0.935	1285
Bogotá	-0.049	0.941	1285
Central	0.056	1.190	1285
Oriental	0.075	1.223	1285
Pacífica	0.052	1.148	1285
Valle del Cauca	0.023	1.084	1285
Time			
2020H2-2021H1	0.084	1.006	1285
2021H1-2021H2	-0.084	1.006	1285

Notes: Standardized mean difference is a commonly used statistic to examine the balance of covariate distribution between treatment and control groups. Differences close to 0 indicate good balance. Similarly variance ratios close to 1 indicate good balance. Regressions include time, sector and region fixed effects.

Figure 9. Propensity Score Balance Plot (Women-owned/led only)

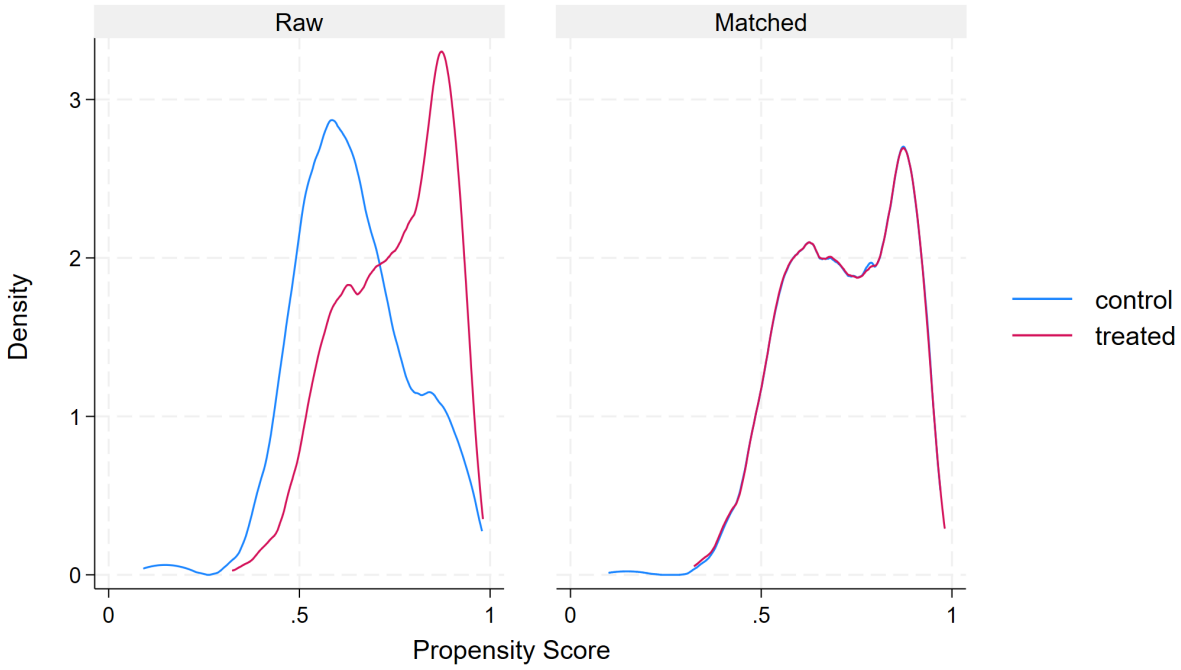


Figure 10. Propensity Score Balance Plot (Micro firms only)

