Social Networks and Elite Entrepreneurship in Latin America: Evidence from the Industrialization of Antioquia

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Elites were pivotal for Latin America's modernization, yet granular evidence of their industrial entrepreneurship is limited. I study Antioquia, an early center of industrialization, from the late nineteenth to early twentieth centuries. Analyzing elite interactions via newfound archival data and exploiting unexpected deaths as exogenous shocks, I find global connectivity—not local—drove industrial entrepreneurship. This suggests diverse resources unavailable in markets but accessible through global connections were crucial in forming industrial ventures. Thus, this paper depicts how social capital shapes elite outcomes.

The economic history of Latin America is characterized by two classic themes: the persistence of traditional elites and the rapid modernization process of the late nineteenth and early twentieth centuries. The former explores how elites with strong interests in landowning, mining, and agriculture have effectively maintained a predominantly extractive status quo for generations. This topic has been studied in detail by several researchers, including Stone (1992), Casaús Arzú (1992), and Acemoglu et al. (2008). The latter analyzes how industrialization rapidly transformed Latin American societies. This has been studied by scholars such as Haber (1989) and Dean (2012).

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Several lines of research have sought to bridge these two themes and explore elites' involvement in Latin America's industrialization. These have shown that understanding the most salient features of industrialization in the region, such as the dependence on commodity cycles, the proximity to highly concentrated financial markets, and the strong reliance on governmental protection, requires taking into account the role of elites (Cardoso 1968; Beatty 2001). However, we still lack a systematic comprehension of the role of elites at the individual level.

This paper addresses this gap in the literature by examining one of the most significant instances of industrialization in Latin America: the case of Antioquia, Colombia, in the late nineteenth and early twentieth centuries. I bring large-scale data on the social interactions of individuals within the elite, which allows me to explore how the structural features of this community, as a network, relate to the entrepreneurial endeavors of its members in the industrial sector. In this way, the paper provides a new perspective on the social fabric behind the modernization of Latin America.

The study of this topic dates back to the mid-twentieth century, when classical development theorists argued that understanding the modernization of Sao Paulo, Monterrey, and Medellín was key to understanding Latin America's development path (see Lipset and Solari 1967). These were non-capital cities that were early centers of industrialization and where an industrious identity emerged among the elite. In the words of Albert Hirschman, these were "isolated, inbred and self-consciously proud industrial centers" (Hirschman 1968, p. 23).

This notion of a community of entrepreneurs playing a critical role in the industrialization of Latin America has previously been examined using a social-network framework. In this approach, social interactions, represented as connections between actors, are seen as important for business activity. Notably, Maurer and Haber (2007) and Musacchio and Read (2007) investigated networks of interlocking boards of directors among large companies in Mexico and Brazil during the late nineteenth and early twentieth centuries. They demonstrate that companies effectively utilized the personal connections of their directors to avoid information and contract-enforcement costs, adjusting to the requirements of each specific context.

I build on this research tradition by examining individual-level entrepreneurial behavior in a more detailed and comprehensive local network setting that spans a longer period. Specifically, I draw on over 100 primary sources from 15 archives and approximately 185 secondary sources to manually reconstruct nodes and links that aim to represent the

social network of Antioquia's elite during the late nineteenth and early twentieth centuries. To achieve this, I use a twofold approach. Firstly, I employ a snowball sampling method that incorporates observations related to the connections of the largest bankers in the region. Secondly, I use a downward sampling approach that includes observations from key spheres of interaction within the elite. Additionally, using a mix of primary and secondary sources, I collect information on all the industrial firms founded during this period, for which we maintain records of their founders.

These granular data allow me to provide evidence on entrepreneurship at the individual level, which was not possible in previous research on Latin American economic history. Thanks to this, I can estimate how an individual's decision to establish industrial firms was related to their network position. Specifically, I focus on two dimensions of a person's location in the network: (i) the cohesiveness of their immediate network, and (ii) their importance as a bridge in the entire network.

I present evidence from three distinct sources of variation. Firstly, I explore whether individuals with similar backgrounds but different network positions exhibit varying levels of entrepreneurial involvement throughout their lives. Secondly, I analyze whether changes in an individual's network position over time are associated with temporal differences in their levels of entrepreneurship. Lastly, I take advantage of unexpected deaths among members of the elite as exogenous shocks to the network and examine whether levels of entrepreneurship changed following these events.

Each of these settings has its strengths and limitations. However, in all three settings, I find a positive and robust relationship between entrepreneurship and an individual's importance as a bridge in the entire network. Conversely, none of these settings provides evidence of an equivalent relationship between entrepreneurship and a highly cohesive local network.

