

Antitrust Enforcement and Firm Performance: Evidence from Colombia's Sugar Market^{*†}

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Abstract

This paper examines the impact of two interventions by Colombia's competition authority (SIC) to enforce competition in the sugar market on firm performance in downstream sectors. Using an exogenous identification strategy, we find that following SIC intervention against collusion in 2015, downstream firms expanded production but did not increase productivity or price-cost margins, consistent with the removal of supply constraints imposed by cartelization. In contrast, the 2011 intervention against abuse of dominance increased price-cost margins of the downstream firms, without altering production scale or labor intensity, consistent with input price reductions and stable consumer demand. Robustness checks, including propensity score matching, confirm the reliability of these findings. Our results show that antitrust enforcement works through different channels, depending on the type of anti-competitive behavior. They also highlight the importance of targeted and continuous antitrust enforcement in addressing market distortions.

Key words: antitrust enforcement, competition

JEL codes: C91; C9

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1 Introduction

This paper looks at the effects of antitrust enforcement on firm- and industry-level performance, emphasizing production, employment and profitability effects. Research on competition policy has been traditionally focused on price effects and consumer welfare [Gutierrez and Philippon, 2022, Cavenaile et al., 2021], with studies of productivity much less common. Studies that do take into account firm-level performance responses concentrated on competitive pressures stemming from international trade liberalization [Edmond et al., 2015, Mayer et al., 2021, Eslava et al., 2004, 2013, Bloom et al., 2015, Cusolito et al., 2023]. Fewer empirical studies explore the firm-level effects of domestic competition policy and antitrust enforcement, particularly in developing countries [Vostroknutova et al., 2025]. This paper relates to this literature [Eeckhout, 2021, De Loecker et al., 2020, Backus, 2019], and goes further than existing empirical studies [Babina et al., 2023, Reed et al., 2022] by eliciting the mechanism of impact of antitrust enforcement on firm performance.

Since the seminal study by Posner [1970], only a few papers directly link competition policy and firm-level outcomes; for example Kang [2025] studies the effect of cartel enforcement on innovation investments of ICT firms in the US. The recent advances in the understanding of the impacts of various shocks on heterogeneous firms following Aghion et al. [2005] are yet to be applied to competition policy and its effects on firm-level outcomes.

This paper analyzes two major interventions by Colombia's Competition Authority, the Superintendencia de Industria y Comercio (SIC), in the sugar market. The SIC serves as Colombia's principal competition authority, operating with full administrative, financial, and budgetary autonomy as established under Law 1340 of 2009. The SIC holds jurisdiction over all sectors of the economy, including those overseen by specialized regulatory agencies. The initiation of investigations is consistently based on market evidence and observable conditions rather than political influence, sector-specific lobbying, or other ex-

ternal pressures. This institutional independence is further safeguarded through periodic external audits, rigorous legal oversight, and accountability mechanisms enforced by public supervisory bodies, thereby strengthening the credibility and impartiality of its enforcement actions.

To uncover the mechanisms through which antitrust enforcement affects downstream firm outcomes, we therefore are able to exploit exogenous variation stemming from SIC's responses to externally triggered investigations: one targeting collusive behavior (2015 case) and the other addressing abuse of dominance (2011 case). These cases provide a unique setting to examine the short- and medium-term impacts of antitrust enforcement on firm performance and market structure. The 2011 case involved abuse of dominance by a major firm that established minimum pricing agreements with sugarcane farmers, for the sugar intended for ethanol and alcohol production. This arrangement led to a nearly 40 percent surge in ethanol prices, despite stable levels of production. The 2015 case involved collusion among sugar producers who restricted supply and obstructed sugar imports, leading to price fluctuations and a nearly 20 percent decline in production. Both SIC's investigations were prompted by complaints from market participants who observed these price distortions and became aware of market manipulation. In 2015 case, these included downstream industries such as cocoa, chocolate, confectionery, food manufacturing, and dairy products. In both 2011 and 2015 case, the evidence of market and price distortions supports the exogeneity assumption, discussed in section 4.

We are able to identify and compare the channels through which antitrust enforcement influences firm performance. For example, when we observe an increase in value-added we can also determine if it is driven by expansion in production capacity or by improved profitability under more competitive market conditions. Our analysis thus sheds light not only on the effectiveness of antitrust enforcement, but also on the heterogeneous nature of its impact depending on the underlying type of market distortion.

We cannot identify the firms involved in the case in our sample and define the treatment

group as firms in industries affected by these interventions. For the 2011 abuse of dominance case, the treatment group includes firms operating in chemicals, chemical products, and alcoholic beverages, sectors impacted by ethanol and alcohol price distortions. For the 2015 collusion case, the treatment group includes firms operating in industries that use processed sugar, including cocoa, chocolate, confectionery, and dairy products.

Our results reveal that antitrust interventions by the Superintendencia de Industria y Comercio (SIC) had significant and heterogeneous effects on downstream firm performance, depending on the nature of the anti-competitive conduct that was enforced. In the 2015 collusion case, firms in affected sectors expanded production capacity—reflected in higher employment and increased use of intermediate inputs—yet did not exhibit improvements in productivity. This pattern is consistent with the easing of supply constraints previously imposed by the sugar cartel. By contrast, the 2011 abuse of dominance case was associated with increased value-added, primarily driven by higher price-cost margins: firms maintained stable output and input levels but absorbed cost increases more profitably, suggesting enhanced market discipline and improved allocation of rents.

To ensure the robustness of these findings, we employ several strategies. We define the control group based on sectoral divisions, apply propensity score matching (PSM) to account for selection biases, and test the results using alternative model specifications and different sample compositions. These robustness checks confirm the reliability and consistency of our results, ruling out potential confounders and model misspecifications. These findings highlight that the impact of competition policy extends beyond correcting price distortions, with the nature of the intervention shaping firm responses: quantity adjustments or improved market efficiency.

The next section describes the empirical approach, including a detailed description of the identification strategy. Section 3 provides a description of the data. Section 4 presents the empirical strategy, and Section 5 summarizes the results. The final section concludes.

2 Empirical Approach

2.1 Market Structure

Between 2008 and 2018, the Colombian sugar market was concentrated, with production controlled by a small number of major players, 12 large sugar mills known as *ingenios*. These mills controlled the sugar market, including prices. The Colombian sugar industry has a relatively closed structure, with most of its output directed toward internal consumption. Sugar imports are minimal and do not significantly influence the market. Exports are smaller compared to the volume of sugar produced for internal consumption, further emphasizing the inward-facing nature of the market (see Figure 1). Given this structure, domestic market forces and domestic competition among the *ingenios*, rather than global supply and demand dynamics, largely dictate pricing behavior and market outcomes.

