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Weavers of connections: The business network in the textile industry of Antioquia in the early twentieth century

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ABSTRACT

This article reconstructs the entrepreneurial investment network behind the rise of the textile industry in Antioquia – one of Colombia's leading industrial regions – between the late nineteenth century and the early twentieth century. Drawing on firm-level ownership records from the Medellín Chamber of Commerce (1887–1934) and evidence on elite social connections, the study applies social network analysis to reconstruct the cross-sector investment ties linking textile entrepreneurs to commerce, industry, and banking. The results show that textile investors were most strongly connected to commercial activities, while banking displayed the highest level of centrality, acting as a key coordinating node across sectors. These network configurations reveal that the development of the textile industry relied on dense intersectoral linkages rather than on isolated entrepreneurial initiatives. By providing a sector-specific, quantitative reconstruction of investment networks, the study offers a refined perspective on how patterns of industrial consolidation emerged in a late-industrializing regional economy.

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1. Introduction

Antioquia is a department (administrative region) in north-western Colombia, covering approximately 63,000 km² – comparable in size to Sri Lanka or West Virginia. This mountainous region, crossed by the Andes, was historically defined by rugged topography that isolated it from the country's traditional colonial centres and major Caribbean ports (Escobar 2004). Despite this geographical isolation, Antioquia achieved early industrial consolidation, with its capital, Medellín, becoming Colombia's primary manufacturing centre during much of the twentieth century (Saavedra 2003).

By the late nineteenth century, Medellín had become the focal point of a unique regional project based on the idea of a mountainous frontier. As analysed by Escobar (2004), this geographical isolation was leveraged by local elites to construct a narrative

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of regional exceptionalism, portraying the area as a disciplined, labour-oriented enclave with a singular vocation for progress. This social and geographical framing turned the region into a self-contained laboratory of modernization, providing the necessary context for the rapid structural transformations that would follow at the dawn of the new century.

This ideal of regional progress, however, initially contrasted with a fragile industrial reality. In the early twentieth century, Antioquia faced a shifting economic landscape. Unlike Colombia's central Andean regions (Boyacá, Cundinamarca, and Santander), which had well-established artisan economies, Antioquia's manufacturing sector was remarkably underdeveloped (Campuzano-Hoyos 2013). The region had long depended on imported goods, particularly textiles, which accounted for nearly 80% of its total imports (Brew 1979). This reliance underscored structural limitations: a small internal market, scarce raw materials, and logistical challenges that hindered growth. Yet within a few decades, Antioquia became Colombia's leading industrial hub, with the textile sector at its core.

This transformation was shaped by a distinct entrepreneurial model based on diversification, financial networks, and cross-sectoral investments. Industrialization was not primarily state-led or reliant on foreign capital but emerged from local elites whose activities expanded from commerce and mining into banking, agriculture, and industry. According to de Dávila (2012), Antioquia's entrepreneurial class displayed unusually high diversification and dense intersectoral linkages, which proved crucial to capital accumulation and subsequent regional industrialization.

The transition to modern textile manufacturing was not simply a matter of technical change but a strategic response to regional constraints (Montenegro, cited by Campuzano-Hoyos 2013). Entrepreneurs integrated textile production into diversified portfolios, a pattern also observed elsewhere (Barbero and Puig 2016). Yet while diversification was not unique to Antioquia and has parallels in early modern Western economies, the Antioquia case unfolded in a markedly different setting: a peripheral economy with limited state intervention and scarce foreign capital, where elites mobilized resources from commerce and gold mining to build financial and industrial networks. This specific combination of conditions – rather than diversification alone – defined the trajectory of Antioquia's industrialization and underscored the prominence of textiles in that process.

Recent scholarship has applied social network analysis to understanding Antioquia's industrialization. Mejía (2023) examines the ownership structure of Antioquia's banking sector over the period from the first bank's creation in 1872 to the onset of the Great Depression, building a dataset covering 24 banks and documenting 924 shareholders. He shows that bankers occupied particularly central positions in the elite network, with higher degree (i.e. more connections) than comparable elite members, and describes how interconnected family groups – mediated through commercial houses – maintained stakes across multiple banks, with the Vásquez and the Correas as a prominent example.

Mejía (2024) extends this network-analytic approach to industrial entrepreneurship across manufacturing sectors. He finds that betweenness centrality – capturing an individual's bridging position in the network – is strongly associated with firm founding: a one-standard-deviation increase corresponds to about 0.07 additional firms, roughly 46% of the average individual's total. In contrast, local cohesiveness (clustering) does not display a robust positive association with entrepreneurship. Mejía interprets these patterns as evidence that, in a

context of ineffective markets, elite social ties functioned as channels to mobilize complementary resources – well beyond information and capital – including skilled labour, tacit knowledge, political favours, and access to machinery and supplies.

Related research has examined trade connections (Mesa-Bedoya 2020) and the later evolution of business groups' internal capital markets (Rodríguez-Satizabal 2021). Yet the systemic structure of the entrepreneurial network during the formative industrial period – and the position of textile pioneers within it – has remained largely unexplored. This article addresses that gap by applying social network analysis to ownership data from the Medellín Chamber of Commerce, covering 1,837 firms between 1887 and 1934. This approach makes it possible to trace financial and organizational ties among shareholders and firms, which serve as indicators of access to capital and strategic coordination. We ask how business networks shaped this process – specifically, whether textile entrepreneurs were peripheral or central within the business elite, and how their diversification strategies sustained industrial consolidation. Our initial hypothesis is that textile entrepreneurs were not isolated pioneers but diversified actors whose bridging positions across commerce, banking, and industry sustained the consolidation of textiles at the core of Antioquia's industrialization.

The theoretical motivation for this approach draws on the literature on economic networks, which highlights how structural positions enable coordination, risk diversification, and knowledge transfer (Granovetter 1985; Jackson 2008). In doing so, the article extends quantitative network analysis from general patterns of industrial entrepreneurship to sector-specific mechanisms, revealing how particular cross-industry connections shaped textile investment and consolidation. More broadly, it speaks to comparative debates on the role of networks in early industrialization, particularly in peripheral economies.

