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Group Consulting Continues to Benefit Firms after a Decade

Experimental Evidence from Colombian Auto Parts Firms

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Abstract

A randomized experiment tested the effectiveness of individual and small group–based consulting services on firms in the Colombian auto parts industry, finding improvements in management and firm performance over three to four years. This paper uses administrative data to track these firms for up to a decade. Firms in the group consulting intervention are more likely to survive, have higher employment, and have increased sales and profits by approximately 50 percent. This longer-term growth appears to in part come through increased exporting as well as persistent management improvements. The more expensive individual consulting has smaller and not statistically significant long-run impacts.

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Group Consulting Continues to Benefit Firms after a Decade: Experimental Evidence from Colombian Auto Parts Firms[*]

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1. Introduction

Policy makers worldwide seek effective policies to support small and medium enterprises (SMEs) to become more productive and profitable, create more jobs, and increase exports. A growing body of evidence highlights the central role of management practices in driving firm performance. Recent experimental studies (Bloom et al, 2013; Bruhn et al, 2018; Iacovone et al. 2022) and non-experimental analysis (Giorcelli 2019; Bianchi and Giorcelli, 2022) have established a causal link between management consulting and better firm performance. Moreover, correlational evidence suggests that better-managed firms are more likely to export (Bloom et al., 2021). However, we lack causal evidence linking these management improvements to subsequent exporting,[1] and it is unclear how persistent we should expect these consulting impacts to be in a challenging environment of import competition and economic shocks.

There are competing views in the literature and among management professionals about how sustained we should expect the impact of consulting to be. One view is that new management practices are a form of long-term behavior change, and once initial enthusiasm and effort wears off, people return to ingrained old ways of doing things, particularly during times of stress or when new challenges arise. As a result, Boston Consulting Group estimates that two-thirds of transformation initiatives ultimately fail (Sirkin et al, 2005). Bloom et al. (2020) track impacts of a consulting intervention in India after nine years on management practices (although not on performance) and find that half the management practices implemented had since been dropped, with managerial turnover and a lack of director time the two most common reasons. Group-based interventions may be particularly vulnerable to fade-out as peer networks dissolve. Additionally, consulting may simply accelerate changes that firms would have adopted independently, implying convergence over time between treated and control firms.

[1] Iacovone et al. (2025) find that a different consulting intervention in Colombia that was intended to improve exports and productivity had null or negative impacts.

Conversely, there are several channels through which impacts may persist or even grow over time. The kaizen approach of continuous improvement posits a virtuous cycle in which initial systems put in place enable firms to then implement further improvements. Historical evidence from Giorcelli (2019) and Bianchi and Giorcelli (2022) shows that management training in Italy in the 1950s and the U.S. in the 1940s led to growing performance gains over a decade. Better management may be particularly important in helping firms survive shocks such as the Covid-19 pandemic (Lamorgese et al, 2024) and rising import competition. Aghion et al. (2005) argue that firms closer to the technological frontier are better equipped to respond to competitive pressure through innovation, while lagging firms fall further behind. Cusolito et al. (2023) show that in middle-income countries such as Chile, only 10% of firms are frontier-proximate. Colombia's auto parts sector faced disruption in domestic markets during the pandemic and increasing Chinese import competition. Better management may have moved more of these firms closer to the frontier, where they had the tools to adjust to these shocks and respond to competition.

This paper tests these competing hypotheses using a long-term follow-up of a randomized experiment in Colombia's auto parts sector. The original intervention compared two consulting models: intensive individual consulting ($29,000 per firm) and a novel group-based approach ($10,000 per firm), where consultants worked with groups of 4–6 firms. Iacovone et al. (2022) found that both models improved management practices in the first year, with the group-based approach yielding significant gains in employment, sales, and profits over the subsequent three years. Individual consulting had estimated impacts that were smaller in magnitude, although we could not reject equality of impacts across treatments.

We use administrative records in Colombia to track these firms up to 8-10 years post-intervention, through to 2024. This covers a period that includes the Covid-19 pandemic and recovery, as well as increasing competition from Chinese imports. We find large and sustained impacts of group consulting, with point estimates that have grown over time. Relative to the control group, treated firms are 11-13 percentage points more likely to survive, with particularly strong effects among firms with initially weak management; annual sales

increase by over $1 million (55%), and annual profits by $475,000 (48%). Although noisily measured, firms appear to have created more jobs, with a 28% increase in employment conditional on survival. Treated firms are also 10 percentage points more likely to export, and they continue to have significantly better management practices. In contrast, the long-term impacts of the individual consulting are less clear, with point estimates on firm performance that are about half the size of the group consulting, but not statistically different from zero nor from the group impacts. The results show high cost-effectiveness for group-based consulting. We complement the quantitative analysis with detailed case studies to explore the channels through which these impacts emerged.

2. Experimental Design and Intervention

The Colombian technological extension program was a government program launched in 2012 to offer assistance in improving management production practices in the auto parts sector. This sector is made up of small and medium enterprises (SMEs) that produce components used in vehicle manufacturing like fenders, tires, paints, metal, rubber, and plastic parts that are both sold domestically and exported to neighboring countries. A public call and outreach through car and bus manufacturers yielded a sample of 159 SMEs. A baseline survey of management practices using the Bloom and Van Reenen (2007) World Management Surveys method found that these firms had similar management practices to the average Colombian manufacturing firm and are fairly typical for manufacturing firms in a range of developing countries.

2.1 Experimental Design and Sample

Firms were well-established single plant firms that had been in business for a median of 23.5 years. They had a mean (median) of 59 (40) employees, averaged $2.3 million in sales in 2013, and 45 percent had exported in 2013. The 159 firms were matched on size, geographic location, baseline labor productivity, and baseline management practices, and randomly assigned within triplets to three groups of 53 firms each: a control group, and two treatment groups.

2.2 The Intervention: Individual and Group-Based Consulting

Firms in all three groups received a diagnostic in the second half of 2013 (see timeline in appendix A), in which consultants assessed the existing state of management practices in logistics, human resources, finance, marketing and sales, and production, ending with a suggested plan for improvement. The diagnostic and subsequent consulting was provided by local specialists from the National Productivity Center (Centro Nacional de Productividad (CNP)). Firms receiving the *individual* treatment then received 500 hours of consulting in these five areas, spread over 3-6 months between March and November 2014. Consultants would meet with the person in the firm in charge of each given area, and work to help the firm implement the improvement plan in each area. Consulting was provided for free to firms, but it cost $28,950 per firm to provide.

The *group* treatment aimed to lower costs and potentially generate benefits from peer interaction by having consultants from CNP work with small groups of 3 to 8 firms located in the same region. Meetings were frequently held in local hotel facilities rooms, with the staff in charge of a particular area or production process from the firm attending. Sessions focused on topics that had been prioritized for a number of firms in the group in their improvement plans. Due to a funding delay, the group intervention took place in 2015, with firms receiving 408 hours of consulting time, at a cost of approximately $10,500 per firm.

This group approach shares some similarities as well as differences with the peer networking interventions of Cai and Szeidl (2018) and Asiedu et al. (2025), which found positive impacts on management practices and profits over one year. As in those interventions, it encourages firms to share knowledge and experiences with one another and overcomes coordination issues by matching firms together. However, our intervention is much more intensive,[2] involving many hours of consulting and the opportunity for firms to learn jointly and experiment from expert guidance. Conversely, due to the structure of the auto parts industry,

[2] Firms in Cai and Szeidl (2018) met for one-half day a month for 12 months; firms in Asiedu et al. (2025) had one virtual meeting per week for 16 weeks. Neither provided consulting.

there are not the same opportunities for firms to partner as suppliers or customers for one another, which was a key channel through which their networking interventions operated.