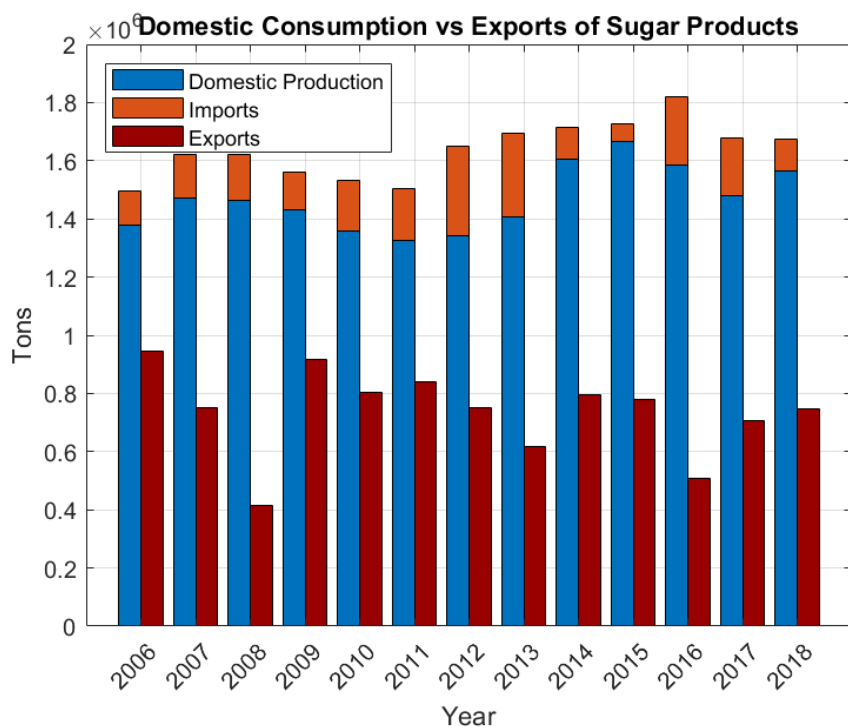


Figure 1: Sugar production composition

The sugar market is regulated by the SIC, Colombia's competition authority that op-

erates with administrative, financial, and budgetary autonomy under Law 1340 of 2009. It oversees competitive practices across all sectors, including finance and transport, despite the presence of specialized regulators. It is subject to oversight from institutions such as the Attorney General’s Office and external audits. This institutional framework underpins the agency’s independence and enforcement capacity.

2.2 Identification Strategy

In this paper, we analyze two major interventions by the Superintendencia de Industria y Comercio (SIC) in the Colombian sugar market in 2011 and 2015, which addressed anti-competitive practices involving price coordination and import restrictions. These cases offer a valuable setting to evaluate the causal effects of competition policy on firm performance, with a particular focus on value-added as a core measure of economic activity. We also examine the mechanisms at play by assessing how downstream sectors responded to restored market conditions.

The 2011 abuse of dominance case (case number 33141) involved a collective bargaining agreement between a large sugar-processing firm (one of the *ingenios*) representing more than 400 sugarcane farmers through representation agreements. This group of sugarcane producers accounted for 99.7 percent of the national sugar production. The agreement aimed to secure higher prices for sugarcane. The practice, which had been in place since at least 2008, persisted until the SIC initiated its investigation in 2010. Under the terms of the agreement, sugar-processing firms were required to pay 50 percent of the sales revenue per liter of ethanol derived from sugarcane to the farmers.¹ As a consequence, ethanol prices surged by more than 50 percent year-over-year during the second half of 2009 (see Figure 2). Importantly, sugarcane production did not decline during this period and therefore the downstream sectors reliant on sugarcane experienced a substantial price shock rather than

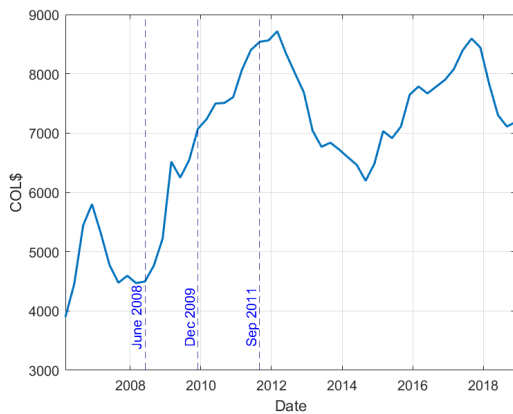
¹The large sugar-processing firm that represented farmers, itself remained unaffected as it had its own agricultural land for production.

a constrained input supply.

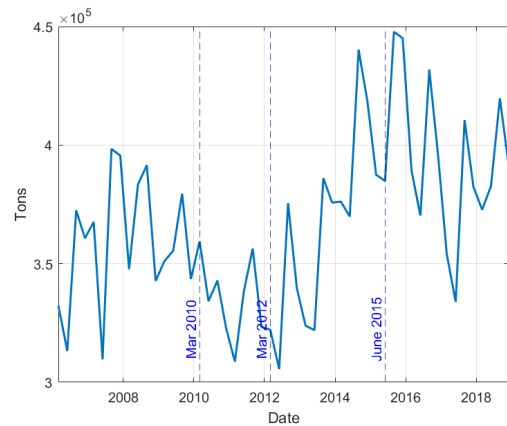
The exogeneity of the SIC's intervention is reflected in the nature of the market distortion that led to complaints from affected producers and stakeholders concerned about the collusive pricing arrangements. In response to these complaints, the agency conducted an independent investigation, ultimately imposing sanctions on the involved parties. This intervention was instrumental in addressing price coordination efforts and restoring competitive conditions in the sugar market.

The 2015 collusion case (case number 80847) involved a cartel of major sugar producers who coordinated production quotas to restrict supply and obstruct sugar imports. This cartel accounted for approximately 80 percent of the country's raw sugar production. The quotas were coordinated among 12 major producers through a third party, which facilitated the exchange of production and pricing information between them. In addition, a major logistics company associated with these 12 producers, limited imports from Bolivia and Brazil to major buyers in Cali by employing strategic selling practices. The logistics company threatened to sell sugar at dumping prices in their domestic markets (in the case of Brazil, at Peruvian and Chilean ports that are used to import sugar), should any Bolivian or Brazilian firms import sugar to Colombia. This significantly cut imports of sugar from Bolivia and Brazil between 2010 and at least until 2013, when the SIC launched its investigation.