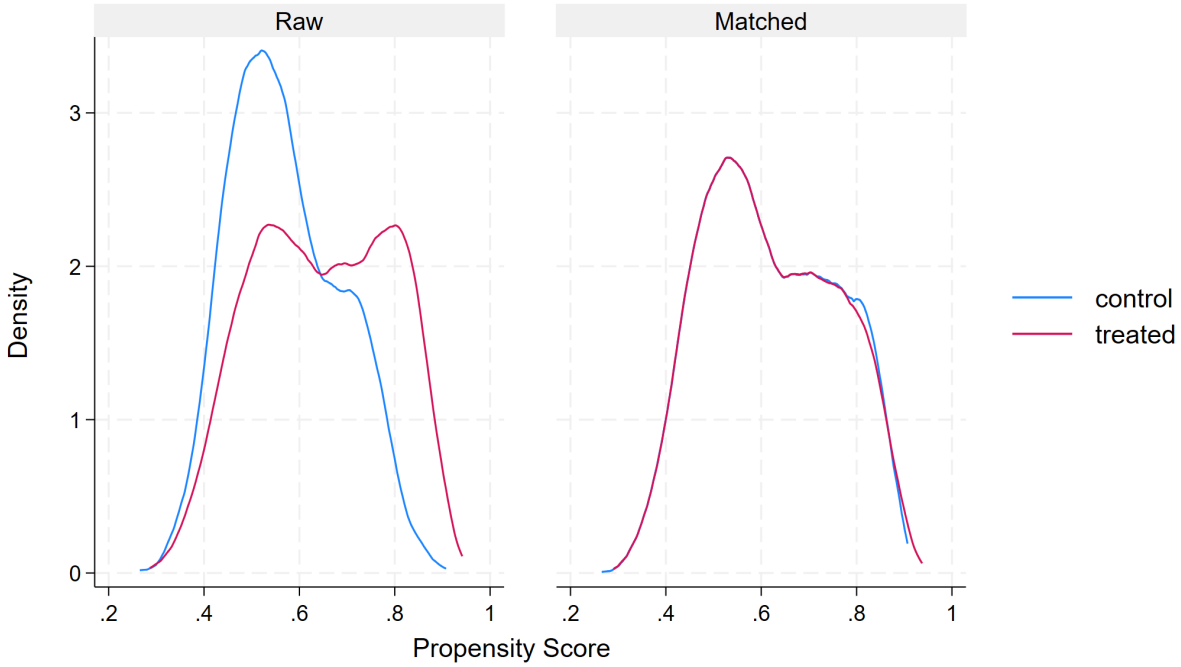


Figure 11. Reasons for not applying for credit

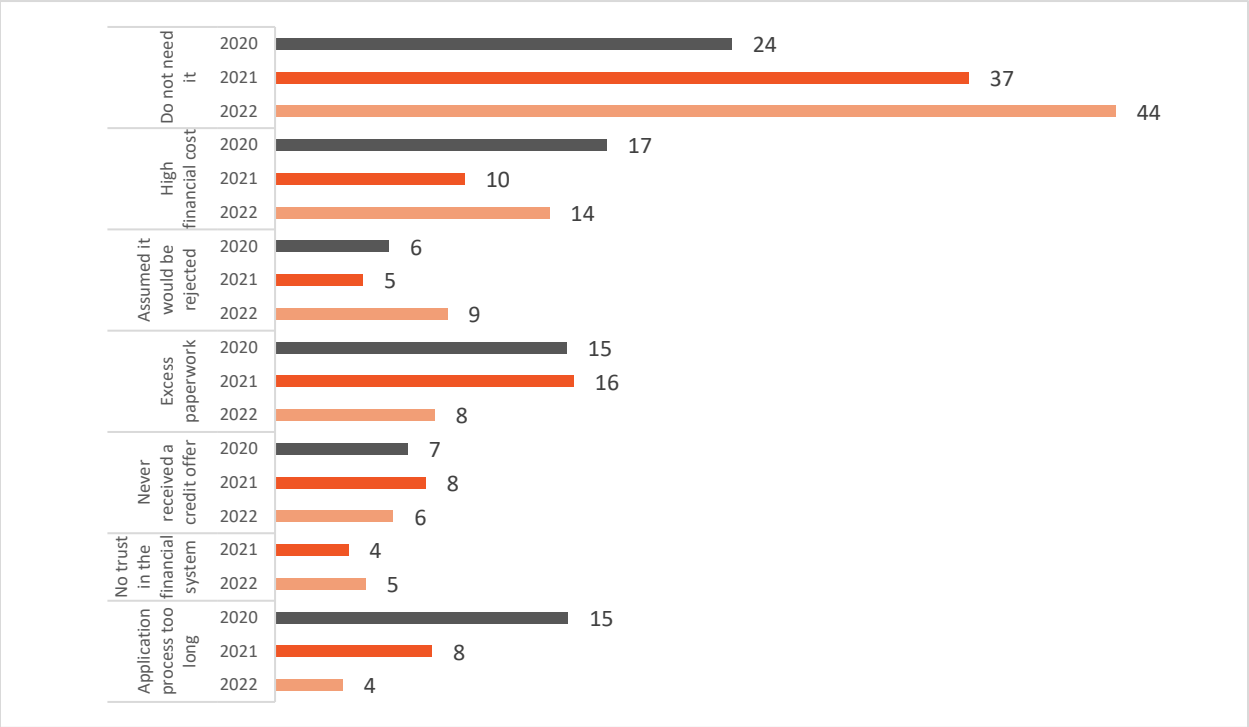


Table 12. Robustness Check: Alternative Standard Error Estimation using clustering based on the number of matches

*** p<0.01, ** p<0.05, * p<0.1. Standard Errors in parenthesis. Standard Errors are robust to heteroskedasticity.

	Workforce Resilience		Workforce Growth		Economic Resilience		Economic Growth	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Placebo 1	-0.018	(0.016)	-0.000	(0.018)	-0.003	(0.015)	0.018	(0.021)
Placebo 2	0.001	(0.015)	0.017	(0.017)	-0.010	(0.016)	0.007	(0.020)
Placebo 3	0.009	(0.016)	0.006	(0.018)	0.005	(0.016)	-0.012	(0.021)
Placebo 4	0.004	(0.016)	0.031*	(0.018)	-0.002	(0.015)	-0.026	(0.021)
Placebo 5	-0.032**	(0.015)	-0.009	(0.019)	-0.037**	(0.015)	-0.016	(0.021)
Placebo 6	0.030*	(0.016)	-0.004	(0.019)	0.000	(0.016)	0.009	(0.022)
Placebo 7	-0.003	(0.016)	-0.004	(0.019)	-0.008	(0.016)	-0.388	(0.022)
Placebo 8	-0.007	(0.015)	0.016	(0.019)	-0.023	(0.016)	0.014	(0.022)
Placebo 9	0.008	(0.016)	-0.022	(0.019)	-0.009	(0.016)	-0.020	(0.022)
Placebo 10	0.033**	(0.017)	0.031	(0.019)	0.030*	(0.017)	0.031	(0.022)

Table 13. Placebo Tests on Outcome Variables