2. Historical background: The rise of Antioquia's textile industry

The emergence and consolidation of large textile firms in Antioquia began in the early twentieth century, with the industry experiencing its first major expansion in the 1910s. This process was shaped by strategic business decisions, technological adoption, and responses to significant logistical challenges.

2.1. Market consolidation and leading firms

From the outset, consolidation strategies involved acquiring competitors and creating 'firms of firms', in which companies themselves became owners of other enterprises. This practice significantly expanded the scale and influence of pioneering firms (Álvarez 2003). Early examples include the establishment of *Compañía Antioqueña de Tejidos* (1902, later *Coltejer*) and other enterprises of the period, such as *Fábrica de Tejidos Cortés y Duque*, *Fabricato*, and *Fábrica El Perro Negro*. Although numerous firms were founded in the 1920s, only a few – most notably *Coltejer* and *Fabricato* – sustained growth over the long run, exemplifying the enduring role of pioneering firms (Saavedra 2003).

By the mid-twentieth century Medellín had consolidated its position as Colombia's leading textile hub, with *Coltejer*, *Fabricato*, and *Tejicóndor* spearheading spinning and weaving. Their reliance on domestic financing strategies illustrates how Antioquia's industrial elites mobilized local sources of capital to expand, reinforcing a trajectory of

endogenous growth. During World War II, contracts with the US government further integrated Antioquia's industry into international markets, facilitating access to machinery and expanding production capacity (Henderson 2001). This dual orientation – anchored in domestic capital yet connected to global demand – proved central to the industry's resilience and long-term expansion.

2.2. Early challenges and technological adoption

Early textile production in Antioquia focused on fabric manufacturing, taking advantage of favourable tariffs on yarn imports (Saavedra 1983). This tariff regime allowed local firms to bypass spinning and concentrate on finishing processes, underscoring how state policies shaped the industry's initial trajectory. Over time, technological innovations enabled specialization in textile finishing and improvements in product quality (Saavedra 1983).

By the 1910s and 1920s, increasing imports of machinery from the United States and Britain modernized production, supported by Antioquia's abundant hydropower resources. The industry's ability to combine imported technologies with local energy sources not only enhanced productivity but also strengthened competitiveness in national and international markets. Episodes often described as mere anecdotes – such as the disassembly of imported machinery to transport it on pack mules and its reassembly by local mechanics (Brew 1979) – are better understood as evidence of entrepreneurial adaptation. These technical improvisations illustrate how Antioquia's industrialists transformed logistical obstacles into capabilities that sustained growth.

2.3. Raw materials and infrastructure

Despite these advances, securing raw materials remained a persistent challenge. Reliance on imported cotton constrained growth until domestic cultivation expanded, though supply continued to be unstable (Saavedra 1983). By the 1920s, entrepreneurs sought to strengthen commercial ties with foreign suppliers to secure seasonal shipments (Pearse 1926). Infrastructure deficiencies compounded these problems: before 1930, most cotton was transported by mule, raising costs and limiting production. The state responded with substantial investment in transport – over 80% of public expenditure between 1925 and 1930 was allocated to roads and railways (Henderson 2001). While this did not create a fully integrated system, it eased circulation and facilitated industrial expansion.

Even by the 1940s, however, the industry depended heavily on imported dyes and chemicals (United States Office of International Trade 1953). In response, President Mariano Ospina Pérez (1946–1950) promoted cotton self-sufficiency through protectionist policies and established the Instituto de Fomento Algodonero in 1948. These measures reflected the broader challenge of positioning Antioquia's industry within a global economy: while local elites mobilized resources to reduce reliance on imports, full integration into international trade networks remained indispensable for sustaining growth.

3. Data and methods: Reconstructing business networks

Social network analysis has become an important tool in economic history, offering a systematic framework to examine how interactions among individuals and institutions shape

economic transformations. Its applications range widely: Esteves and Mesevage (2019) highlight medieval merchant networks, Enlightenment intellectual collaborations, and elite financial ties within the British Empire. Flandreau and Jobst (2005) apply the method to international monetary systems, revealing hierarchical patterns in currency linkages between 1890 and 1910. Gómez-Galvarriato (2008) demonstrates its sectoral potential by tracing how the Barcelonnette community shaped the Mexican textile industry during the Porfirian era.

In Antioquia, network analysis has provided valuable insights into the region's industrial and financial transformations. Melo (2017) uses social network analysis to examine how capital for industrialization (1880–1930) was coordinated across actors linked to commerce, banking, and agriculture, highlighting the diversity of funding sources beyond banks. Mesa-Bedoya (2020), drawing on the Uribe Ruiz family's epistolary correspondence, reconstructs the international commercial network of local traders in Antioquia and analyses how relationships with foreign firms were established and strengthened in the second half of the nineteenth century.

Mejía (2023) reconstructs the banking shareholder network using a novel dataset on local elites, documenting that banker families occupied structurally central positions within Antioquia's elite network and that ownership ties were organized through interconnected family groups and commercial houses. Mejía (2024) extends this network-analytic approach to industrial entrepreneurship across manufacturing sectors, showing that betweenness centrality – capturing bridging positions across otherwise weakly connected groups – is strongly associated with industrial firm founding. Collectively, these studies illustrate the central role of economic networks in Antioquia's industrialization and show how local, institutional, and transnational connections intersected in shaping regional development.

3.1. Sources and data

Building on this literature, our analysis focuses on the textile sector. We use incorporation records from the Medellín Chamber of Commerce (CCMA) (Gaviria, Gil & Vélez, 2022) to reconstruct shareholder connections in Medellín between 1887 and 1934. Over this period, 1,837 firms and more than 5,000 investors were registered, of whom 126 participated in at least one textile company.