Figure 2 illustrates a nearly 20 percent year-on-year decline in sugar production by the end of 2010. According to the SIC's findings, the contraction in sugar production lacked any external justification, creating a market distortion that negatively impacted direct consumers and downstream industries reliant on sugar inputs, including cocoa, chocolate, confectionery, food manufacturing, milling products, starches, derivatives, and dairy.



(a) Ethanol prices: related to the abuse of dominance case



(b) Sugar production: related to the collusion case

Figure 2: Price and production trends in the sugar market

Source: Fondo de Estabilización de Precios del Azúcar. Note. The three vertical lines represent the year when the behavior is assumed to have begun, the start of the SIC investigation, and the year the decision was made. Information is presented on a quarterly basis.

2.3 Identification of the Treatment Group

In the previous section, we examined the nature of the SIC’s interventions and their potential impact on market dynamics. It is equally important to consider that firms under investigation may adjust their behavior in anticipation of regulatory actions. Such preemptive changes in firm conduct could introduce biases that can affect the analysis of the intervention’s outcomes. Once firms are notified of an ongoing investigation, they may alter pricing strategies, adjust production levels, or modify market conduct; this change in behavior is not necessarily a direct response to the intervention itself, but a strategic reaction to the prospect of enforcement. These endogenous adjustments can complicate the identification of the true causal impact of the SIC’s actions.

This potential bias stemming from firms’ anticipatory responses is a key concern in empirical research evaluating competition policy effectiveness. To mitigate this limitation,

we analyze how other sectors that use sugar as an input responded to the SIC's interventions. The underlying assumption is that for firms in these downstream industries, the SIC's interventions in the sugar market were exogenous: first, because these firms did not know the outcome of the investigation in advance, and, second, because they had no means to influence or modify the regulatory decision. Thus, their responses reflect broader market effects rather than direct reactions to the investigation itself.

In defining the treatment group, we align sector selection with the specific implications of each case by using input-output matrices. For the 2011 abuse of dominance case, we focus on firms in the manufacturing of chemicals and chemical products, as well as the production of alcoholic beverages, since the SIC's investigation explicitly identified these sectors as being affected by price distortions in ethanol and sugar allocated to alcohol production. Meanwhile, for the 2015 collusion case, we concentrate on firms using raw sugar as an input, particularly those in the cocoa, chocolate, and confectionery products sector, as well as other food products, milling products, starches and derivatives, and dairy products, which were all impacted by distortions in the production of manufactured sugar.

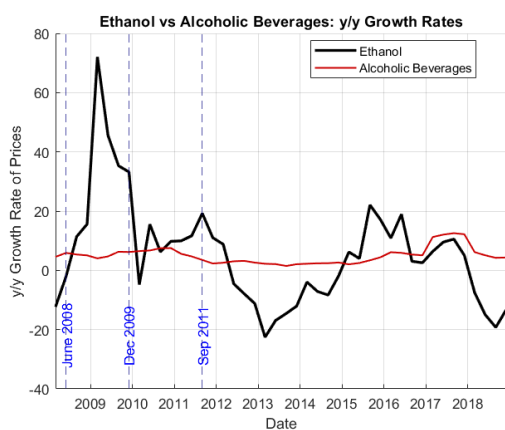
A key consideration in our analysis is that the treatment groups for the two cases consist of different sets of firms. This distinction is important, as it introduces the possibility of biases in our results, particularly if the firms affected by the abuse of dominance case systematically differ from those impacted by the collusion case in ways that also influence their responsiveness to market interventions.

2.4 Price Pass-Through to Downstream Sectors

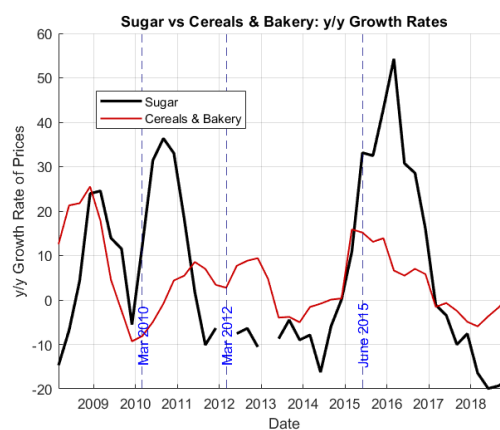
Despite the high concentration in the sugar market, the pass-through of input price changes to downstream sectors appears limited. For instance, the correlation between ethanol prices and that of alcoholic beverages, where ethanol is a key input, is just 0.23 using quarterly data. Similarly, sugar prices show only a modest correlation of 0.35 with prices in bakery and dairy products, both significant consumers of sugar. These facts suggest that price

fluctuations in the sugar market do not fully translate into downstream price changes (see Figure 3).

Understanding this limited pass-through is crucial for interpreting the estimated effects of the SIC interventions on downstream firms. If firms are not passing on input cost changes to consumers, then observed responses such as changes in value-added are less likely to reflect simple cost-shifting behavior. Instead, they may reveal deeper adjustments in production efficiency, market strategy, or input sourcing. Several factors may explain the muted pass-through: first, demand in downstream sectors may be relatively elastic, encouraging firms to absorb input cost changes to remain competitive. Second, the cost share of sugar or ethanol in total production is relatively low (less than 10 percent according to input-output tables), reducing the impact of these price changes on final prices. Third, higher markups may provide firms with enough pricing power to cushion cost increases without fully passing the increase to consumers.



(a) Ethanol and alcoholic prices: related to the abuse of dominance case



(b) Sugar and cereals & bakery prices: related to the collusion case

Figure 3: Prices pass-through in the sugar market

Source: Fondo de Estabilización de Precios del Azúcar, and Colombia Central Bank. Note. The three vertical lines represent the year when the behavior is assumed to have begun, the start of the SIC investigation, and the year the decision was made. Information is presented on a quarterly basis.

Thus, weak pass-through does not indicate a lack of market discipline in downstream sectors. Rather, it highlights their ability to manage cost shocks through internal adjustments, an important mechanism to consider when evaluating the broader effects of antitrust enforcement in upstream markets.

3 Data

3.1 The Annual Manufacturing Survey

The firm-level data are sourced from the Annual Manufacturing Survey conducted by the National Administrative Department of Statistics (DANE). This census covers all manufacturing establishments employing 10 or more persons across all states, enabling the construction of a firm panel for the 2007–2018 period. The survey is representative of manufacturing activity across states and sectoral divisions under the ISIC Rev. 4 classification, providing a comprehensive view of the sector.