These results, when combined with data on the location, activities, and performance of industrial firms, as well as historical accounts of the period, suggest that social connections were used to supplement poorly functioning markets. Industrial entrepreneurship was a complex activity that required a diverse range of complementary resources, which were not always readily available in the market. Therefore, individuals relied on their social interactions to obtain these resources. As a result, individuals who held network positions that allowed them to access a broad set of resources—those who were more important as bridges in the entire network—had a comparative advantage in industrial entrepreneurship.

However, having a supportive social circle with high local connectivity did not necessarily guarantee access to all the necessary resources, as plenty of them were spread out across the entire network. Thus, being a bridge in the network was particularly relevant for entrepreneurship in places where markets were less developed.

Furthermore, I demonstrate that bridging people within a particular social sphere—for example, connecting miners with miners or bankers with bankers—was irrelevant to entrepreneurship. The key was to bridge people across spheres—for example, connecting miners with bankers, politicians, or merchants.

This paper presents novel findings in the literature on the economic history of Latin America by highlighting how global connectivity was essential in the industrialization process. Previous studies have mainly focused on the value of local connectivity (Maurer and Haber 2007; Musacchio and Read 2007), emphasizing the role of close ties within the core of the business community in providing capital, information, and coordination mechanisms for entrepreneurs. In contrast, this paper brings attention to the capacity of diverse and distant social connections to serve as steps for accessing a wide range of resources that were not available due to the absence of functional markets in the region.

Moreover, the results of this study challenge the conventional perspective on elites in the history of Latin America. Traditional accounts emphasize the ability of elites to maintain a homogeneous identity through practices such as marriage and schooling and to resist the forces of modernization through their social and political influence (Echeverri 1987; Krozer 2022). Instead, this paper portrays a heterogeneous elite with strong interests in modernizing the local economy, whose efforts were significantly constrained by their economic and social circumstances.

In addition to being part of the conversation on the economic and social history of Latin America, this paper contributes to two other branches of literature. First, it is part of a well-established tradition in economic history that investigates social networks (see Esteves and Mesevage (2019) for a survey). The existing literature has acknowledged the significance of social interactions in enforcing contracts in weak institutional settings (Greif 1989, 1993), as well as reducing information asymmetries in credit transactions (Lamoreaux 1994; Meissner 2005). Social networks have therefore been critical in the development of modern capitalism, serving as sources of information (Erikson and Samila 2015, 2018), channels for securing capital (Hoffman, Postel-Vinay, and Rosenthal 2000; Musacchio and Read 2007), and mechanisms for monitoring and regulating behavior (Padgett and Ansell 1993; Frydman and Hilt 2017).

While much of the literature in this field concentrates on economic interactions among businesspeople, this paper expands the scope of observation to include other types of elites, such as influential intellectuals or politicians, and a broader range of social spheres, including friendship, family, politics, arts, and philanthropy, as well as business. This approach aims to provide a more comprehensive understanding of the real social environment of the elite. To my knowledge, such an analysis has not been conducted in the economic history literature, at least not with the level of detail presented in this paper. From that point of view, this paper is more closely related to the literature on multiplexity in sociology (Bliemel, McCarthy, and Maine 2014, 2016), which emphasizes the importance of connections across different realms of social life.

Moreover, I delve into the specific structural features of individuals' networks that were particularly important in their roles as entrepreneurs. I examine the duality between local cohesiveness and global diversity. While previous research has explored this topic in the context of partnership networks in Imperial Russia (Hillmann and Aven 2011), my paper expands on this by examining a broader network beyond strict economic interactions. As a result, this paper presents new evidence on the role of networks in the modernization of traditional societies. It describes how social interactions served as broad channels for mobilizing resources beyond information and capital in situations where markets were unable to satisfy this function. In addition to collecting capital and gathering information about their partners' attributes, entrepreneurs in Antioquia also used their networks to recruit skilled labor, access specialized knowledge, import machinery and supplies, navigate legal barriers, and distribute and advertise their products in remote markets.

Second, this paper contributes to a line of research in applied microeconomics that explores the determinants of entrepreneurship. Recent work on this topic indicates that entrepreneurs are systematically smarter, have more experience in risky behavior, and are rather young (Levine and Rubinstein 2017; Azoulay et al. 2020; Bernstein et al. 2022). This paper goes beyond individual attributes and explores the collective determinants of entrepreneurship, adding to the work of a long tradition in management and sociology that explores the importance of networks in entrepreneurial decisions and performance (Robinson and Stuart 2007; Løvås and Sorenson 2008; Bliemel, McCarthy, and Maine 2016).