The incorporation certificates identify both individual and institutional shareholders, providing original evidence on ownership structures. These records enable the construction of a shareholder network that captures the structural relations through which entrepreneurs accessed capital and developed intersectoral linkages.

While our shareholder network does not include individual-level characteristics, some investors can be matched by name to the individual-level dataset in Mejía (2024), which provides information on 1,876 members of Antioquia's elite between 1850 and 1930. Importantly, our paper analyses a different network. Whereas Mejía (2024) studies entrepreneurs' multi-sphere social networks and relates centrality measures to industrial firm founding across manufacturing sectors, we reconstruct an ownership-based shareholder network from incorporation records, focused on ownership ties. We use this name match only to enrich a subset of shareholders with additional covariates – such as family wealth, political affiliation, and gender – which we incorporate in the empirical analysis below.

3.2. Network construction and centrality measures

The network is modelled as an affiliation graph in which nodes represent shareholders (individuals or institutions) and ties denote joint ownership in one or more firms. These links go beyond financial coincidence: they created opportunities for information exchange, collective decision-making, and the coordination of industrial activities. In this sense, the network can be interpreted as a map of capital and governance ties among Antioquia's business elites.

We evaluate shareholder prominence using three standard centrality measures. Degree centrality captures the number of direct connections of an investor. Eigenvector centrality reflects the importance of indirect ties by assigning greater weight to connections with highly connected actors. Betweenness centrality identifies intermediaries who bridge otherwise disconnected groups and thus captures their capacity to coordinate across sectors. We omit closeness centrality because the shareholder network is fragmented into 388 connected components (Appendix C), with the largest containing 4,358 nodes (79.5% of all shareholders); in such a setting, closeness is not well defined and is highly sensitive to component membership (Jackson 2008).

4. Quantitative results: Network position and textile investment

Figure 1 presents the distribution of investments made by 126 shareholders from 21 textile companies across various sectors between 1887 and 1934. The evidence shows that textile entrepreneurs did not confine themselves to their core industry. Instead, they frequently diversified into commerce (25%), other industrial ventures (23%), and

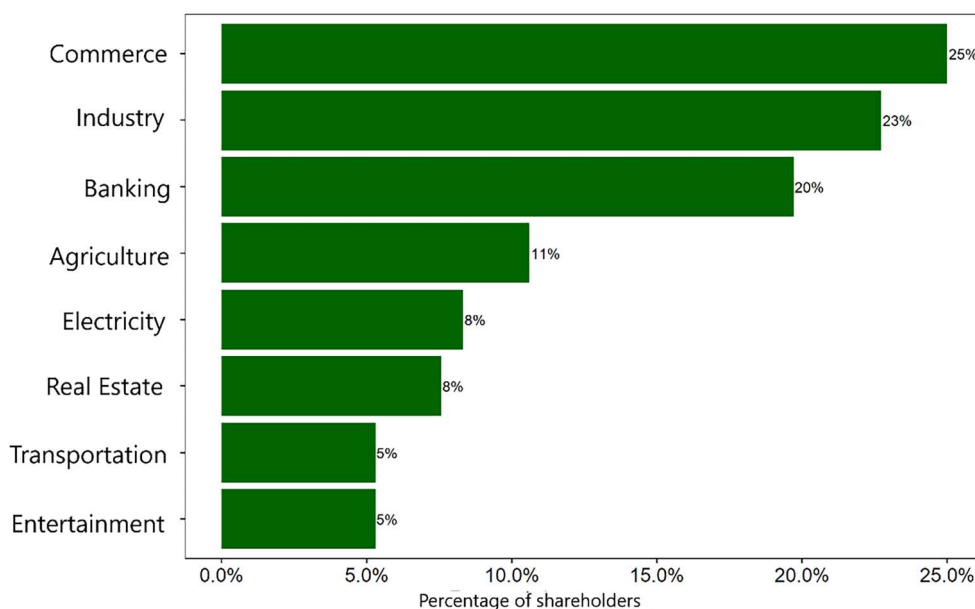


Figure 1. Distribution of textile entrepreneurs' investments across economic sectors (1887–1934).

Note: Percentages correspond to the share of textile entrepreneurs (126 individuals) who invested in each economic sector between 1887 and 1934.

banking (20%). This diversification reflects a broader portfolio strategy and underscores that textile ventures were rarely isolated or initial undertakings. While the data do not allow us to reconstruct the precise chronology of entry into textiles, most investors had already established positions in other sectors, indicating that textile ventures were embedded within wider patterns of economic diversification.

Using the shareholder network and centrality measures defined in Section 3, we now assess the structural positions of investors across sectors. Because degree, eigenvector, and betweenness centrality each capture a distinct aspect of prominence, the rankings they generate do not necessarily coincide, but together they provide a multi-dimensional perspective on the structural role of shareholders (Jackson 2008). Figure 2 illustrates the intuition behind these measures through a stylized artificial network. Banco Alemán Antioqueño is depicted as the node with the highest degree centrality, connecting directly to the largest number of actors. For explanatory purposes, the figure also displays closeness centrality, though this measure is not reported in the empirical analysis given the fragmented nature of the historical network. R. Echavarría & Cía. exemplifies eigenvector centrality, as its limited number of ties are directed towards highly connected nodes, amplifying its overall influence. Alejandro Echavarría illustrates betweenness centrality, occupying the brokerage position between the banking and commercial cluster on one side and the textile firms on the other.