The dataset used for this paper comprises 40,886 firms, among which we have 2,133 treated firms for the collusion analysis (2010–2018) and 3,366 treated for the abuse of dominance analysis (2007–2016). The identification of treated firms follows the sectoral exposure detailed in the SIC’s investigations, which affected distinct groups across the two cases. Given that the intervention specifically targeted distortions in ethanol and sugar prices allocated to alcohol production, treated firms in the 2011 abuse of dominance case are from the manufacturing of chemicals and chemical products and alcoholic beverages sectors. For the 2015 collusion case, treated firms are those in sectors primarily consuming raw sugar, including cocoa, chocolate, and confectionery products; other food products n.e.c.; milling products, starches, and derivatives; and dairy products. Control firms, in both cases, consist of firms from other manufacturing sectors. We exclude from the control group any firms that were classified as treated in either exercise, ensuring a clear separation between treated and control units across analyses.

A key consideration is that the treated groups for the two cases consist of different sets of firms. This distinction is crucial, as it introduces potential biases in our estimates, given that firms affected by the abuse of dominance case may differ systematically from those impacted by the collusion case in ways that could also shape their responses to antitrust interventions.

To ensure comparability across years, all monetary values are deflated using the manufacturing GDP index. Firms included in the analysis were required to be observed for at least three years during the evaluation period, ensuring sufficient observations for reliable panel estimations. Lastly, there is observed variability in measures such as sales and capital stock, particularly for treated firms, which may reflect both the effects of competition interventions and the inherent volatility of industry leaders.

Table 1: Firm statistics

	Full sample		Control group		Treated group	
	Average	Std. Deviation	Average	Std. Deviation	Average	Std. Deviation
	Collusion (2010-18)					
Number of firms	40,886		38,753		2,133	
ln Sales	14.87	1.57	14.86	1.56	15.00	1.70
ln Valued-added (VA)	14.07	1.56	14.06	1.55	14.16	1.71
ln Stock of Capital	13.76	1.94	13.76	1.93	13.76	2.06
ln Employment	3.52	1.19	3.52	1.19	3.57	1.16
ln VA per worker	10.54	0.77	10.54	0.76	10.59	0.85
ln PCM	-1.25	0.70	-1.25	0.70	-1.27	0.70
	Abuse of dominance (2007-16)					
Number of firms	45,090		41,724		3,366	
ln Sales	14.85	1.58	14.88	1.58	14.56	1.53
ln Valued-added (VA)	14.05	1.58	14.07	1.57	13.79	1.63
ln Stock of Capital	13.68	1.94	13.72	1.95	13.24	1.76
ln Employment	3.49	1.20	3.50	1.20	3.32	1.17
ln VA per worker	10.56	0.80	10.57	0.80	10.47	0.80
ln PCM	-1.23	0.70	-1.23	0.70	-1.21	0.70

The treated group includes sectors more exposed to sugar. The control group consists of firms in other markets. For abuse of dominance case, the sectors include: Manufacture of chemicals and chemical products and Beverages (2011, 2012, 2021, 2022, 2023, 1101, 1102, 1103, 1104). For collusion case, the sectors include: cocoa, chocolate, and confectionery products, other food products n.e.c.; milling products, starches, and derivatives; and dairy products (1082, 1089, 1081, 1051, and 1052). The full sample includes all firms in the database. PCM stands for Price-Cost margin. Information is presented in logarithms.

3.2 Antitrust Enforcement Data

The Superintendencia de Industria y Comercio (SIC) is a technical agency attached to the Ministry of Trade, Industry and Tourism; it has administrative, budgetary, and financial autonomy in inspection and supervision roles. Between 1999 and 2020, it dealt with 89 enforcement cases. Among these, 58 relate to collusive practices, and 31 to abuses of dominant position. The most investigated sector was manufacturing, followed by wholesale and retail trade, and construction.

The SIC provides access through the SICOMP website to the resolutions adjudicating offenses committed and the resultant sanctions. They briefly summarize the case, the sanction, date of imposition, sector, geographic market, and the generic conduct evidenced by the SIC. Each resolution is the result of a long investigative process, which does not always correspond to the year of publication of the administrative act; 90 percent of cases are resolved with a monetary sanction for the natural or legal person that is being investigated.

4 Empirical Specification

Our empirical strategy follows a two-way fixed effects panel model, which accounts for firm-level heterogeneity and time-varying sectoral and regional dynamics. The model is specified as follows:

$$\log y_{i,j,s,t} = \mu_i + \alpha_t + \gamma_{j,t} + \gamma_j + \theta_{s,t} + \theta_s + \beta D_{j,t} + \epsilon_{i,j,s,t}, \quad (1)$$

where $y_{i,j,s,t}$ denotes firm i 's performance outcome: sales, value-added, capital stock, employment, value-added per worker, and price-cost margin² in the 4-digit sector j and state s at time t . The sector-year fixed effects $\gamma_{j,t}$ capture time-varying sectoral shocks, while the

²Price-Cost Margin (PCM) is defined as the difference between sales and operational costs, expressed as a percentage of total sales. It measures the extent to which a firm can mark up its prices over its costs, serving as an indicator of pricing power and profitability.

state-year fixed effects $\theta_{s,t}$ control for time-varying regional conditions. The enforcement variable $D_{j,t}$ is defined at the 4-digit sector level, and $\epsilon_{i,j,s,t}$ is the error term, assumed to be independently distributed with zero mean and variance σ_ϵ^2 .

This approach builds on the standard difference-in-differences framework to analyze the effects of competition on firm performance indicators. The framework leverages sectoral and temporal variation in enforcement actions to estimate causal effects. We employ three control group definitions to comprehensively assess the impact of competition enforcement. First, the baseline specification defines the treated group as firms in the affected 4-digit sectors, with the control group consisting of firms in other 4-digit manufacturing sectors. Second, we refine the control group by including only firms that operate within the same division (2-digit sector) as the treated firms. This specification helps control for unobservable demand factors, assuming these are similar across firms within the same division. Finally, we use a propensity score matching procedure to construct a control group composed of firms that are more likely to be similar to the treated firms based on observable characteristics. These complementary specifications provides robustness to the results.