	Workforce Resilience		Workforce Growth		Economic Resilience		Economic Growth	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Treatment vs Control				
Treatment	0.040**	(0.020)	0.050**	(0.020)	0.044**	(0.020)	0.068***	(0.023)
Treatment Mean	0.831	(0.006)	0.277	(0.008)	0.819	(0.006)	0.473	(0.008)
Control Mean	0.791	(0.005)	0.226	(0.006)	0.776	(0.006)	0.404	(0.007)
				Panel B: Baseline Characteristics in Treatment vs Control				
Firm-level variables								
Age	0.041	(0.010)	0.041	(0.010)	0.041	(0.010)	0.041	(0.010)
Age-squared	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)
Women-owned/led	0.236	(0.094)	0.236	(0.094)	0.236	(0.094)	0.236	(0.094)
Micro	-0.388	(0.092)	-0.388	(0.092)	-0.388	(0.092)	-0.388	(0.092)
Linkages	0.117	(0.120)	0.117	(0.120)	0.117	(0.120)	0.117	(0.120)
Formality	0.227	(0.197)	0.227	(0.197)	0.227	(0.197)	0.227	(0.197)
Digitalization	-0.103	(0.102)	-0.103	(0.102)	-0.103	(0.102)	-0.103	(0.102)
Observations	2,780	2780	2,780	2780	2,780	2780	2,780	2780
Region FE	YES	YES	YES	YES	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1. Standard Errors in parenthesis. Errors robust to heteroskedasticity.
Note: Each placebo test randomly assigns a treatment category to a proportionate sub-sample of firms in the sample as those that accessed credit in the data and re-estimates the model again with the simulated sample.