2.3 Brief Recap of Short-term Results

Iacovone et al. (2022) measure impacts through to 2018, using a survey taken in the year post-intervention to measure management practices, and administrative data to measure firm performance impacts. The survey measured 141 management practices across the five areas targeted by the intervention and found that both individual and group treatments improved these practices by 8 to 9 percentage points on average, relative to a control mean of 56% of the practices being implemented by 2015. Not only were the average impacts similar, but there was a high correlation (0.71) in which practices improved the most with large gains in monitoring key performance indicators, defining strategic goals and objectives, and setting up master budgets, and smaller impacts on logistics and human resource practices. Within the group treatment, we saw that firms were more likely to improve practices that other firms in their group also improved, suggesting coordinated learning, whereas there was no association between the change in practices and being placed in a group where another firm already did the practice very well.

In the 3-4 years post-intervention, we found that the group intervention led to a statistically significant increase in employment, sales, profits and value-added. The individual treatment impacts were almost all positive, but smaller than those of the group treatment and not statistically significant. One explanation for this difference between treatments could be that it just reflects noise, since we could not reject equality of impacts for most outcomes. In that case, we might expect the longer-term impacts to also be similar for both treatments. A competing explanation is that the group treatment provided other benefits to firms beyond what was captured in the management practices alone. A year after the intervention, 54% of the firms in the group treatment said they still communicated occasionally with other members, whereas few firms discussed management practices with other firms in the industry outside of the intervention.

2.4 Data and Long-run Estimation

We measure long-term impacts by linking the firms in our experiment to several administrative data sources. The most comprehensive set of outcomes comes from the annual manufacturing survey (*Encuesta Anual Manufacturera (EAM)*) which is mandatory for establishments with more than 10 employees. Of the 159 firms in our experiment, 120 are matched, with our previous work (Iacovone et al, 2022) finding that the firms not found tend to be much smaller, as well as several of them trading, rather than manufacturing, auto parts. We measure the same outcomes as in our previous work (employment, sales, profits, value-added, and production), as well as survival and exporting. Appendix B provides more details on construction of our main outcomes. The EAM is released with a lag, so we were able to access data for the 13 years from 2010 to 2022, which covers a decade since firms entered the program, and 7-8 years since their consulting finished.

We supplement this data with three other data sources. The first is the *Planilla Integrada de Liquidación de Aportes (PILA)* (Unified Register of Contributions), which is the national system used by firms to file mandatory worker health insurance and pension contributions. In theory all firms should be included in these data, and we were able to match 156 of the 159 firms. We have data at monthly frequency from January 2012 until September 2024, which we use as an additional measure of firm survival and formal employment that is available for more firms and a longer time horizon than with the EAM.

The second is annual data on exports from 2010 until 2024 provided by the National Directorate of Taxes and Customs (DIAN). We find 109 of the 159 firms have exported at least once during this time frame. Note that this captures direct exports only, so firms that export through an intermediary would not have their exports captured in these data.

Third, we use data from the biannual *Encuesta de Desarrollo Technológico e Innovación* (EDIT) survey, using the six rounds from 2010-11 until 2019-20. These surveys contain 114 firms, all of which are also in the EAM. We use the EDIT to examine impacts on product innovation, as well as using questions on management practices asked only in the 2017-18, and 2019-20 rounds.

These different administrative datasets enable us to track firms over a long period of time, without concerns about survey attrition. Selection into appearing in these surveys depends on factors like firm size and activity or sub-sector, which are predetermined and orthogonal to treatment in expectation. However, over time, some firms die, and treatment may affect firm survival. This raises the question of how to code outcomes when firms die. Our main specifications code employment, sales, and other firm outcomes as zero in periods after a firm has closed. This enables us to estimate unconditional impacts of treatment that combines the extensive margin impact on survival with any intensive margin impacts on firms that remain in business. This can be done for measuring impacts on levels, but not for proportional impacts using a log transformation. Our prior work (Iacovone et al, 2022) also used the inverse hyperbolic sine transformation, but given recent work by Chen and Roth (2024), we instead present log impacts, conditional on survival, and then examine robustness by also looking at level impacts conditional on survival, and level impacts in the balanced sample of firms present in all waves. We use individual firm fixed effects to improve precision (given considerable heterogeneity in initial size among firms) and to condition on any time-invariant characteristics of firms that affect appearance in each database or survival.

We then estimate impacts on outcome *Y* with the following equation for firm *i* in period *t* over *J* periods:

$$Y_{i,t} = \alpha_i + \beta_0 Individual_i * During_i + \sum_{j=1}^{J} \beta_j Individual_i * 1(j)_{i,t} + \gamma_0 Group_i * During_i + \sum_{j=1}^{J} \gamma_j Group_i * 1(j)_{i,t} + \sum_{s=1}^{T} \delta_s 1(s = t) + \varepsilon_{i,t} \quad (1)$$

Where α_i are firm fixed effects (which subsume randomization strata), *During* indicates the period during which the individual or group intervention took place, *Individual* and *Group* denote assignment to the individual and group treatments respectively (the control group is the reference group), *1(s=t)* are time period fixed effects, and the standard errors $\varepsilon_{i,t}$ are clustered at the firm level. This follows the same specification as in Iacovone et al. (2022),

except that given our interest is now in tracing dynamics, we allow the post-treatment impacts to vary over time. To balance the presentational and power gains from pooling periods with exploring dynamics, we use the *1(j)* dummies to indicate two-year calendar periods.[3] We then also test equality of the treatment effects over time, as well as testing whether the individual and group treatment effects are equal in the last measured time period *J*.

3. Long-run Impacts

3.1 Impacts on Survival and Employment

Figure 1 plots survival in the PILA by month. By the end of our prior study (December 2018), 138 of the 159 firms were reporting formal employees, with survival rates similar for the individual and group consulting, and higher than the control group. Remarkably, over the next 6 years, no further firms in the group consulting treatment die, whereas survival rates start falling in the individual treatment and continue to fall in the control.[4] By September 2024, the survival rate in the control group is 75%. Column 1 of Table 1 shows the 13.2 percentage point increase in survival relative to the control group by September 2024 for the group treatment is significant at the 10 percent level (p=0.074), and we can reject equality of impacts with the individual treatment (p=0.010). Column 2 shows similar magnitudes in the EAM sample, with an 11 percentage point increase in survival in the group treatment, which is statistically different from the individual treatment (p=0.049).

In Table A1 we compare the baseline characteristics of surviving firms in the PILA by September 2024 to those which die, for the full sample, and by treatment group. The firms which die in the control group have lower baseline labor productivity, and worse management practices than those that survive. Since our prior work found that both the individual and group interventions improved management, this raises the question of

[3] That is, 1(j) is a dummy variable equal to 1 if *t* is in a given two-year calendar window. The exception is that to account for the staggering of treatment, we let the first post-treatment pooled period for the individual treatment to be over 2015-18, and for the group treatment to be 2016-18, which in both cases captures the time horizon in our prior work (Iacovone et al, 2022).

[4] We had IPA Colombia call and web search the firms that do not appear in the PILA, and only one of the 36 firms not found in the September 2024 PILA appears to be still operating.

whether, by doing so, they particularly helped initially poorly managed firms to survive. The bottom panel of Figure 1 shows that this appears to be the case for the group, but not the individual, treatment. In both the control group and the individual treatment group, we see the survival rate increasing with baseline management practices, whereas in the group treatment, survival rates are similar across quartiles. Only 56% of baseline poorly managed control firms survive, compared to 92% in the group treatment. Table A2 shows that this relationship between baseline management practices and survival is statistically significant in the control group, and the group treatment interaction with initial management is significant when interacted with a continuous baseline management score (p=0.092), but not when interacted with a dummy for below median baseline management (p=0.238).[5] Despite this suggestive evidence of selective treatment effects on survival, Table A3 shows that we cannot reject equality of means of baseline observables across treatment groups for the surviving firms. Taken together, this evidence suggests that analysis which conditions on survival may give a lower bound of the impact of the group treatment, if the group treatment helps keep less productive and worse managed firms alive.