5 Results

The main findings are presented in Table 2, which reports the estimated impact of the SIC’s interventions on firm outcomes using three alternative definitions of the control group. Panel A uses all remaining firms in the manufacturing sector as the control group. Panel B restricts the control group to firms operating within the same 2-digit sector as the treated firms, thereby accounting for potential unobserved sector-specific demand shocks. Panel C further refines the comparison by applying a propensity score matching procedure, matching treated firms to observationally similar firms based on pre-treatment characteristics.³ Across all panels, the results are highly consistent and reveal distinct mechanisms by which the two

³See Appendix psm for a detailed description of PSM methodology.

interventions affected downstream firm performance.

In the case of collusion, the SIC's intervention removed restrictions that cartel had imposed on domestic supply and imports, thereby alleviating a key input constraint on downstream firms. Following the removal of this distortion, affected firms were able to expand their operations. This is evidenced by significant increases in value added, employment, and intermediate input costs in both Panels A, B and C. Importantly, there is neither a corresponding increase in productivity (measured as value added per worker) nor in price-cost margins (PCM). This pattern suggests that the intervention enabled firms to produce more by being able to access previously constrained inputs to meet existing demand, with no improvement to efficiency. In other words, the pre-intervention equilibrium reflected a quantity constraint rather than a productivity deficit. Once the constraint was removed, firms scaled up production without altering the underlying production technology or cost structure.

The abuse of dominance case tells a different story. This intervention targeted ethanol producers who had maintained elevated input prices for downstream firms in the chemicals and alcoholic beverages sectors. The SIC's action led to a decline in ethanol prices, thereby reducing input costs for affected firms. The most robust result in this case is a statistically significant increase in PCM, observed across all three panels. This finding indicates that the intervention enhanced firms' profitability by lowering input costs, with little change in production scale or labor intensity. Indeed, employment does not exhibit significant increases, while intermediate input costs and productivity increased but much lower compared to PCM.

Panel C results rely on matched comparisons using propensity scores and, for the abuse of dominance case, only PCM remains significant, while changes in value added, employment, and input use become statistically indistinguishable from zero. This provides further evidence that the primary effect of the intervention was a shift in profitability rather than expansion in productive capacity. The lack of effect on productivity or in intermediate in-

put cost is consistent with no binding production constraints prior to the intervention; with stable demand for their products, these firms had no need to increase output and instead they captured cost savings as higher margins.

In summary, the two antitrust interventions produced similar increases in value added but through distinct economic mechanisms. The collusion case improved access to a critical input, thereby allowing firms to expand production without increasing efficiency. The abuse of dominance case lowered input costs and raised profitability without requiring changes in scale or productivity. The consistency of these results across different identification strategies (industry-wide controls, within-division comparisons, and propensity-score matching) lends credibility to the causal interpretation of the findings and underscores the importance of understanding the specific market distortions targeted by antitrust enforcement.

Table 2: Main Results: Antitrust Enforcement

	Sales	Valued-added (VA)	Capital	Employment	Int. cost	Wages	VA per worker	PCM
A. Baseline (treated group: targeted sectors; control group: other sectors in the full sample)								
Collusion	0.136*** (0.0423)	0.196*** (0.0471)	0.0820 (0.0593)	0.180*** (0.0373)	0.133*** (0.0478)	0.0170** (0.0154)	0.0156 (0.0539)	0.134 (0.110)
Dominance	0.158*** (0.0438)	0.179*** (0.0641)	0.447*** (0.100)	0.0476 (0.0811)	0.177*** (0.0370)	-0.0446*** (0.0147)	0.131** (0.0558)	0.210*** (0.0298)
Obs collusion	40,871	40,871	40,725	40,871	40,871	40,871	40,871	40,006
Obs dominance	45,088	45,088	44,996	45,088	45,088	45,088	45,088	44,093
B. Baseline (control group defined by the non-treated sectors in the same division)								
Collusion	0.155*** (0.0492)	0.229*** (0.0579)	0.107 (0.0697)	0.154*** (0.0420)	0.163*** (0.0519)	-0.00289 (0.0123)	0.0749 (0.0520)	0.243* (0.114)
Dominance	0.169*** (0.0438)	0.190*** (0.0634)	0.460*** (0.103)	0.0529 (0.0807)	0.192*** (0.0379)	-0.0408*** (0.0144)	0.137** (0.0601)	0.212*** (0.0292)
Obs collusion	6,602	6,602	6,573	6,602	6,602	6,602	6,602	6,456
Obs dominance	15,221	15,221	15,196	15,221	15,221	15,221	15,221	14,902
C. Baseline (control group matched by propensity score in the full sample)								
Collusion	0.953*** (0.189)	0.970*** (0.291)	0.937*** (0.173)	0.675*** (0.0986)	0.967*** (0.183)	0.107* (0.0583)	0.295 (0.257)	0.0329 (0.235)
Dominance	0.341 (0.492)	0.527 (0.487)	0.756 (0.601)	0.267 (0.312)	0.174 (0.520)	0.0496 (0.0745)	0.260 (0.194)	0.253*** (0.0908)
Obs collusion	5,824	5,824	5,804	5,824	5,824	5,824	5,824	5,764
Obs dominance	11,513	11,513	11,497	11,513	11,513	11,513	11,513	11,397

Robust standard errors in parentheses, with *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The standard errors are clustered at the 4-digit sector classification at the national level. The regression results for the Collusion case include data from 2010 until 2018, while the Abuse of Dominance case includes data from 2007 until 2016. All regressions control for firm fixed effects, state*year, and sector (4-digit)*year fixed effects as defined in Equation (1).

5.1 The Dynamic Effects

The dynamic impact of the interventions over time is illustrated in Figure 4.⁴ To assess the evolution of treatment effects, we estimate event-study specifications by shifting the intervention dummy one, two, and three years prior to the intervention, and extending the analysis up to five years post-intervention. The findings indicate that firm-level value added shows no statistically significant differences before the SIC investigation in either case. This absence of pre-trends supports the assumption that the interventions were exogenous: firms did not anticipate the regulatory actions and thus did not adjust their behavior in advance in ways that could confound the estimation.