Appendix II

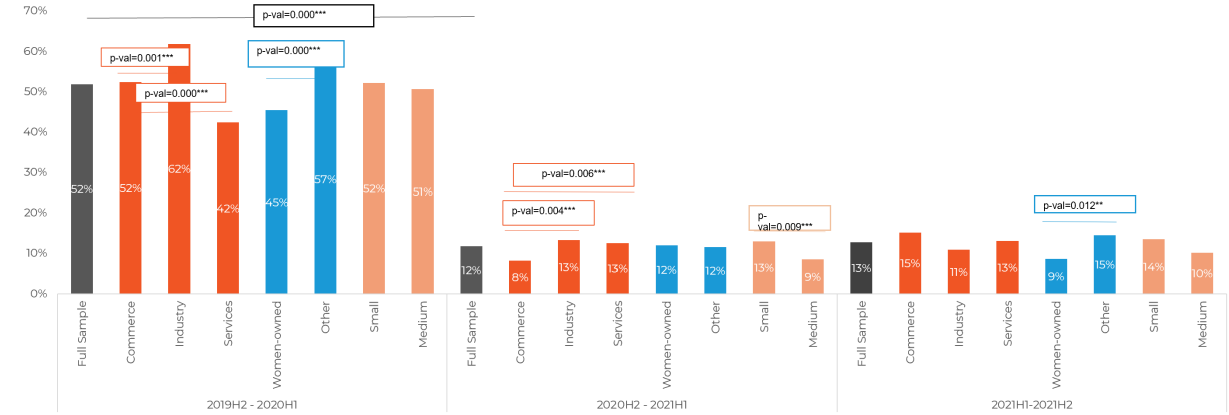
1. Comparability and Design

This appendix harmonizes three survey waves to analyze firm dynamics during and after the pandemic shock. The early wave (2019H2–2020H1) excludes microenterprises; for comparability, subsequent interpretations exclude micro conceptually as well. Outcomes are shares of firms. “p-val” annotations denote two-sided t-tests of differences in proportions within a period (or full sample between periods); only statistically significant contrasts are shown (* $p<0.10$, ** $p<0.05$, *** $p<0.01$).

2. Changes in Employment

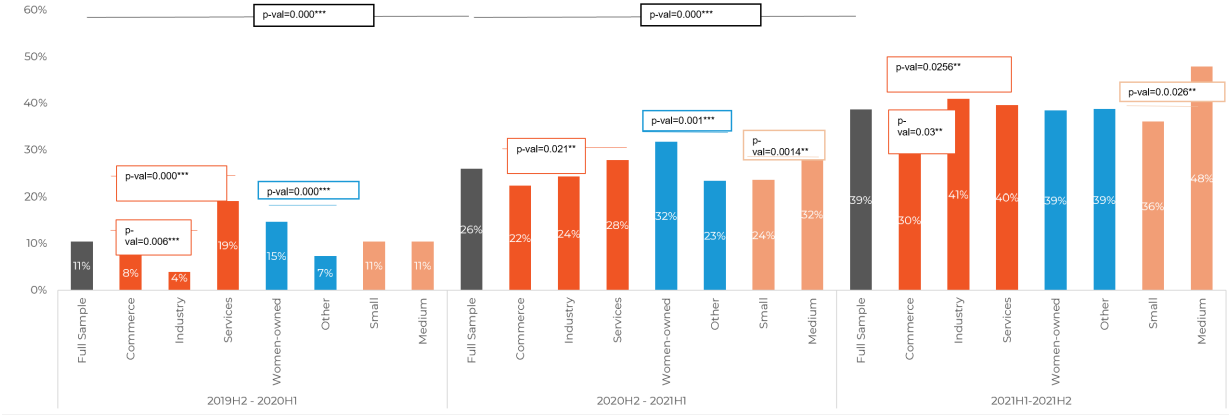
The comparison between the shock and the rebound is stark. From 2019H2–2020H1 to 2020H2–2021H1, the share reporting a decrease in workforce falls from roughly one-half (~52%) to the low teens (~12%). In the shock period, industry is significantly above services, and women-owned report fewer decreases than other firms. In the rebound, decreases are uniformly low, with a few significant sectoral contrasts only where annotated. Conversely, employment increases jump from about one in ten (~11%) to roughly one in four (~26%). Within the rebound, women-owned are significantly more likely to expand employment than other firms, and medium firms exceed small firms. The subsequent period (2021H1–2021H2) shows further strengthening of increases and stable, low decreases, consistent with normalization. These shifts motivate examining firms’ perceived economic situation over the same pair of periods.