4.1. Centrality measures across sectors

Table 1 reports the average centrality of shareholders within the main sectoral subnetworks of Antioquia’s business network, computed relative to the overall network

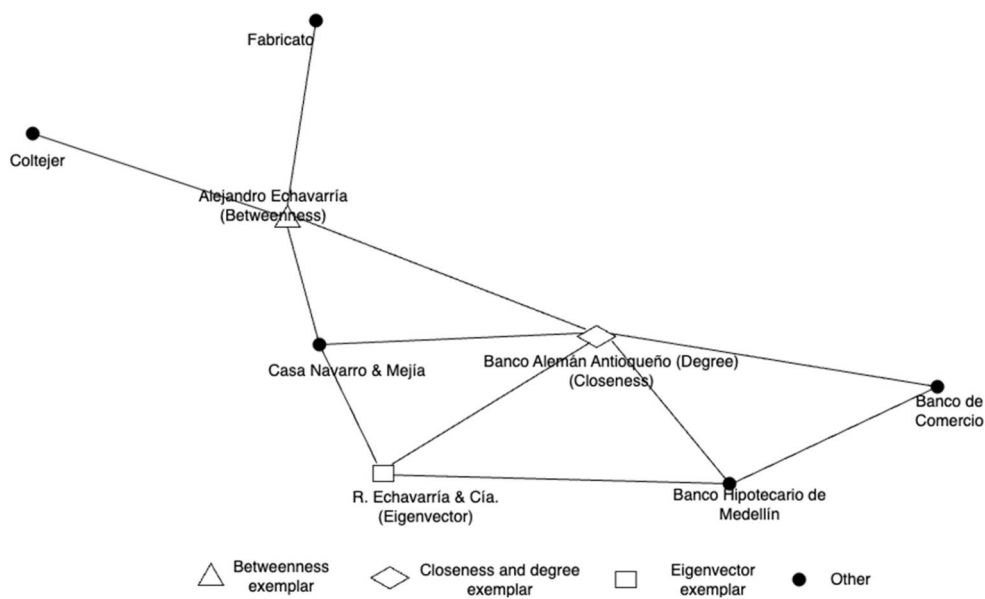


Figure 2. Centrality measures illustrated in an artificial network.

Note: The figure highlights illustrative nodes for each centrality measure.

Table 1. Centrality measures by economic sector.

Sector	Number of shareholders	Betweenness	Eigenvector	Degree
Commerce	1,598	9,624.36	0.03	21.82
Banking	1,380	12,716.68	0.12	64.63
Industry	637	16,979.88	0.04	34.22
Agriculture	587	14,162.16	0.02	24.34
Entertainment	328	14,439.03	0.01	33.71
Real estate	296	16,735.70	0.03	34.29
Electricity	209	22,452.00	0.04	54.17
Mining	172	16,557.94	0.02	42.48
Transportation	155	28,956.76	0.04	42.99
Textile	131	23,431.96	0.04	35.35
Communications	113	27,715.02	0.06	64.66
Professional Activities	92	19,937.43	0.06	39.41
Construction	84	15,737.95	0.03	24.86
Accommodation	55	11,600.03	0.03	24.93
Public Admin.	26	35,756.24	0.08	54.04
Health	20	6,990.25	0.00	17.25

Note: Sectoral subnetworks are based on firms' primary activity in the Chamber of Commerce records. Because some investors participated in multiple sectors, individuals may appear in more than one subnetwork. Closeness centrality is not reported, (see Section 3) (Jackson, 2008).

structure. Each subnetwork comprises all shareholders with at least one investment in a firm classified in that sector in the Chamber of Commerce records, together with all ties among them; a tie exists whenever two shareholders co-invest in at least one firm. As noted in Section 3, closeness centrality is omitted due to the network's fragmentation; our analysis therefore focuses on degree, eigenvector, and betweenness centrality.

The communications sector exhibits the highest degree centrality, followed by banking, while textiles occupy an intermediate position. This indicates that shareholders in communications and banking firms, on average, maintain more direct ties – either reflecting sector-specific requirements or the nature of their businesses – than those in textiles. By contrast, commerce and health record the lowest levels of direct connectivity.

Eigenvector centrality shows a similar pattern, with banking and communications again ranking highest. The textile sector, however, improves its relative position under this measure due to its strong integration with the banking sector (Figure 2). Although textile firms held fewer direct ties, their association with highly connected industries amplified their influence within the network.

Betweenness centrality ranks the textile sector fourth among the 16 industries, after public administration, transportation, and communications. This suggests that while textile shareholders were not the most directly connected actors, they performed a pivotal role in bridging otherwise disconnected parts of the network. Such bridging capacity likely reflected the operational demands of the industry – a theme further explored in the following sections.

Beyond centrality, we also capture intersectoral linkages through binary indicators of sectoral participation. For each shareholder, we identify whether they held investments in commerce, banking, transport, electricity, or other industries. This measure allows us to assess diversification strategies. As shown later in the case studies, textile entrepreneurs often originated from families with portfolios already spread across multiple sectors.

4.2. Regression analysis

We estimate reduced-form models that relate investors' structural positions in the ownership network to their participation in the textile sector. The dependent variable, Y_i , measures the presence and size of an individual's investment in textiles. Explanatory variables include eigenvector centrality ($Eigen_i$), which captures embeddedness in influential clusters, and betweenness centrality ($Betweeness_i$), which identifies brokerage across otherwise disconnected groups.

$$Y_i = \alpha_0 + \alpha_1 Eigen_i + \alpha_2 Betweeness_i + \sum_j \beta_j Sectj_i + \sum_{k \neq j} \beta_k + \varepsilon_i$$

Here, $Sectj_i$ are dichotomous indicators for sectoral affiliations (banking, commerce, transport, industry), and X_i includes control variables – political affiliation, family wealth, gender, marital status, birthplace, and migration background – drawn from Mejía (2024).

This specification is best understood as a reduced-form model, consistent with established approaches in the networks and entrepreneurship literature (Renzulli, Aldrich, and Moody 2000; Stuart and Ding 2006; Mejía 2024). It does not aim to identify structural causal effects but rather to document systematic associations between network position and textile investment. By combining centrality measures with sectoral controls, the model isolates the marginal contribution of network position while recognizing that sectoral membership itself could serve as a pathway into textiles.