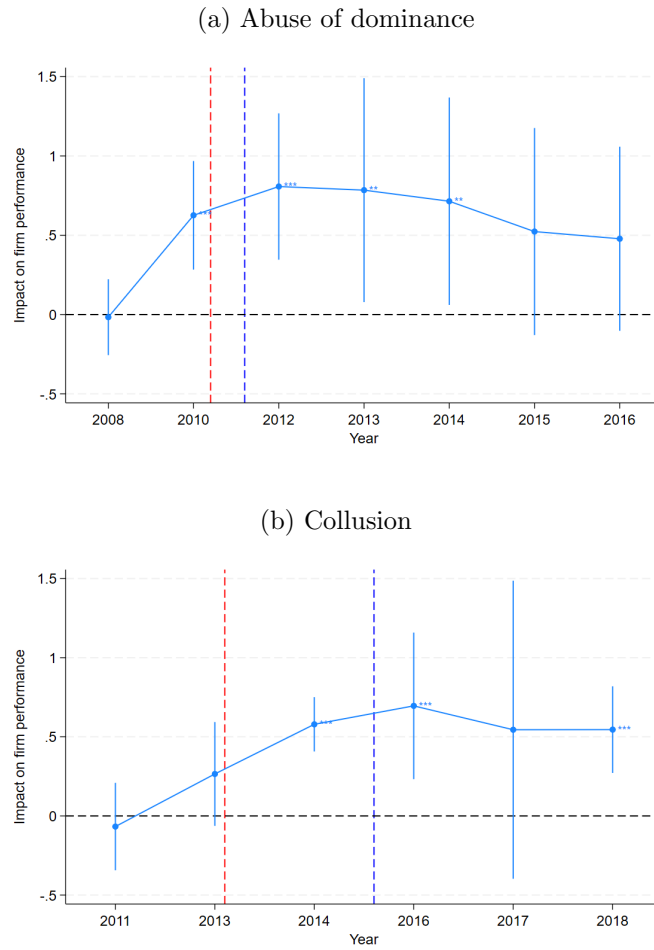
Further evidence supporting the exogeneity of the SIC interventions is presented in Appendix B, which reports the results from a logit regression using pre-intervention firm performance indicators as predictors of treatment status. None of the covariates are statistically significant, reinforcing the claim that treatment assignment was not systematically related to prior firm characteristics, and thus supports the identification strategy based on plausibly exogenous variation induced by the interventions.

Post-intervention, the trajectory of the value-added coefficient becomes increasingly positive in both types of cases, suggesting a favorable market response once the underlying distortions were removed. However, the effects appear to taper off over time. In both interventions, the estimated treatment effects show signs of diminishing returns, implying that the gains from antitrust enforcement might gradually dissipate. This temporal pattern highlights that while competition policy can yield substantial short- to medium-term benefits, sustained improvements may require ongoing regulatory oversight and consistent enforcement.

A detailed event-study analysis for additional firm outcomes, including employment, input use, capital, and price-cost margins, is presented in Appendix A.

⁴For the abuse of dominance case, coefficients are relative to 2009, while for the collusion case, they are relative to 2012.

Figure 4: The recursive impact of antitrust enforcement on value-added



We graphically present the yearly estimate of β in Equation (1) relative to the year prior to investigation. The standard errors are clustered at 2-digit sector. The regression results for the Collusion case includes data from 2010 until 2018, while the Abuse of Dominance from 2007 until 2016. The dashed lines indicate key event years: the year the investigation began, and the year of resolution. All regressions control for firm fixed effects, state and sector (4-digit) fixed effects.

5.2 Further Robustness: Effects on Market Leaders

In our baseline analysis, the treated group includes all firms in downstream sectors affected by the interventions in the sugar market. However, we acknowledge a limitation: the data

do not contain firm-level input shares, preventing direct observation of sugar dependency. To address this, we refine the treated group by focusing on larger (or "leading") firms, under the assumption that scale correlates with greater use of sugar-intensive inputs. This strategy enhances identification by restricting attention to firms that plausibly experienced stronger exposure to the intervention's effects.

Table 3 summarizes the results. In Panel A, firm's size is defined by sales, while in Panel B it is defined by the number of employees. The results remain consistent with our baseline findings. The collusion intervention continues to show significant increases in value added, employment, and intermediate input use among large treated firms. These patterns support the interpretation that lifting production restrictions enabled firms to scale up operations, though without corresponding gains in productivity. This aligns with the view that prior to the intervention, firms were operating below capacity due to input shortages, not inefficiency.

In the abuse of dominance case, the PCM effect remains positive and significant, while the impact on value added is only significant in Panel A but B. Value added per worker also remains unaffected, suggesting that cost reductions from lower input prices post-intervention translated primarily into higher margins rather than increased output. This is consistent with firms facing elastic demand, choosing to retain the cost savings rather than expanding production.

Taken together, these robustness checks bolster the credibility of our baseline conclusions. The collusion intervention facilitated recovery from supply constraints, generating output growth without productivity gains. The abuse of dominance intervention primarily improved margins among larger firms through input cost reductions, with limited effects on firm scale or efficiency.

Table 3: Robustness: Antitrust Effects on Market Leaders

	Sales	Valued-added (VA)	Capital	Employment	Int. cost	Wages	VA per worker	PCM
A. Baseline with total sales for size to define leaders								
Collusion	0.641*	0.523**	0.00281	0.391**	0.656*	0.106**	0.132	0.230***
	(0.331)	(0.230)	(0.0869)	(0.157)	(0.374)	(0.0438)	(0.101)	(0.0855)
Dominance	0.430	0.644**	0.630	0.272	0.429	4.22e-05	0.372	0.958**
	(0.285)	(0.302)	(0.432)	(0.286)	(0.285)	(0.0506)	(0.366)	(0.476)
Obs collusion	13,338	13,338	13,319	13,338	13,338	13,338	13,338	13,054
Obs dominance	11,434	11,434	11,429	11,434	11,434	11,434	11,434	11,178
B. Baseline with number of employees for size to define leaders								
Collusion	0.414***	0.424***	-0.00539	0.290***	0.433***	0.0529	0.134***	0.219***
	(0.0486)	(0.0453)	(0.0802)	(0.0194)	(0.0816)	(0.0831)	(0.0403)	(0.0485)
Dominance	0.391	0.400	0.560	0.210	0.419	0.109***	0.190	0.454*
	(0.265)	(0.295)	(0.412)	(0.268)	(0.269)	(0.0210)	(0.276)	(0.232)
Obs collusion	13,514	13,514	13,494	13,514	13,514	13,514	13,514	13,230
Obs dominance	11,341	11,341	11,338	11,341	11,341	11,341	11,341	11,077

In panel A, the size is determined by total sales, while in panel B it is determined by the number of employees. Robust standard errors in parentheses, with *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The standard errors are clustered at the 4-digit sector classification at the national level. The regression results for the Collusion case include data from 2010 until 2018, while the Abuse of Dominance case includes data from 2007 until 2016. All regressions control for firm fixed effects, state*year, and sector (4-digit)*year fixed effects as defined in Equation (1).