Figure 12: Decrease in the workforce, overall, sector, women – owned status, and firm size (%)



Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.

Figure 13: Increase in the workforce, overall, sector, women – owned status, and firm size (%)

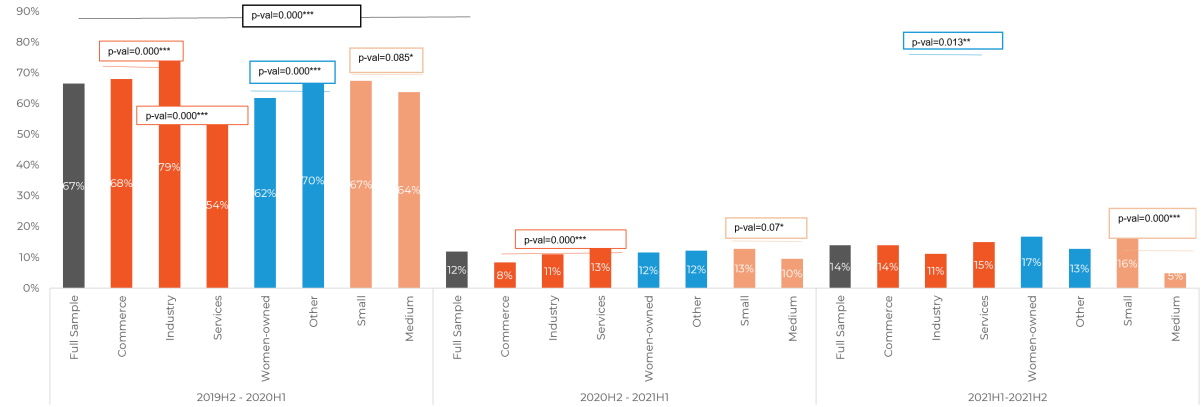


Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.

3. Changes in Economic Situation

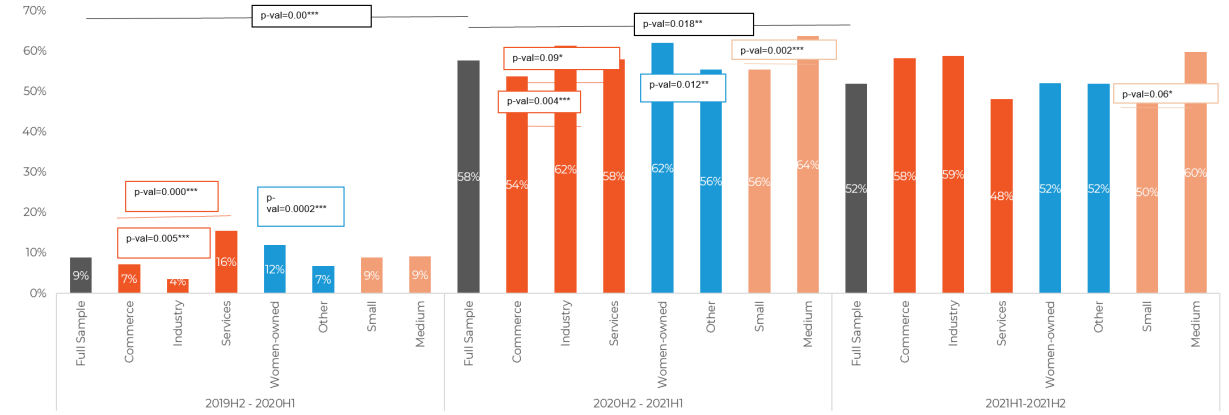
Reports of a worsened situation collapse from very high levels in 2019H2–2020H1 (~67%) to about one in eight in 2020H2–2021H1 (~12%). In the shock, industry is significantly worse than services, and women-owned fare better than other firms. Mirroring employment, the share reporting a better situation rises from single digits (~9%) to around three-fifths (~58%) in the rebound. Within this second period, women-owned are significantly more likely to report improvement than other firms, and medium firms exceed small firms. The third period moderates (better near one-half; worsened in mid-teens), but the key novelty is the large swing between the first two periods. These assessments naturally connect to firms' evolving credit needs.