Consistent with this reduced-form strategy, we exclude degree centrality from the main regressions, for two reasons. First, it is highly correlated with eigenvector centrality, generating multicollinearity. Second, because links are induced by co-ownership in the one-mode projection, degree is mechanically inflated for investors in firms with many shareholders, even when that firm constitutes their sole investment. Closeness centrality is omitted for the reasons outlined in Section 3 (Jackson 2008).

Table 2 reports the estimation results. Only 2% of individuals in our sample invested in the textile sector, with an average participation of 0.24 firms per investor. These figures reflect the limited but non-negligible involvement of shareholders in textiles. The similarity between the two measures arises from the fact that no individual in the sample held shares in more than three textile firms, a feature that also accounts for the comparable coefficients shown in Table 2.

The regression results reveal two principal findings. First, betweenness centrality – rather than eigenvector centrality – shows a statistically significant association with textile sector investment. Specifically, a one-unit increase in betweenness centrality is linked to a 0.019 percentage point rise in the probability of investing in the textile industry. This indicates that textile investors did not necessarily occupy dominant positions within the overall business network but instead played a pivotal role in bridging otherwise disconnected economic sectors. Given the operational demands of the industry, textile manufacturing relied on strong intersectoral linkages, particularly with finance, commerce, and suppliers of raw materials.

Second, investment experience in other industrial sectors is significantly associated with a higher likelihood of investing in textiles. Individuals previously engaged in other manufacturing activities were 16 percentage points more likely to invest in the textile

Table 2. Regression results on textile sector investment.

	Investor in the textile industry	Portfolio size in the textile industry
Betweenness centrality	0.00019** (0.0009)	0.00019** (0.0009)
Eigenvector centrality	-0.141 (0.149)	-0.142 (0.163)
Other industries	0.168** (0.056)	-0.169 (0.057)
Electricity	-0.019 (0.076)	-0.061 (0.080)
Banking	-0.060 (0.047)	-0.004 (0.057)
Transport	-0.076 (0.120)	-0.082 (0.160)
Controls for individual characteristics		Yes
Controls for other economic sectors		Yes
Number of observations		5,432

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Robust standard errors are reported. While the table displays results for four representative sectors, the specification includes binary controls for all economic sectors in the sample. All regressions are estimated on the complete population of 5,432 investors.

sector. This finding underscores the value of practical and technical expertise – such as factory management and machinery maintenance – which could be transferred across industries. Consequently, textile firms frequently attracted investors with backgrounds in industrial production, in line with the interpretation that diversification across business activities facilitated the sector's expansion.

These results corroborate and extend Mejía's (2024) findings on network structure and industrial entrepreneurship in Antioquia. Mejía shows that betweenness centrality – capturing bridging positions across otherwise weakly connected groups – is strongly associated with firm founding across manufacturing sectors, whereas local clustering does not display a comparable effect. Our textile-focused analysis confirms the relevance of bridging positions while situating this mechanism within a specific industrial context.

Disaggregation further clarifies how this association operates at the sectoral level. In our estimations, betweenness centrality remains significantly associated with investment in textiles, even after controlling for sectoral affiliations and individual characteristics. Prior industrial experience is also significant, indicating that network position and sectoral background were jointly linked to textile participation. This sector-specific evidence complements aggregate manufacturing analyses by showing how these structural advantages materialized within a particular industry. In Section 5, we examine selected investors to illustrate how these structural patterns translated into concrete investment trajectories.

4.3. Robustness checks

To assess the stability of our results, we divide the sample into two subperiods: before 1915, corresponding to the early experimental stage of textile ventures, and after 1915, when the industry consolidated with the foundation of Coltejer (1907) and Fabricato (1920). The estimates (Appendix A) confirm that our findings are robust across both periods: betweenness centrality remains positively and significantly associated with textile investment, while eigenvector centrality is consistently non-significant. This reinforces that the relationship we identify is not driven by aggregation bias but reflects a persistent structural feature of the ownership network.

We further extend the robustness analysis by estimating spatial autoregressive (SAR) and spatial autoregressive combined (SAC) models that capture network or peer effects using spatial econometrics methods (Esteves and Mesevage 2019). Both specifications confirm the stability of our results. The SAR model detects significant peer effects, while the SAC model attributes most of the dependence to the autoregressive component rather than residual correlation. In both cases, betweenness centrality remains strongly positive and significant, and eigenvector centrality remains non-significant. These results, reported in Appendix B, indicate that our main findings are robust even when explicitly modelling network dependence and spatial error correlation.

5. Qualitative evidence: Family firms and cross-sector linkages

5.1. *Embeddedness within the business network*

Figure 3 depicts the shareholder network in Antioquia between 1887 and 1934. Node positions are obtained using a force-directed layout (Fruchterman-Reingold) and are intended to facilitate visualization rather than provide a quantitative measure of cohesion. Visually, some regions, particularly the banking sector, appear more tightly clustered. However, in a co-ownership projection, such apparent density can be mechanically inflated by firm size, since widely held firms induce many links among their shareholders. For this reason, we treat these density patterns as descriptive and rely on centrality measures for systematic comparisons across sectors.

Even with this caveat, the figure illustrates that textile investors were not confined to a separate component. Textile-related shareholders appear both in peripheral positions and in proximity to central areas of the network, with multiple connections to highly connected sectors, especially banking. This is consistent with textile entrepreneurship being embedded in broader ownership structures and, in some cases, linking otherwise weakly connected parts of the business network, a pattern that aligns with the sector's capital needs and its dependence on financial intermediation and imported inputs.

5.2. *Family firms and capital accumulation*

The emergence of industry in Antioquia was an endogenous process. It was driven by a local business elite whose practices of capital accumulation defined the region's economic trajectory. Initial resources for industrial ventures stemmed from nineteenth-century commercial surpluses – the main engine of the regional economy – and revenues from gold mining. Botero (1983) described this linkage as the '*trade – gold dyad*', the foundation upon which the first industrial enterprises were financed.