There is considerable cross-sectional variation in employment in our sample, with the standard deviation increasing over time (Figure A1). The left panel of Figure 2 shows considerable month-to-month variation in how mean employment in each group compares to their 2012-13 average, and that the group treatment mean is higher than the other two groups in the last 3 years. Treatment impacts on employment are shown in columns 3 to 5 of Table 1. The increasing cross-sectional heterogeneity is reflected in standard errors which increase with duration since treatment, making it harder to precisely measure longer term employment effects. Column 3 shows a 4-6 worker long-run increase in formal employment from the group treatment, using the full sample of firms using the PILA, but that this increase is not statistically significant, with a standard error of 8 workers in the last period. We find stronger long-run impacts of the group treatment on employment for the sample matched

[5] We requested, but were not granted, permission to link our baseline management practice to the manufacturing survey data, and so cannot examine of impacts in the EAM with respect to baseline management.

to the manufacturing survey, with a 17 worker increase when measured in levels (relative to a control mean of 53 workers), and a 28.7% increase for log employment conditional on survival (both significant at the 10% level). Estimated impacts for the individual treatment are smaller in magnitude (8 workers, or 20% conditional on survival) and not statistically different from either zero or from the group treatment. Table A4 helps further reconcile the differences between the PILA and EAM by examining changes in different types of employment in the EAM. We see that the total impact on employment reflects both an increase in permanent workers (that are captured in the PILA), but also in temporary workers contracted through specialized agencies (that are not in the PILA).

3.2 Impacts on Firm Performance

The manufacturing survey permits studying the long-term impacts on firm performance (Table 2). We find strong, lasting, and statistically significant impacts of the group treatment on all measures of firm performance, with the point estimates increasing over time (although we cannot reject equality of impacts over the 7 years post-treatment, and as with employment, the standard errors also increase over time). Annual sales increase by 2,866 million pesos (US$1.2 million[6]) relative to a control mean of 5,204 million pesos (a 55% increase), and 28% conditional on surviving. Annual profits increase by 1,127 million pesos (US$475,000), relative to a control mean of 2,355 million pesos (a 48% increase). We also see a 47% increase in value-added, and 57% increase in production. The last column of Table 2 combines these measures into an aggregate index and shows a significant 0.56 standard deviation increase in firm performance. Long-run impacts on log outcomes conditional on survival are similar in magnitude to those in earlier rounds, but lose significance by the last round as the standard errors grow. In Table A5 we show level results conditional on survival for balanced and unbalanced panels are still significant for sales, production, and the overall index, with similar magnitudes to those shown in Table 2.

[6] We use the Colombia Producer Price Index to convert nominal pesos into 2014 real pesos, and then an exchange rate of 2,372 COP =1 US$ that prevailed in 2014-15 for consistency with our earlier work.

The long-term impacts of the individual treatment are less clear. The point estimates are all positive, and sizeable (29% increase in sales, 27% increase in profits), although smaller in magnitude than the group treatment. The overall index measure shows an increase in firm performance 8 years post-treatment of 0.28 standard deviation, half the group treatment estimate. We can neither reject that these impacts are zero, nor that they are equal to those of the group treatment. In Table A6 we pool together all post-treatment rounds for more power, and still see significant impacts for the group treatment, and smaller, and not statistically significant estimates for the individual treatment. Impacts for the individual treatment are more similar in magnitude to those of the group treatment when we condition on the sample of surviving firms: the point estimates on log outcomes in Table 2 are similar in magnitude for the two treatments, and in Table A5 we see the treatment effect estimates in levels for the individual treatment are statistically significant for firm performance and similar in magnitude to the group treatment for the sample of surviving firms.

3.3 Potential Mechanisms

We have seen firms were able to produce and sell more over a long period post-treatment. One potential way to sell this additional production is through expanding into export markets. The main export markets for the firms in our study are in neighboring countries, with three-quarters of all exports going to Ecuador, Guatemala, Costa Rica, Honduras, Panama, El Salvador, Peru and the República Bolivariana de Venezuela. The left panel of Figure 2 uses customs data to show the proportion of firms exporting each year in the three groups, with the group treatment showing a higher likelihood of exporting than the other two groups in the long run. The first four columns of Table 3 look at both the extensive margin (columns 1 and 3) and volume (columns 2 and 4) of exports. We see a 10.4 percentage point increase in exporting (not significant) for the full set of firms using customs data, and a statistically significant 23.5 percentage point increase for the set of firms matched to the manufacturing survey. As well as excluding smaller firms, the manufacturing survey can capture indirect exporting that would not get picked up in the customs data. Export volumes have lots of zeros and a skewed distribution, making it hard to get precise magnitudes for increases. Columns 2 and 4 show a US$92,000-$132,000 increase in export volume from the group treatment,

which is significant at the 10% level in the customs data but not in the manufacturing survey data. The group treatment impacts on exports grow in magnitude over time, consistent with it taking time for the management improvements to translate into more exporting. We can reject equality of impacts over time in the customs data (p=0.098), but not in the manufacturing survey (p=0.167). The individual treatment again has smaller and not statistically significant impacts, and we can reject equality with the group treatment for the extensive margin in the manufacturing survey.

Second, we examine whether firms are expanding sales through introducing more products. The EDIT survey asks firms if they have introduced new products, and whether these are new for the firm, country, or world. In the control group, all the new product innovation in 2020 was just new for the firm, not for the country. Column 5 of Table 3 shows a significant negative impact of the individual treatment on firms introducing new-to-them products, and negative, but not statistically significant, impacts of the group treatment. This may reflect the fact that the consultants advised focusing on improving core products and building markets for them, rather than producing all varieties. For example, many firms faced competition on the domestic market for generic low-end plastic and metal products from Chinese imports, and consulting advised them to focus more on their more specialized and higher end varieties.

Third, the EDIT implemented 16 questions from the Management and Organizational Practices Survey (MOPS) in its 2018 and 2020 survey rounds, which enable us to see whether the interventions have lasting impacts on management practices. We pool the two rounds for power and find a positive and significant impact of the group treatment of 6 percentage points, relative to a control mean of 36 percent of practices being implemented. In contrast, the individual treatment has an insignificant 0.7 percentage point increase in management, although this is not statistically different from the group treatment (p=0.140). Note further that these results are conditional on survival, so they may understate the improvement in management from the group treatment given the results we have on the group treatment particularly helping the survival of initially poorly managed firms. This sustained increase in

management from the group treatment may be one reason firms were able to survive better and continue to improve.

3.4 Qualitative Case Studies

In order to provide further insights into the growth paths of treated firms, we commissioned nine in-depth case studies, which were carried out by Innovations for Poverty Action in March and April 2025. These involved a semi-structured interview, factory walkthroughs, and comparison of current practices to recommendations made in CNP's final reports in 2016. We selected firms that had grown employment and were exporting, in order to understand their trajectories.

We use these case studies to provide qualitative evidence on three questions. The first is what factors led to management practices being sustained or not? A key factor in maintaining practices was embedding them in internal systems. Firms identified the use of formal KPIs as one of the main lasting contributions. In most cases they adapted the over time, integrating them into their current management strategies, and using them as a foundation for further changes. For example, a vehicle paint manufacturer noted how implementing these performance indicators helped them to standardize production and adopt international quality certifications such as ISO. As in Bloom et al. (2020), staff turnover was given as a reason for some practices being dropped, along with firms picking and choosing which practices they felt were most worthwhile. A manufacturer of adhesives noted "we took the parts that worked for us and implemented them in the company, and the rest—well, we set it aside." Finally, as in Anderson and McKenzie (2022), consulting seems to be an experience good, with firms more open to purchasing additional external advisory services to build on their initial gains.