Figure 14: Percentage of firms reporting a worsened economic situation, overall, sector, women – owned status, and firm size (%)



Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.

Figure 15: Percentage of firms reporting a better economic situation, overall, sector, women – owned status, and firm size (%)

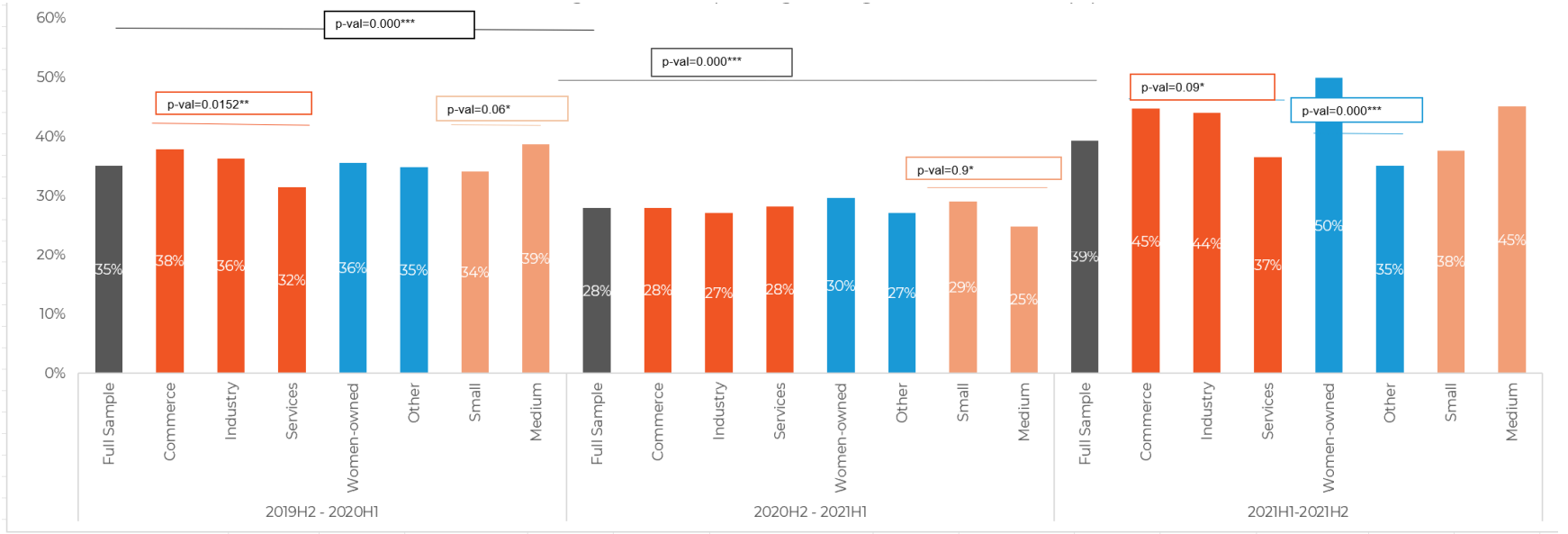


Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.

4. Changes in Credit Demand

Credit demand behaves pro-cyclically with a short lag when comparing the first two periods. During the shock (~35% overall), demand is elevated—consistent with buffering needs—while in the rebound it eases to roughly one-quarter to one-third (~28%), as immediate liquidity pressures abate. By the third period, demand rises again (~39%) and becomes notably higher among women-owned firms than others (significant), suggesting the transition from liquidity to working-capital and adjustment finance.