Capital accumulation was not anonymous but firmly embedded in family firms and kinship-based partnerships. These firms provided organizational structures in which trust and social capital supported risk management and facilitated portfolio diversification. Profits were reinvested in agriculture, ranching, banking, and real estate before being channelled into large-scale industrial projects. The textile industry became the paradigmatic case of how family firms, supported by diversified capital, catalysed Antioquia's industrial modernization.

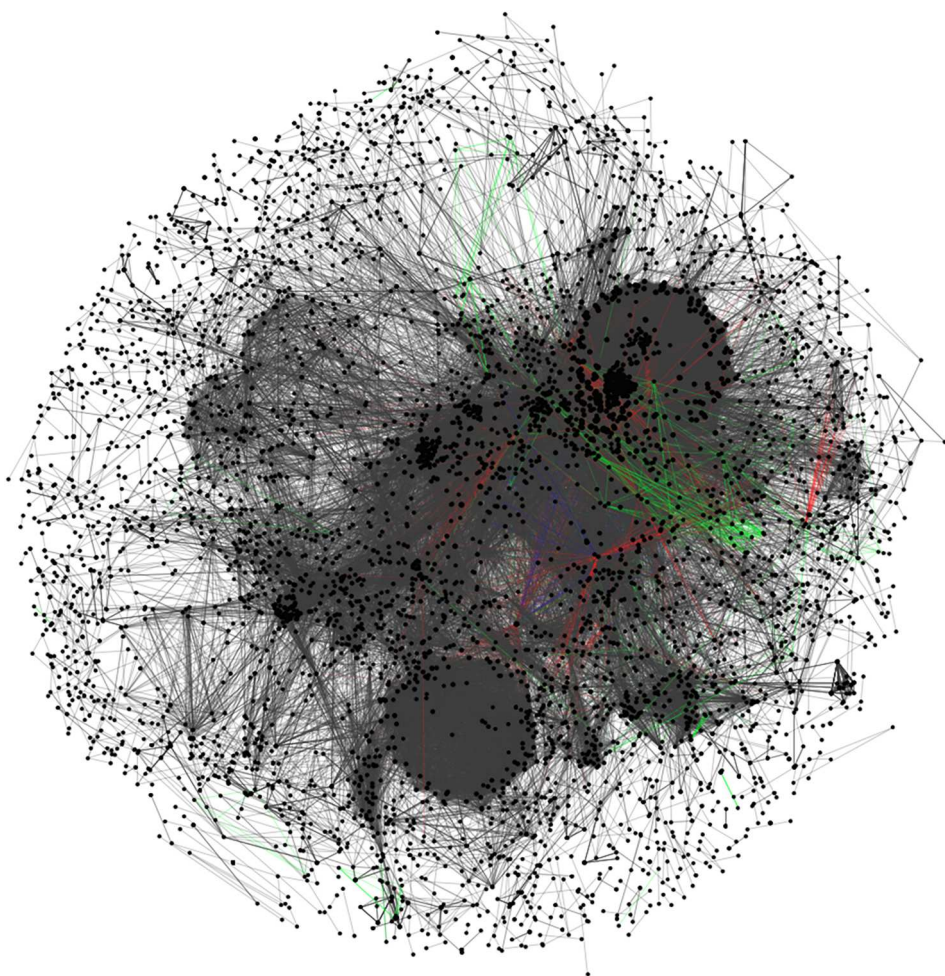


Figure 3. Shareholder network of companies in Antioquia, 1887–1934: highlighting textile and banking connections.

Note: The figure depicts the complete network of shareholder ties. Node positions are obtained using the Fruchterman-Reingold force-directed layout applied to the projected shareholder network and are used for visualization only. Links involving textile firms are highlighted in green, while those involving banking firms appear in red. Black links represent connections across all other sectors. The visualization illustrates the dense clustering of banking shareholders and the embedded but bridging position of textile investors within the broader network. Colour version available online.

Coltejer illustrates this trajectory. At its creation, 1,000 shares were equally divided between Alejandro Echavarría e Hijo (500) and R. Echavarría y Compañía (500) (Campuzano-Hoyos 2013). These two trading houses, led by Alejandro and Rudesindo Echavarría, were the cornerstone of a business empire that spanned multiple sectors. Alejandro founded Alejandro Echavarría e Hijo in 1904 with his son Gabriel, later reorganized as Alejandro Echavarría e Hijos to incorporate Guillermo, Alejandro, Diego R., and Germán (Mejía 2014). Through this firm, the family held stakes in Banco Hipotecario de Medellín and a wide array of enterprises in manufacturing, transport, agriculture, and trade. Alejandro also played a central role in finance, serving on the boards of Banco de Crédito Antioqueño, Banco del Atlántico, Banco de Comercio, Banco de los Mineros, and Banco

Alemán Antioqueño (Mejía 2014). Gabriel Echavarría later founded Corona, a leading ceramics producer, while Guillermo created Imusa, dedicated to metallurgical manufacturing (Bernal 2007).

Rudesindo Echavarría Isaza, meanwhile, managed an import business inherited from his father under the name Rudesindo Echavarría y Cía., later reorganized as Rudesindo Echavarría e Hijos with his wife María Josefa and their sons Jorge, Enrique, Ramón, and Pablo. Like Alejandro's branch, this firm also became deeply engaged in finance, holding shares in Banco Popular de Medellín and Banco de los Mineros de Antioquia (Mejía 2014).

The family firm model provided not only access to credit – facilitated by board memberships in banks (Mejía 2023) – but also the managerial expertise to structure and expand new ventures (Castrillón 2021). Figure 4 illustrates the dense interconnections linking Coltejer's shareholders to a wide range of other businesses at the time of its foundation, underscoring how the firm emerged from the embeddedness of the Echavarría family within Antioquia's entrepreneurial ecosystem.