The second question is how did these practices help firms survive shocks and expand into exports? Firms noted that the pandemic and post-pandemic changes in the economy had disrupted the local economy, providing both challenges and new opportunities that adaptable firms could respond to. Better management practices enabled firms to quickly react and reposition themselves in response to declining demand for their core products.

Export orientation was described by several firms as a strategic decision that enabled them to survive, when others were forced to close. One owner remarked: “I think that if we hadn’t started exporting, we would have shut down or gone bankrupt”. A manufacturer of rubber parts noted how the consulting had helped them think through their strategy for dealing with an oversaturated domestic market and heavy competition from Chinese mass producers. They focused on model-specific parts for which they could compete on quality, rather than price, and since Ecuador and Central America had similar car fleets, were able to extend this strategy to export in those markets. A manufacturer of automobile control cables noted that delays in imports from China during the pandemic coupled with a move to a more systematized production model gave them the opportunity to quickly respond by entering the Ecuadorian market, leading them to describe exports as now their “13th month” of sales. Advice from the consultants to diversify their client base also helped resiliency. An anodized aluminum parts manufacturer noted they had only a single client before the intervention, and through the consultancy developed a marketing plan that enabled them to start selling to many more companies.

Finally, the case studies provide some additional insight into mechanisms through which the group treatment may have especially helped. The first was the usefulness of benchmarking. A manager in the control cable manufacturer noted that “we looked at what was done in our company, and what other companies were doing – what we were doing that they weren’t, and vice versa”. Second was the knowledge that they were not alone in dealing with the issue. A coupling manufacturer stated: “I liked that I could see other companies facing the same problems”, and collective learning allowed them to reflect on common challenges. Third, none of the firms in the individual treatment reported having any peer collaborations, while the group treatment seems to have seeded some long-term professional relationships, with five out of six firms in the group treatment retaining some contact with other group members. As well as sharing knowledge, this also resulted in some collective action. For example, when the Ministry of Commerce, Industry and Tourism imposed anti-dumping measures that affected a raw material used by several of the firms in the group treatment, four of the companies joined forces to contest the sanction.

4. Discussion and Conclusions

The novel group consulting intervention pioneered in Colombia's technological extension program continues to deliver benefits to firms 8 to 10 years later. This shows that management improvements can stick and need not dissipate over time. The persistence of personal relationships developed in the group intervention may be akin to the "gym buddy" effect (Gershon et al, 2025), whereby desired behaviors have more follow-through when made social, suggesting these groups should be integrated into consulting extension program design.

Further, the return on investment is large, with firms earning $475,000 higher annual profits in the long term, for a program which cost only $10,000 per firm to provide. The obvious question is then why more firms do not purchase consulting services. One reason is that poorly managed firms often do not know they are poorly managed. Bloom and Van Reenen (2010) find no correlation between perceived and actual management scores. It appears that not only benchmarking by consultants, but peer benchmarking through the group intervention can redress this market failure. Managers may further underestimate the returns from consulting, and/or find it hard to know the quality of consulting providers. However, in the case of the group-based approach here, there is also a missing market: group consulting is not a product that firms can buy on the market. Moreover, firms may be worried about a lemons problem in peers if private consultants were to offer such a product. We therefore see a role for the government in solving this coordination problem and encouraging firms in a sector to learn from one another as well as from the consulting experts in group consulting.

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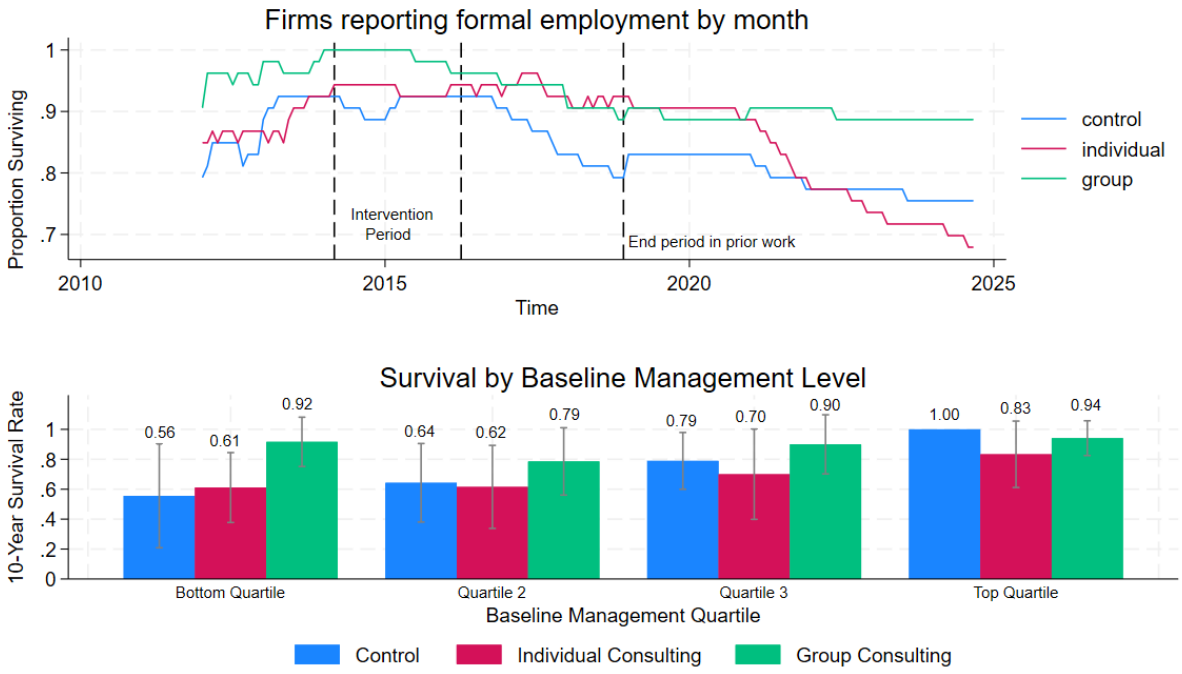
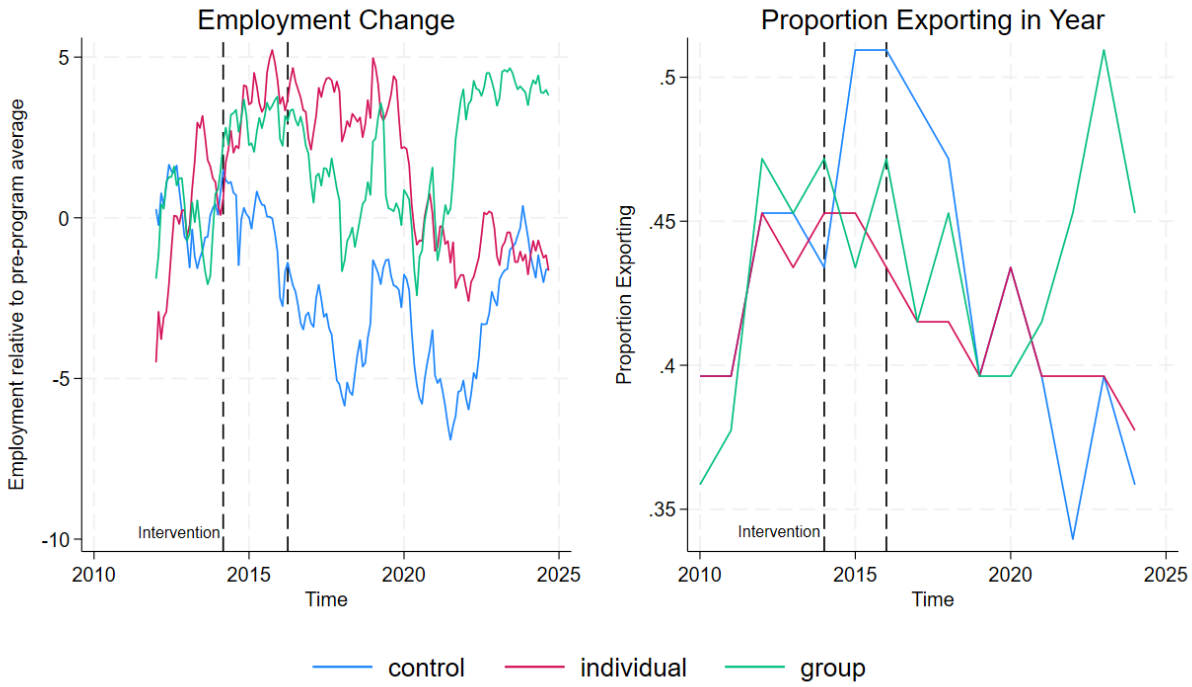
Figure 1: Group Consulting Increased Survival, Especially for Poorly Managed Firms