6 Conclusion

This paper examines the effects of two antitrust interventions by Colombia’s competition authority (SIC) in the sugar market, focusing on downstream firms affected by the anti-competitive practices. Leveraging the exogeneity of SIC’s actions —triggered by documented price distortions and formal complaints from affected industries— we estimate the causal impact of these interventions on firm-level outcomes in downstream sectors.

The results indicate that SIC’s interventions led to economically and statistically significant increases in firm-level value-added and sales. These gains, however, were driven by distinct channels across the two cases. In the 2015 collusion case, the removal of input constraints enabled firms to expand production capacity, scale operations, and increase output, though without corresponding improvements in productivity. In contrast, the 2011 abuse of dominance case resulted in higher price-cost margins, as firms absorbed input price reductions, suggesting improved profitability under more competitive market conditions but limited expansion in production.

Robustness checks using alternative control groups, both within-sector and via propensity score matching, support the consistency of the main results. Dynamic event-study specifications further validate the identification strategy, showing no evidence of pre-trends and reinforcing the interpretation of SIC’s actions as exogenous shocks to market conditions. Post-intervention dynamics suggest that firms adjusted their operations in response to reduced distortions.

Taken together, these findings underscore the broader economic relevance of antitrust enforcement. Beyond correcting specific anti-competitive behaviors, well-targeted interventions can alleviate supply-side constraints, restore competitive market conditions, and enhance firm performance in affected sectors. The results highlight the importance of sustained monitoring and timely enforcement actions by competition authorities, particularly in input markets where distortions can have wide-reaching implications for downstream industries.

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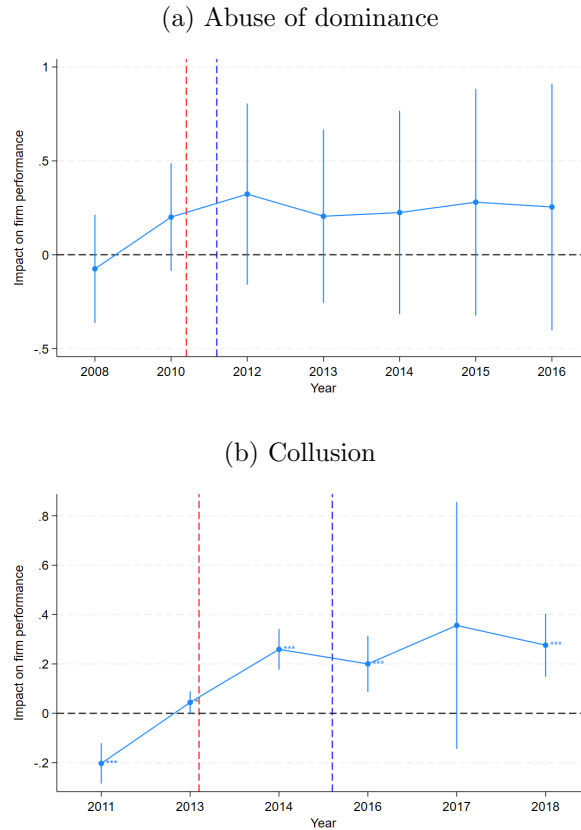
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Appendix

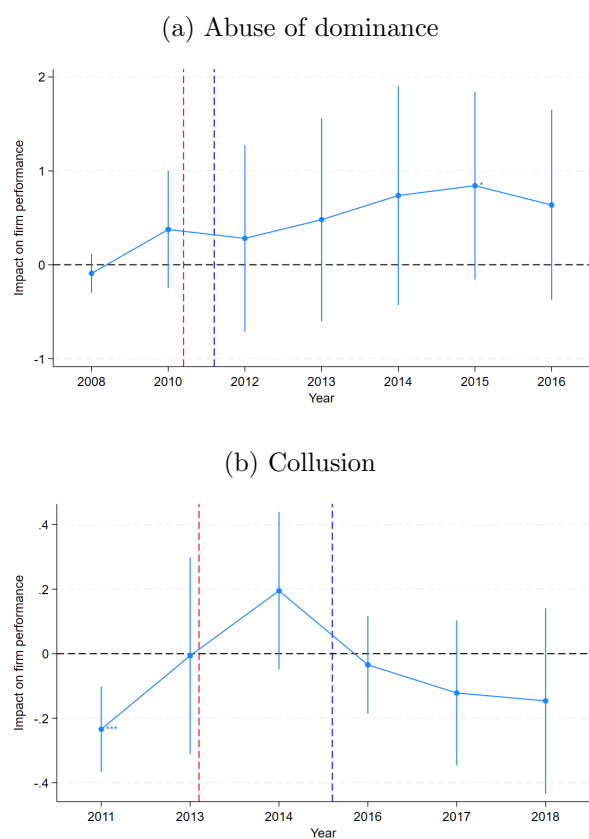
A Additional results

Figure 5: The recursive impact of antitrust enforcement on employment



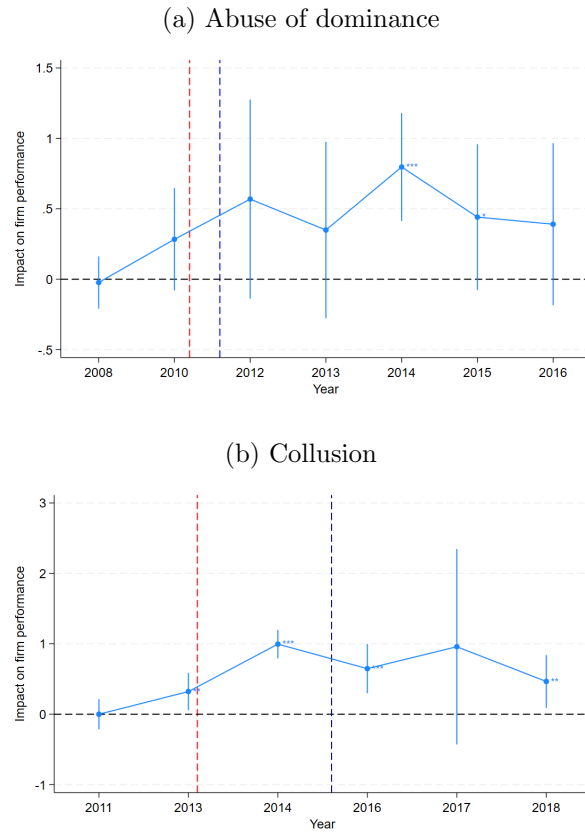
We graphically present the yearly estimate of β in Equation (1) relative to the year prior to investigation. The standard errors are clustered at 2-digit sector. The regression results for the Collusion case includes data from 2010 until 2018, while the Abuse of Dominance from 2007 until 2016. The dashed lines indicate key event years: the year the investigation began, and the year of resolution. All regressions control for firm fixed effects, state and sector (4-digit) fixed effects.