By the early 1920s the Echavarrías had consolidated their leadership in textiles, joining forces with other prominent groups. In 1920 Antonio Navarro and Carlos Mejía, heads of L. Mejía y Cía. and Miguel Navarro y Cía., invited them into Fábrica de Hilados y Tejidos del Hato – later Fabricato (Zafrané 1966). Initially reluctant, the Echavarrías under Ramón Echavarría acquired 16 of the 80 shares (Mesa, León, and López 2020). When adverse conditions forced the Navarros' withdrawal in 1923, the Echavarrías assumed majority control, consolidating their dominance. Jorge Echavarría, trained at Coltejer, provided continuity

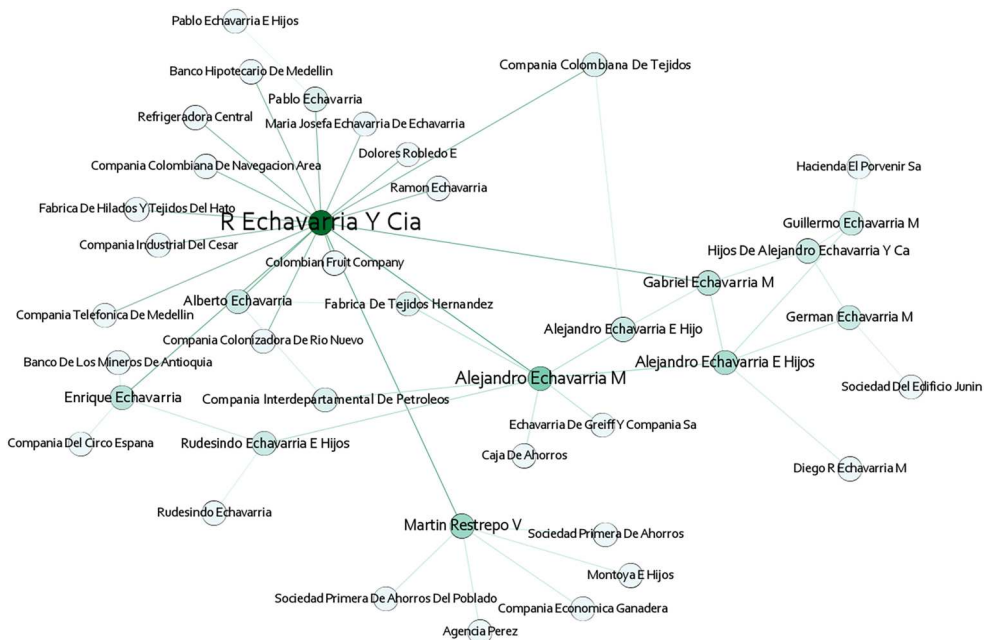


Figure 4. Shareholder network of Compañía Colombiana de Tejidos (Coltejer).

Note: The figure maps the shareholder network of Coltejer at its inception, highlighting the extensive interconnections between the Echavarría family and other enterprises. The visualization illustrates how Coltejer's establishment was embedded within a diversified web of financial, industrial, and familial ties, rather than as an isolated entrepreneurial initiative.

as manager for over a decade, while the family retained influence in Fabricato until 1961 (Zafrané 1966).

The Echavarría case demonstrates how family firms and cross-sector diversification underpinned entry into textiles. While other families such as Navarro and Mejía also engaged in textile ventures, this study highlights the Echavarrías as an illustrative example of how kinship networks and diversified capital facilitated industrial entry, without implying a uniform trajectory for all investors.

5.3. Cross-sector linkages and physical capital

The consolidation of the textile industry in Antioquia relied on dense intersectoral linkages that provided financial support, technical expertise, and logistical capacity. One of the most pressing challenges was the acquisition of modern machinery. The Echavarría family initially sourced looms from Gustavo Marizalde, a relative by marriage, but these soon proved inadequate for growing production needs (Castrillón 2021). They subsequently imported state-of-the-art equipment from England, facilitated by tax exemptions and in partnership with Acevedo Isaza & Cía., a firm with expertise in customs, railway logistics, and fiscal policy. Collaboration with the Antioquia Railroad and the Ministry of Finance further ensured the efficient transport and installation of this machinery.

Network ties also shaped land acquisition. By purchasing property from William Gordon, a representative of an international trading house, the Echavarrías secured access to the Santa Helena stream, a crucial source of hydraulic energy for textile manufacturing (Mesa, León, and López 2020).

These episodes exemplify how textile entrepreneurs leveraged their networks to obtain privileged access to capital, technology, and infrastructure. As shown in Table 1, ties to banking, commerce, and transport were central to consolidating the industry, while Figure 4 highlights how Coltejer's shareholder network was embedded at the intersection of multiple sectors. Such embeddedness demonstrates that Antioquia's textile expansion was not an isolated trajectory but the systemic outcome of cross-sectoral coordination.

6. Conclusions

This study contributes to debates on Antioquia's entrepreneurial landscape by highlighting the strategic role of business networks in shaping industrial development. Drawing on novel evidence from the Medellín Chamber of Commerce, it provides a quantitative perspective on ownership ties among textile entrepreneurs and tests the hypothesis that these actors were not isolated pioneers but diversified investors whose cross-sectoral linkages sustained and expanded industrial ventures in the late nineteenth and early twentieth centuries.

The results confirm this hypothesis. Textile entrepreneurs were indeed diversified, but their distinctive contribution lay in bridging positions across commerce, banking, and industry. Despite holding only a moderate number of direct connections, they occupied strategic positions that linked otherwise segmented sectors, reinforcing their role as connectors within the broader economic network. Their influence derived less from the sheer accumulation of ties than from the ability to coordinate resources across diverse spheres. Banking emerged as the backbone of these dynamics, exhibiting the highest

degree and eigenvector centrality and underscoring its role as the financial foundation of industrial expansion. This sector-specific finding complements Mejía's (2024) evidence that betweenness centrality is strongly associated with industrial firm founding across manufacturing sectors. While his analysis establishes the importance of bridging positions in shaping entrepreneurial activity at the aggregate level, our results show how these structural advantages operated within a specific industry, interacting with prior industrial experience to channel investment towards textiles.