Figure 16: Percentage of firms reporting having demand a credit, overall, sector, women – owned status, and firm size (%)

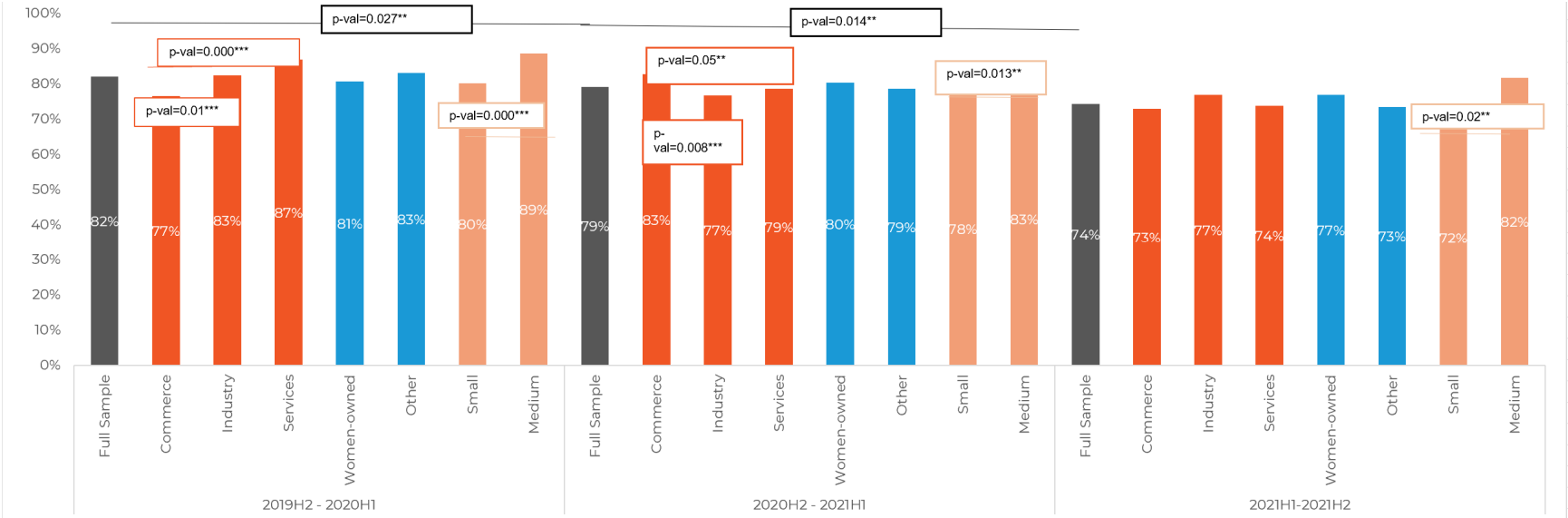


Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.

5. Changes in Technology Adoption

Technology adoption is high in both the shock and rebound, with only modest attenuation. It stands near the low-80s in 2019H2–2020H1 and remains around 79% in 2020H2–2021H1. In the shock, adoption is significantly higher in services/industry than commerce, and medium exceeds small firms. In the rebound, the size premium persists (medium reports more adoption than the small firms, being this difference significant), and selected sectoral contrasts reach significance as annotated. The third period shows partial normalization but continued medium-firm advantages, consistent with capabilities accumulated during the shock and supported by evolving credit access. Together with the employment and perception results, the comparison of the first two periods suggests that digital practices established under duress were largely sustained through the rebound.

Figure 6: Percentage of firms reporting technology adoption, overall, sector, women – owned status, and firm size (%)



Note: "p-val" labels report two-sided t-tests of differences in the share of firms across the bracketed groups within each period. Only statistically significant comparisons are annotated; unlabeled contrasts are not significant at conventional levels. Significance codes: * p < 0.10, ** p < 0.05, *** p < 0.01. The following comparisons were estimated: (i) full sample across periods (2020H2–2021H1 vs. 2021H1–2021H2); and (ii) within each period—Commerce vs. Industry and vs. Services; Women-owned/led vs. Other firms; Micro vs. Small, and Small vs. Medium firms. H1 refers to first half of the year and H2 refers to second half of the year.