Notes: Top panel shows proportion of firms in each treatment group that report positive formal employment in the PILA each month from January 2012 until September 2024. Bottom panel shows proportion of firms surviving until September 2024 (approximately 10 years post-intervention) by treatment group status and quartile of baseline management score.

Figure 2: Dynamics of Employment and Exporting for Full Sample of Firms



Notes: Left panel shows monthly formal employment reported in the PILA relative to 2012-13 average by treatment status, up to September 2024. Right panel shows proportion of firms with positive direct exports reported in DIAN data by year from 2012 to 2024.

Table 1: Impact on Survival and Employment

	PILA Survival to Sept 2024	EAM Survival to 2022	PILA Employment	EAM Employment Levels	EAM Employment Logs
	(1)	(2)	(3)	(4)	(5)
Assigned to Individual Treatment	-0.075	-0.057			
	(0.086)	(0.083)			
Assigned to Group Treatment	0.132*	0.111			
	(0.073)	(0.081)			
Individual Treatment*During Intervention			-1.3	1.4	-0.001
			(3.0)	(4.4)	(0.061)
Individual Treatment* Years 2015-18			3.4	6.2	0.072
			(4.6)	(5.6)	(0.09)
Individual Treatment*Years 2019-20			2.4	5.6	0.106
			(6.6)	(7.6)	(0.119)
Individual Treatment*Years 2021-22			1.3	8.3	0.182
			(7.9)	(9.7)	(0.134)
Individual Treatment*Years 2023-24			-2.4		
			(8.8)		
Group Treatment*During Intervention			1.9	5.2	0.122
			(2.0)	(4.5)	(0.079)
Group Treatment * Years 2016-18			2.6	10.9*	0.226**
			(4.5)	(6.4)	(0.098)
Group Treatment*Years 2019-20			2.1	12.7	0.24**
			(6.3)	(7.7)	(0.117)
Group Treatment*Years 2021-22			5.9	16.7*	0.253*
			(7.6)	(9.7)	(0.14)
Group Treatment*Years 2023-24			3.9		
			(8.3)		
Sample Size	159	120	23576	1560	1420
Number of Firms	159	120	156	120	120
Control Mean in 2012			57	60	3.852
Control Mean in last period (2022 or 2024)	0.75	0.81	52	53	3.885
P-value: Individual = Group in last period	0.010	0.049	0.445	0.435	0.539
P-value: Individual Constant post-intervention			0.479	0.724	0.473
P-value: Group Constant post-intervention			0.266	0.534	0.957

Notes: column 1 is cross-sectional regression of whether firm shows up reporting formal employment in the PILA in September 2024 and controls for randomization triplet; column 2 examines survival in 2022 of firms matched to manufacturing survey EAM; column 3 is regression of monthly level of formal employment (winsorized at the 99th percentile) reported in the PILA from 2012:1 to 2024:9, with 0 for missing;
Column 4 is winsorized level of employment reported in the EAM for balanced sample with 0s for missing;
column 5 is log employment for unbalanced panel in EAM of firms with positive employees. Columns 3-5 include firm and time fixed effects, and cluster standard errors at the firm level. *, **, *** denote significance at the 10, 5, and 1 percent levels respectively.

Table 2: Impacts on Firm Sales, Profits, and Production

	Sales		Profits		Value-Added		Production		Aggregate
	Levels	Logs	Levels	Logs	Levels	Logs	Levels	Logs	Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Individual Treatment*During Intervention	-249	-0.098	-158	-0.250	-106	-0.091	-494	-0.139	-0.073
	(499)	(0.095)	(249)	(0.211)	(277)	(0.126)	(549)	(0.097)	(0.098)
Individual Treatment* Years 2015-18	314	0.047	-58	-0.193	-34	0.101	46	-0.026	0.043
	(611)	(0.107)	(257)	(0.182)	(300)	(0.147)	(637)	(0.112)	(0.122)
Individual Treatment*Years 2019-20	514	0.025	130	-0.184	108	-0.021	372	-0.031	0.088
	(1021)	(0.146)	(459)	(0.219)	(517)	(0.232)	(1040)	(0.154)	(0.202)
Individual Treatment*Years 2021-22	1643	0.255	654	0.234	684	0.305	1444	0.214	0.281
	(1488)	(0.162)	(637)	(0.227)	(730)	(0.21)	(1474)	(0.163)	(0.273)
Group Treatment*During Intervention	1088**	0.246***	674***	0.321**	683***	0.319**	1174***	0.243***	0.244***
	(443)	(0.085)	(229)	(0.144)	(249)	(0.136)	(449)	(0.087)	(0.087)
Group Treatment * Years 2016-18	1582**	0.267***	646**	0.181	739**	0.353***	1587**	0.252***	0.29**
	(662)	(0.098)	(282)	(0.144)	(317)	(0.135)	(665)	(0.098)	(0.122)
Group Treatment*Years 2019-20	1944**	0.243*	677	0.129	849*	0.159	2134**	0.26*	0.354**
	(953)	(0.14)	(436)	(0.186)	(480)	(0.184)	(956)	(0.144)	(0.18)
Group Treatment*Years 2021-22	2866**	0.245	1127*	0.017	1377*	0.175	3143**	0.272	0.56**
	(1413)	(0.173)	(636)	(0.246)	(714)	(0.21)	(1427)	(0.177)	(0.265)
Sample Size	1560	1420	1560	1360	1560	1420	1560	1420	1560
Number of firms	120	120	120	120	120	120	120	120	120
Control mean 2012	5204	22.010	2390	21.099	2894	21.353	5325	22.016	-0.008
Control mean 2022	5588	22.126	2355	21.116	2914	21.469	5443	22.054	0.021
P-value: Individual = Group in 2021-22	0.482	0.945	0.490	0.382	0.380	0.527	0.331	0.708	0.374
P-value: Individual Constant post-intervention	0.235	0.212	0.249	0.056	0.268	0.168	0.265	0.138	0.255
P-value: Group Constant post-intervention	0.367	0.968	0.37	0.721	0.337	0.518	0.279	0.988	0.260

Notes: regressions include firm and time fixed effects, with standard errors clustered at the firm level in parentheses.

*, **, *** denotes significance at the 10, 5, and 1 percent levels respectively.

Data are from the Colombian annual manufacturing survey (EAM). 2010 - 2022

Outcomes are measured in millions of real Colombian pesos, with level outcomes winsorized at the 95th percentile.