Figure 6: The recursive impact of antitrust enforcement on capital stock



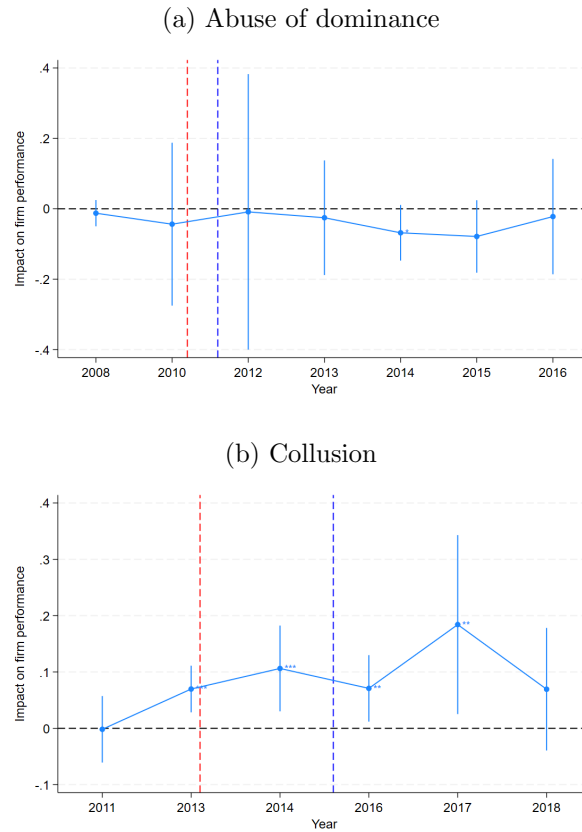
We graphically present the yearly estimate of β in Equation (1), this is the year contribution to the coefficient, with the standard errors clustered at 4-digit sector classification at national level. The regression results for the Collusion case includes data from 2010 until 2018, while the Abuse of Dominance from 2007 until 2016. All regressions control for firm fixed effects, state*year, and sector (4-digit)*year fixed effects.

Figure 7: The recursive impact of antitrust enforcement on intermediate input cost



We graphically present the yearly estimate of β in Equation (1) relative to the year prior to investigation. The standard errors are clustered at 2-digit sector. The regression results for the Collusion case includes data from 2010 until 2018, while the Abuse of Dominance from 2007 until 2016. The dashed lines indicate key event years: the year the investigation began, and the year of resolution. All regressions control for firm fixed effects, state and sector (4-digit) fixed effects.

Figure 8: The recursive impact of antitrust enforcement on average wages



We graphically present the yearly estimate of β in Equation (1) relative to the year prior to investigation. The standard errors are clustered at 2-digit sector. The regression results for the Collusion case includes data from 2010 until 2018, while the Abuse of Dominance from 2007 until 2016. The dashed lines indicate key event years: the year the investigation began, and the year of resolution. All regressions control for firm fixed effects, state and sector (4-digit) fixed effects.

B Additional robustness

Table 4: Probability of SIC Intervention

Collusion							
Avg. VA	-0.185						
	(0.128)						
Avg. Capital		-0.137					
		(0.103)					
Avg. Employment			-0.154**				
			(0.0719)				
Avg. Int. cost				-0.0961			
				(0.173)			
Avg. Wages					-0.403		
					(0.287)		
Avg. VA per worker						-0.330	
						(0.337)	
Avg. PCM							-0.117
							(0.158)
Obs.	3,017	3,017	3,017	3,017	3,017	3,017	2,959
Abuse of dominance							
Avg. VA	-0.196						
	(0.153)						
Avg. Capital		-0.162*					
		(0.0954)					
Avg. Employment			-0.196				
			(0.123)				
Avg. Int. cost				-0.185			
				(0.143)			
Avg. Wages					-0.233		
					(0.329)		
Avg. VA per worker						-0.312	
						(0.345)	
Avg. PCM							-0.0940
							(0.144)
Obs.	2,218	2,218	2,218	2,218	2,218	2,218	2,177

Robust standard errors in parentheses, with *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The standard errors are clustered at the 4-digit sector classification at the national level. The regression results for the Collusion case include data for 2015, while the Abuse of Dominance case includes data for 2011, in both cases the year in which intervention occurred. All regressions control for region fixed effects.

C Propensity score matching methodology

The propensity score matching (PSM) approach allows for restricting the comparison between treated and control groups based on observable firm characteristics [Heckman et al., 1997]. The treated group consists of firms operating in downstream sectors affected by the competition authority interventions. The control group comprises firms in other sectors with similar average characteristics. To account for geographical differences, we also include a dummy for the state where the firm is located.

The matching procedure involves two steps. First, we estimate a logit model to determine the conditional probability (i.e., the propensity score $p(X)$) that a firm is treated, conditional on its observable characteristics:

$$D_{ij} = \beta_0 + \beta_1 X_{ij} + \varepsilon_{ij} \quad (\text{A.1})$$

where i indexes firms and j indexes the group (treated or control). The binary variable D_{ij} takes the value 1 if firm i belongs to the treated group, and 0 otherwise. The vector X_{ij} includes firm-level covariates such as state location dummies, value-added, number of employees, capital stock, price-cost margin, and average wages. The propensity score $\hat{p}(X)$ summarizes these characteristics into a single index.

In the second stage, we use nearest-neighbor matching with replacement to construct the control group. Each treated firm r in group j is matched with the control firm k in group j' that has the closest propensity score, subject to a caliper restriction of one-fourth of the standard deviation of the estimated propensity scores ($\hat{\sigma}_p$):

$$A_{rj} = \left\{ k_{j'} \in I_0 : \hat{p}_{k_{j'}} = \min_{k_{j'} \in I_0} |\hat{p}_{rj} - \hat{p}_{k_{j'}}| < 0.25 \hat{\sigma}_p \right\} \quad (\text{A.2})$$

where I_0 denotes the sample of potential control firms. This caliper ensures that matched firms are sufficiently similar in their observable characteristics, improving the validity of the counterfactual comparison.