Closer examination of entrepreneurial trajectories, particularly that of the Echavarría Isaza family, illustrates how cross-sectoral diversification facilitated the consolidation of the textile industry. Experience in commercial and financial ventures positioned them as pivotal actors in the creation and consolidation of firms such as Coltejer and Fabricato. These cases show how intersectoral linkages not only secured funding but also provided technical expertise, infrastructure, and logistical support.

Some methodological limitations remain. The classification of businesses by sector, although carefully refined, introduces ambiguities in the case of highly diversified firms. Likewise, although regression models control for individual characteristics, reverse causality cannot be entirely ruled out, precluding causal claims. The findings should therefore be read as descriptive of structural patterns that shaped opportunities for diversification and industrial entry. Moreover, because dissolutions and shareholder exits cannot be systematically observed, the reconstructed network should be interpreted as a long-run structural map rather than a contemporaneous snapshot.

This study advances the understanding of how entrepreneurial networks, diversification strategies, and financial connectivity underpinned industrial development in Antioquia. Beyond documenting these dynamics, it demonstrates the enduring relevance of network structures in explaining the centrality of the textile sector to regional industrialization.

While future research could enrich this perspective through longitudinal analysis or comparative work across Latin America, our findings already invite broader theoretical reflection on development models. By showing an industrialization process driven primarily by local elites through endogenous mechanisms, this work lays the groundwork for assessing how distinctive – or potentially replicable – this pathway is with respect to other peripheral economies, thus contributing to a global debate on the diverse trajectories towards economic modernization.

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Appendices

Appendix A

A potential limitation of our static network approach is that it aggregates firms and investors across the entire 50-year period, even though some actors did not coexist. To address this concern, we divide the sample into two subperiods of comparable size: pre-1915, covering the earlier, more experimental stage of textile investment, and post-1915, when the industry reached consolidation.

Table A1. Regression results on textile sector investment (by subperiod).

	Pre 1915	Post 1915
Betweenness centrality	0.0007*** (0.0001)	0.0003*** (0.0001)
Eigenvector centrality	−0.027 (0.017)	−0.026 (0.016)
Other industries	0.0146** (0.0061)	0.0125** (0.0062)
Electricity	0.0145 (0.0135)	−0.0186* (0.0111)
Banking	−0.012 (0.0128)	−0.0106 (0.0114)
Transport	0.0045 (0.0048)	−0.0088* (0.0047)
Controls for individual characteristics		Yes
Controls for other economic sectors		Yes
Number of observations	2,288	3,194

Notes: $p < 0.05$, $*p < 0.01$, $**p < 0.001$. Robust standard errors are reported. Although only four sectors are displayed, binary variables for all economic sectors in the sample are included. Table A1 is estimated on the full population of 5,432 investors.

Table A1 presents the regression results separately for these two subperiods. In both cases, betweenness centrality consistently shows a positive and statistically significant association with textile investment, confirming the importance of bridging positions across sectors. By contrast, eigenvector centrality remains insignificant, consistent with the idea that embeddedness in dense clusters was less predictive of textile entrepreneurship. Sectoral controls exhibit some variation across periods, but other industries maintain a robust positive association with textile entry.

Taken together, the persistence of these results across both subperiods strengthens our interpretation that the bridging role of textile entrepreneurs was a structural feature of the network, rather than a by-product of pooling actors into a static framework.

Appendix B

To test the robustness of our main findings, we estimate spatial autoregressive (SAR) and spatial autoregressive combined (SAC) models. Both specifications confirm the robustness of our main results. The SAR model indicates significant network autocorrelation ($\rho=0.21$), while the SAC model attributes most of the dependence to the autoregressive component ($\rho=0.90$) rather than to residual correlation (λ not significant). In both specifications, betweenness centrality remains positive and highly significant, and eigenvector centrality remains non-significant. These results show that our findings are robust to alternative estimators that explicitly account for network dependence and spatial error correlation.

Table B1. Regression results on textile sector investment (SAR and SAC models).

	SAR	SAC
ρ	0.206*** (0.050)	0.900*** (0.063)
λ	—	−0.210 (0.206)
Betweenness centrality	0.000112*** (0.00010)	0.00090*** (0.00021)
Eigenvector centrality	−0.024 (0.016)	−0.013 (0.041)
Other industries	0.012** (0.005)	0.010 (0.010)
Electricity	−0.011 (0.011)	0.023 (0.027)
Banking	0.006 (0.010)	0.041 (0.034)
Transport	0.006 (0.006)	0.037* (0.014)
Controls for individual characteristics		Yes
Controls for other economic sectors		Yes
Number of observations		5,432

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Robust standard errors reported. All regressions include binary indicators for every economic sector, although only four are displayed. ρ denotes the network autoregressive component, and λ captures residual spatial error correlation.

Appendix C

This appendix reports descriptive metrics for the shareholder network of Antioquia (1887–1934). Nodes represent shareholders, and an undirected link exists between two shareholders if they co-invested in at least one firm. The network contains 5,432 nodes and 68,400 links, with a low overall density (0.0046). The network is fragmented into 388 connected components; however, the largest component contains 4,358 shareholders (79.5% of all nodes), indicating that most investors belong to a single interconnected component.

To characterize connectivity within the part of the network where distances are meaningful, we compute path-based measures within the largest component only. Within this component, the average shortest path length is 3.87 and the diameter is 12. These statistics support our decision to omit closeness centrality from the main analysis, since it is not well defined across disconnected components and becomes sensitive to component membership in fragmented graphs.

Table C1. Summary statistics of the shareholder network (Antioquia, 1887–1934).

Metric	Value
Number of shareholders (nodes)	5,432
Number of links (edges)	68,400
Network density	0.0046
Connected components	388
Largest component size (nodes)	4,358
Largest component (share of nodes)	79.5%
Avg. shortest path length (largest component)	3.87
Diameter (largest component)	12