Table 3: Impact on Exports, Innovation, and Management

	Exports in year (DIAN)	Export Value (DIAN)	Exports in year (EAM)	Export Value (EAM)	New product innovation	Management
	(1)	(2)	(3)	(4)	(5)	(6)
Individual Treatment*During Intervention	0.000	10	-0.038	-82	-0.244**	
	(0.050)	(48)	(0.055)	(104)	(0.119)	
Individual Treatment* Years 2015-18	-0.066	31	0.015	67	-0.204**	
	(0.058)	(60)	(0.08)	(103)	(0.091)	
Individual Treatment*Years 2019-20	0.000	61	0.006	53	-0.359***	
	(0.076)	(83)	(0.114)	(156)	(0.122)	
Individual Treatment*Years 2021-22	0.028	40	-0.008	-33		
	(0.083)	(91)	(0.115)	(152)		
Individual Treatment*Years 2023-24	0.009	35				
	(0.095)	(99)				
Individual Treatment*2018 or 2020						0.007
						(0.034)
Group Treatment*During Intervention	-0.080	30	0.096	15	-0.073	
	(0.059)	(36)	(0.061)	(84)	(0.077)	
Group Treatment * Years 2016-18	-0.042	13	0.104	29	-0.032	
	(0.057)	(51)	(0.069)	(85)	(0.083)	
Group Treatment*Years 2019-20	-0.019	66	0.129	204	-0.145	
	(0.069)	(65)	(0.1)	(141)	(0.1)	
Group Treatment*Years 2021-22	0.066	103	0.235**	93		
	(0.072)	(75)	(0.097)	(129)		
Group Treatment*Years 2023-24	0.104	132*				
	(0.088)	(79)				
Group Treatment*2018 or 2020						0.059**
						(0.03)
Sample Size	2385	2385	1560	1560	531	210
Number of firms	159	159	120	120	114	111
Control mean 2012	0.45	133.5	0.558	334	0.077	
Control mean last period (2020, 2022, or 2024)	0.36	73.7	0.395	342	0.212	0.360
Last period year	2024	2024	2022	2022	2020	2020
P-value: individual = group in last period	0.237	0.351	0.018	0.456		0.140
P-value: individual effect constant post-treatment	0.601	0.889	0.967	0.527	0.120	
P-value: group effect constant post-treatment	0.098	0.117	0.167	0.293	0.300	

Notes: columns 1 and 2 are annual export data from DIAN from 2010-2024; columns 3 and 4 are annual exports reported by firms in the annual manufacturing survey (EAM) from 2010-22; columns 5 and 6 are product innovation measured in the binannual EDIT survey from 2012-2020; column 7 is management practices which is an index based on 16 questions asked in 2018 and 2020 EDIT surveys. Columns 1-6 include firm and year fixed effects; column 7 is only measured post-treatment and so includes a year fixed effect. Standard errors clustered at the firm level in parentheses. *, **, *** denote significance at the 10, 5, and 1 percent levels respectively.

Online Appendices

A. Timeline

Pre-treatment

April 12, 2012: Program officially launched and firms invited to apply

June 25, 2012: Deadline for firms to apply to the program

June 11, 2013: Diagnostic phase starts

October 30, 2013: Diagnostic phase ends

November 2013: Random assignment to treatment status

During treatment

March-November 2014: Individual Consulting Intervention

September 2015-April 2016: Group Consulting Intervention

Post-treatment

2015-2018 (individual) and 2016-2018 (group): time period used for previous study (Iacovone et al, 2022)

2015-September 2024: post-treatment availability of formal labor data in PILA database

2015-2022: post-treatment availability of firm performance data in EAM survey

2015-2024: post-treatment availability of direct export data in DIAN database

2018, 2020: MOPS management practices collected in EDIT survey

B. Definitions of Key Outcome Variables

Table 1 Outcomes

Survival to September 2024 in the PILA: A binary variable which takes value 1 if the firm files health and retirement contributions for its workers in September 2024 in the PILA (Unified Register of Contributions), and 0 otherwise.

Survival to 2022 in the EAM: A binary variable which takes value 1 if the firm is found in the manufacturing survey (EAM) in 2022, and 0 otherwise. Restricted to the 120 firms that are ever matched to the EAM. Non-matched firms include those that were smaller, ones that trade rather than manufacture auto parts, as well as some multi-activity firms.

PILA Employment: A monthly panel variable that runs from January 2012 to September 2024, defined as the number of formal employees that the firm reported on in the PILA in the given month. This is winsorized at the 99th percentile, and is defined as 0 in months where the firm is closed or does not report. Restricted to the 156 firms that were ever found in the PILA.

EAM Employment: An annual panel variable that runs from 2010 through to 2022, and is total number of employees the firm reports in the manufacturing survey (EAM). This is restricted to the 120 firms ever matched to the EAM. *Levels* of employment replace missing values with 0 for years where the firm does not appear in the EAM, and winsorizes at the 99th percentile. *Log* employment is conditional on reporting positive employees in a given year, and is missing for closed firms.

Table 2 Outcomes

These firm performance outcomes all come from annual data for 120 firms matched to the manufacturing survey (EAM). *Levels* replace missing values with 0 and winsorize outcomes at the 95th percentile; *Logs* condition on appearing in the EAM with a positive value for the outcome. Outcomes are measured in millions of real 2017 Colombian pesos, using the Colombian Manufacturing Producers Price Index to convert nominal to real pesos.

Sales: Annual sales

Profits: Value-added less wage costs

Value-added: Total value-added. The Colombian statistics agency DANE calculates this as the difference between the value of gross production and the amount spent on consumption of intermediate inputs.

Production: Value of annual production

Aggregate Index: The average of standardized z-scores of total sales, annual profits, value-added and production. For each variable, a z-score is calculated by subtracting the control mean from 2012 and dividing by the control standard deviation from 2012.

Table 3 Outcomes

Exports in year (DIAN): a binary value which takes value 1 if the firm is found to be directly exporting in the year according to the DIAN customs data, and 0 otherwise, available for the years 2010-24.

Export Value (DIAN): annual exports in thousands of USD according to the DIAN customs database, for the years 2010-24. Coded as 0 for years the firm does not directly export. Winsorized at the 99th percentile.

Exports in year (EAM): a binary value which takes value 1 if the firm reports exporting in the year in the EAM, and 0 otherwise. This covers both direct and indirect exporting. Available for the years 2010-2022.

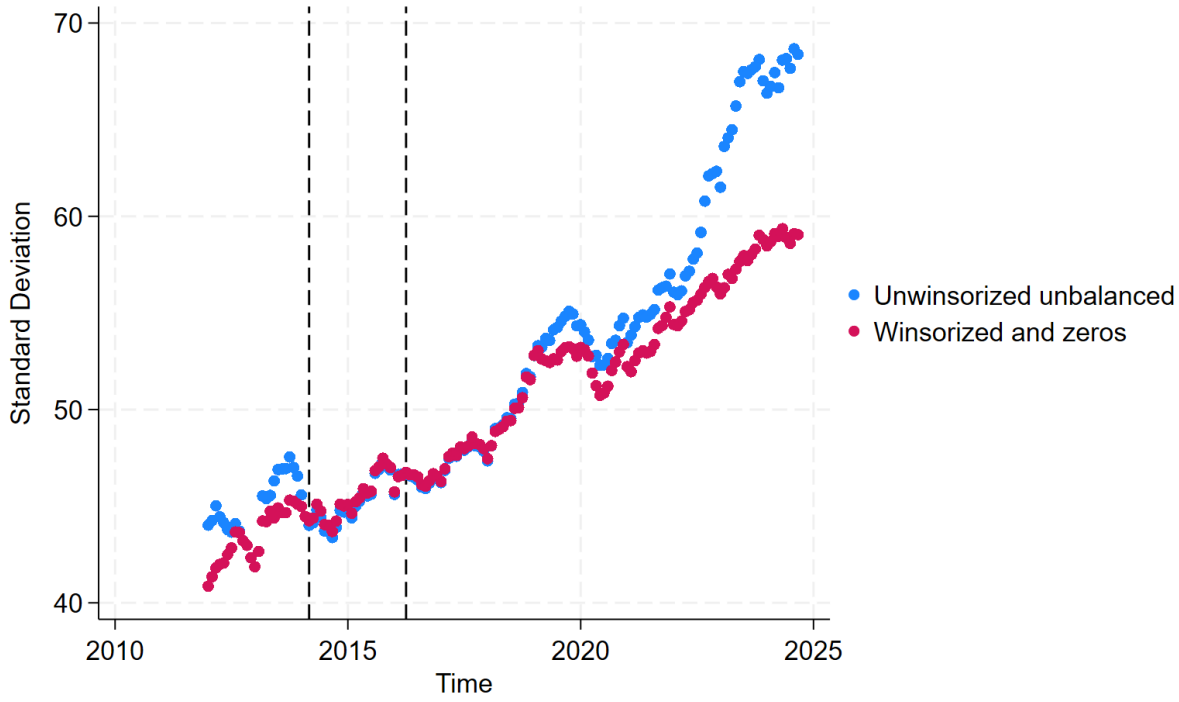
Export value (EAM): value of annual exports in thousands of USD according to the EAM, coded as 0 for firms not exporting. Winsorized at the 95th percentile.

New product innovation: a binary variable coded as 1 if the firm reports introducing a new product in the past year, and 0 otherwise. Available biannually for the 114 firms matched to the EDIT survey, from 2012-2020.

Management: the proportion of 16 management practices that the firm reports doing in the 2018 and 2020 EDIT surveys. Measure is conditional on appearing in the survey.

C. Appendix Figure and Tables

Figure A1: The Standard Deviation of Employment Increases over Time



Notes: Figure plots the cross-sectional standard deviation of the number of formal employees reported by firms in the PILA, month-by-month from January 2012 through to September 2024. Unwinsorized unbalanced series conditions on appearing in the PILA. Winsorized and zeros codes employment as zero in months in which the firm does not appear, and winsorizes employment at the 99th percentile.

Table A1: Which firms Survive to September 2024 in PILA?

	Full Sample			Control Group			Individual Treatment Group			Group Treatment Group		
	Survive	Die	p-value	Survive	Die	p-value	Survive	Die	p-value	Survive	Die	p-value
Number of Employees	60.6	54.4	0.540	62.9	65.7	0.888	68.5	45.8	0.189	52.7	54.5	0.910
Small	0.561	0.694	0.154	0.575	0.692	0.462	0.5	0.765	0.070	0.596	0.5	0.661
Medium	0.439	0.306	0.154	0.425	0.308	0.462	0.5	0.235	0.070	0.404	0.5	0.661
Cundinamarca	0.472	0.5	0.765	0.55	0.538	0.943	0.444	0.588	0.338	0.426	0.167	0.230
Valle	0.171	0.139	0.652	0.175	0.154	0.863	0.111	0.0588	0.552	0.213	0.333	0.516
Labor Productivity	32	26.6	0.117	28	21.1	0.044	32.3	31.2	0.850	35.2	25.2	0.317
Financing	51.3	47.8	0.181	52.6	45.7	0.109	48.1	46.5	0.681	52.6	56	0.583
Human Resources	43	40.9	0.355	43.3	39.6	0.376	42	41.8	0.954	43.6	41.2	0.627
Logistics	47.5	41.1	0.007	49.7	45.1	0.223	45.3	37.5	0.037	47.4	42.6	0.401
Marketing	47.3	39.5	0.005	50.3	37.7	0.004	44.6	40.5	0.346	46.7	40.5	0.349
Production	47.8	42.2	0.018	48.2	42.1	0.075	49.2	40.9	0.051	46.4	45.9	0.928
Level 2 Supplier	0.951	0.889	0.178	0.975	0.846	0.084	0.944	0.941	0.963	0.936	0.833	0.379
Metal Products	0.61	0.556	0.563	0.8	0.615	0.186	0.472	0.588	0.440	0.553	0.333	0.319
Plastic Products	0.146	0.278	0.069	0.1	0.308	0.072	0.167	0.176	0.931	0.17	0.5	0.063
Firm Age	24.6	22.1	0.365	28.1	24.3	0.430	23.8	21.5	0.638	22.3	19.2	0.561
Anexo K Management Score	47.4	42.3	0.008	48.8	42	0.034	45.9	41.4	0.151	47.3	45.2	0.641
USD Sales	2620375	1279434	0.020	2004587	1220905	0.164	3487532	1482642	0.101	2502832	810279	0.176
Export at all	0.463	0.389	0.432	0.4	0.692	0.069	0.472	0.294	0.227	0.511	0	0.018
Sample Size	123	36		40	13		36	17		47	6	

Notes: Columns compare means of baseline variables for firms that survive to report formal employment in the PILA in September 2024 versus those that do not.

Table A2: Heterogeneity in Survival with Baseline Management Score

	Survives until September 2024		
	(1)	(2)	(3)
Assigned to Individual Treatment	-0.075	-0.094	-0.048
	(0.086)	(0.111)	(0.088)
Assigned to Group Treatment	0.132*	0.059	0.142*
	(0.073)	(0.082)	(0.075)
Individual Treatment*Below Median Management		0.098	
		(0.176)	
Group Treatment*Below Median Management		0.178	
		(0.150)	
Below Median Management at Baseline		-0.258**	
		(0.122)	
Individual Treatment*Demeaned Baseline Management Score			-0.003
			(0.008)
Group Treatment*Demeaned Baseline Management Score			-0.010*
			(0.006)
Baseline Management Score			0.013***
			(0.005)
Sample Size	159	159	159
Survival Rate in Control Group	0.75	0.75	0.75

Notes: Survival defined as reporting formal employees in the PILA in September 2024. Robust standard errors in parentheses, *, **, *** denotes significance at the 10, 5, and 1 percent levels.

Table A3: Baseline Characteristics for Firms Surviving in PILA until September 2024

	All Firms		Means by treatment group			p-value for testing equality		
	Mean	SD	Control	Individual	Group	C vs I	C vs G	All 3 equal
Number of Employees	61	48	63	68	53	0.612	0.113	0.131
Small	0.56	0.5	0.57	0.50	0.60	n.a.	n.a.	n.a.
Medium	0.44	0.5	0.42	0.50	0.40	n.a.	n.a.	n.a.
Cundinamarca	0.47	0.5	0.55	0.44	0.43	0.391	0.285	0.541
Valle	0.17	0.38	0.17	0.11	0.21	0.678	0.672	0.696
Labor Productivity	32	20	28	32	35	0.260	0.057	0.159
Financing	51	14	53	48	53	0.385	0.788	0.486
Human Resources	43	11	43	42	44	0.532	0.720	0.572
Logistics	48	12	50	45	47	0.089	0.314	0.218
Marketing	47	15	50	45	47	0.033	0.222	0.102
Production	48	12	48	49	46	0.942	0.562	0.813
Level 2 Supplier	0.95	0.22	0.97	0.94	0.94	0.658	0.353	0.647
Metal Products	0.61	0.49	0.80	0.47	0.55	0.018	0.005	0.008
Plastic Products	0.15	0.35	0.10	0.17	0.17	0.367	0.319	0.515
Firm Age	25	13	28	24	22	0.253	0.283	0.42
Anexo K Management Score	47	10	49	46	47	0.151	0.518	0.354
USD Sales in 2013	2620375	3128409	2004587	3487532	2502832	0.029	0.160	0.045
Export at all 2013	0.46	0.5	0.4	0.47	0.51	0.852	0.252	0.483
Sample Size	123		40	36	47			
Omnibus test p-value						0.391	0.790	

Table A4: Impact on Components of Employment in the Manufacturing Survey

	Total Employment	Permanent Workers	Temporary Direct	Temporary Contracted	Apprentices & Interns
	(1)	(2)	(3)	(4)	(5)
Individual Treatment*During Intervention	1.4	6.4	-2.9	-4.0	-0.2
	(4.4)	(4.8)	(2.3)	(2.6)	(0.2)
Individual Treatment* Years 2015-18	6.2	4.8	-0.8	-1.5	0.2
	(5.6)	(5.7)	(3.3)	(3.1)	(0.2)
Individual Treatment*Years 2019-20	5.6	5.2	-1.9	0.1	0.1
	(7.6)	(6.5)	(4.3)	(4.0)	(0.4)
Individual Treatment*Years 2021-22	8.3	3.6	-0.3	1.4	0.5
	(9.7)	(7.9)	(5.1)	(3.9)	(0.4)
Group Treatment*During Intervention	5.2	0.2	2.0	3.5*	-0.1
	(4.5)	(3.9)	(2.7)	(2.1)	(0.3)
Group Treatment * Years 2016-18	10.9*	4.6	-0.4	4.2*	0.7**
	(6.4)	(5.2)	(3.2)	(2.4)	(0.3)
Group Treatment*Years 2019-20	12.7	8.8	-3.3	5.5*	0.5
	(7.7)	(5.8)	(4.1)	(3.0)	(0.3)
Group Treatment*Years 2021-22	16.7*	10.7	-3.0	6.7**	0.7*
	(9.7)	(7.4)	(4.9)	(3.0)	(0.4)
Sample Size	1560	1560	1560	1560	1560
Number of Firms	120	120	120	120	120
Control Mean in 2012	60	33	15	10	2
Control Mean in last period (2022 or 2024)	53	29	17	3	1
P-value: Individual = Group in last period	0.435	0.406	0.603	0.162	0.682
P-value: Individual Constant post-intervention	0.724	0.781	0.53	0.303	0.494
P-value: Group Constant post-intervention	0.534	0.325	0.391	0.256	0.644

Notes: sample restricted to the 120 firms matched to the manufacturing survey (EAM). Regressions show winsorized levels of employment for the balanced sample in which closed firms are coded as having 0 employees. Column 1 is total workers reported in the survey. Column 2 is total permanent employees reported.
Column 3 is total temporary workers hired directly by the firm. Column 4 is total temporary workers hired through specialized agencies (contract workers). Column 5 is apprentices and interns.
All regressions include firm and time fixed effects, and cluster standard errors at the firm level. *, **, *** denote significance at the 10, 5, and 1 percent levels respectively.

Table A5: Robustness to using Unbalanced and Balanced Panels

	Sales		Profits		Value-Added		Production		Aggregate Index	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Individual Treatment*During Intervention	54	327	-9	47	146	212	-221	208	-0.015	0.032
	(435)	(505)	(236)	(248)	(264)	(283)	(518)	(534)	(0.085)	(0.09)
Individual Treatment* Years 2015-18	727	1246*	68	177	119	220	438	984	0.114	0.208
	(627)	(640)	(255)	(260)	(280)	(289)	(668)	(652)	(0.125)	(0.129)
Individual Treatment*Years 2019-20	891	1863*	408	570	440	636	1188	1902*	0.139	0.307
	(1089)	(1086)	(499)	(501)	(558)	(553)	(1103)	(1085)	(0.208)	(0.203)
Individual Treatment*Years 2021-22	2751*	3707**	1192*	1363*	1329*	1508*	2912*	3523**	0.455	0.618**
	(1601)	(1726)	(683)	(717)	(756)	(797)	(1521)	(1607)	(0.277)	(0.295)
Group Treatment*During Intervention	1123**	1180**	714***	706***	702***	680***	1258***	1299***	0.248***	0.251***
	(465)	(497)	(243)	(252)	(260)	(261)	(473)	(498)	(0.093)	(0.097)
Group Treatment * Years 2016-18	1681**	1797**	656**	663**	770**	751**	1755**	1810**	0.297**	0.312**
	(694)	(743)	(315)	(335)	(333)	(354)	(704)	(750)	(0.13)	(0.139)
Group Treatment*Years 2019-20	1919*	1981*	642	525	817	686	2261**	2168*	0.347*	0.335
	(1020)	(1096)	(492)	(515)	(537)	(559)	(1048)	(1116)	(0.192)	(0.206)
Group Treatment*Years 2021-22	2759*	3216*	958	1027	1192	1266	2949*	3284**	0.534*	0.607*
	(1542)	(1688)	(701)	(755)	(766)	(826)	(1534)	(1664)	(0.285)	(0.312)
Balanced Panel	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Sample Size	1451	1222	1420	1214	1420	1214	1420	1214	1451	1222
Number of firms	120	94	120	94	120	94	120	94	120	94
Control mean 2012	5221	5801	2406	2698	2895	3202	5343	5948	-0.007	0.110
Control mean 2022	6525	6505	2917	2920	3593	3612	6727	6711	0.192	0.191
P-value: Individual = Group in 2021-22	0.996	0.811	0.756	0.679	0.870	0.790	0.984	0.905	0.808	0.974
P-value: Individual Constant post-intervention	0.141	0.112	0.133	0.132	0.126	0.134	0.092	0.110	0.135	0.095
P-value: Group Constant post-intervention	0.557	0.315	0.665	0.335	0.631	0.331	0.537	0.369	0.429	0.204

Notes: regressions include firm and time fixed effects, with standard errors clustered at the firm level in parentheses.

This examines robustness to the method of dealing with closed firms by using the unbalanced panel that conditions on survival in odd columns, and the balanced panel of firms present in all periods in even columns. *, **, *** denotes significance at the 10, 5, and 1 percent levels respectively.

Outcomes are measured in millions of real Colombian pesos, with level outcomes winsorized at the 95th percentile.

Table A6: Pooled Impacts over all post-treatment years (2015/16-2022)

	Sales		Profits		Value-Added		Production		Aggregate
	Levels	Logs	Levels	Logs	Levels	Logs	Levels	Logs	Index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Individual Treatment*During Intervention	-249	-0.099	-158	-0,251	-106	-0.091	-494	-0.14	-0.073
	(498)	(0.094)	(249)	(0,211)	(276)	(0.126)	(548)	(0.097)	(0.098)
Individual Treatment*Post Intervention	696	0.086	167	-0,103	181	0.114	477	0.024	0.114
	(878)	(0.111)	(357)	(0,176)	(415)	(0.148)	(889)	(0.116)	(0.169)
Group Treatment*During Intervention	1265**	0.263***	778***	0,361**	783***	0.325**	1374***	0.264***	0.277***
	(510)	(0.086)	(250)	(0,145)	(275)	(0.132)	(505)	(0.088)	(0.098)
Group Treatment*Post Intervention	2027**	0.25**	777**	0,112	939**	0.248*	2159**	0.255**	0.381**
	(905)	(0.115)	(385)	(0,16)	(433)	(0.14)	(908)	(0.117)	(0.167)
Sample Size	1560	1420	1560	1360	1560	1420	1560	1420	1560
Number of firms	120	120	120	120	120	120	120	120	120
P-value: Individual = Group During	0.006	0.007	0.006	0.020	0.011	0.039	0.001	0.004	0.003
P-value: Individual = Group Post	0.225	0.171	0.151	0.242	0.116	0.412	0.129	0.069	0.185
Control mean 2012	5204	22.010	2390	21.099	2894	21.353	5325	22.016	-0.008
Control mean 2022	5588	22.126	2355	21.116	2914	21.469	5443	22.054	0.021

Notes: regressions include firm and time fixed effects, with standard errors clustered at the firm level in parentheses.

*, **, *** denotes significance at the 10, 5, and 1 percent levels respectively.

Data are from the Colombian annual manufacturing survey (EAM). 2010 - 2022

Outcomes are measured in millions of real Colombian pesos, with level outcomes winsorized at the 95th percentile.