The effort to extract evidence from a broad *social milieu*, rather than a specific type of network, also distinguishes this paper from earlier

work. Additionally, most prior research in this field focuses on entrepreneurship in contemporary advanced economies, while this paper examines a traditional society transitioning to modernity. Therefore, this paper aligns more closely with studies like Fafchamps and Quinn (2018), Cai and Szeidl (2018), and Chatterji et al. (2019), which have demonstrated the significant effects of improving the local connectivity of firms and individuals on their managerial practices and performance within months through randomized control trials in Africa, China, and India. My contribution to this work consists of bringing evidence about global connectivity from a natural-environment network that extends for decades.

INSTITUTIONAL CONTEXT

The Industrialization of Antioquia

Antioquia is a region in the western part of Colombia of approximately 76,000 square kilometers of mostly mountainous territories (see Figure 1). Although its formal borders have changed over the years, for the purposes of this paper, I will consider what is known as "Great Antioquia," which includes the current departments of Antioquia, Caldas, Risaralda, and Quindío. Due to its landlocked location and challenging terrain, Antioquia has faced high transport costs, resulting in economic and social isolation, both internally and with the rest of Colombia and the world.

Up until the late nineteenth century, Antioquia was mostly a rural society, with over 70 percent of its workforce employed in agriculture or mining and less than 5 percent in manufacturing. The region's manufacturing sector was small and relied heavily on high-value goods imported from Europe and the United States and a few medium-value goods from other parts of Colombia. Additionally, the settlement pattern reinforced the region's rural features. In the early twentieth century, the region had around 90 municipalities, with only six having populations larger than 20,000 people. Medellín, the capital, was the only municipality with a population exceeding 30,000, with over 48 percent of its population living outside the urban area (Carreño 1912; DANE 1976). All of this prevented the development of a strong urban economy.

The rural economy of Antioquia, however, was particularly productive, more than anything, because of a dynamic gold mining sector. This industry provided a steady supply of currency and capital. Despite this, the region's per capita income was only slightly above subsistence levels

FIGURE 1
MAP OF ANTIOQUIA

Notes: Towns are represented by small diamonds, while cities are represented by large diamonds.
Source: Author's compilation.

and barely surpassed the Colombian average. For instance, in the 1860s, Antioquia's income per capita was only about 35 percent of that in the United States (Mejía 2015). In addition, according to authors such as Brew (1977) and Poveda (1981), the local diet consisted primarily of inexpensive carbohydrates with little to no animal protein.

Overall, Antioquia was not fundamentally different from other semi-peripheral areas in Latin America, where rural dynamics and low living conditions were predominant. However, it rapidly modernized and became the heart of the industrial sector in Colombia, just like other dynamic regions such as Nuevo Leon and Sao Paulo. In 1945, during the first manufacturing census, Antioquia accounted for 22 percent of the Colombian population but employed 32 percent of the workers, 28 percent of the capital, and 35 percent of the energy used in the entire manufacturing sector of the country (Palacio 1947).

Like most of Latin America, the modern manufacturing sector that emerged in Antioquia until the mid-twentieth century mainly consisted of small and medium-sized firms with capital that ranged between a few dozen and a couple of thousand times the yearly income per capita. These firms specialized in consumer goods such as food processing, clothing, and other light industry products and focused on the national market (see Online Appendix Table A22).

The Complexity of Industrial Entrepreneurship

The industrialization of Antioquia has been studied for decades by social scientists and historians, with the local entrepreneur as the main character in the literature. This is reasonable given that industry in Antioquia emerged as the result of local efforts, in contrast to other industrial poles in Latin America. Table 1 shows that the role of immigrants and foreign firms was minuscule in the industrial development of Antioquia, as documented by Maloney and Zambrano (2017). Immigrants owned only 5 percent of industrial firms, which was equivalent to their participation in the overall population. In contrast, in other places like Argentina, 80 percent of industrial firms were owned by immigrants, representing almost three times the fraction of immigrants in the population.

Scholars have developed various theories to explain the remarkable involvement of Antioqueños in industrial activity. A fundamental piece of most of these theories is the identification of some sort of widespread frugal and creative culture in the region. Some suggest that Antioqueños disproportionately come from Basque and Jewish communities, resulting in an intergenerational transmission of norms and attitudes common

TABLE 1
INDUSTRIAL ENTREPRENEURSHIP AND IMMIGRATION:
NORTH AND SOUTH AMERICA

Country	Year	% Owners Immigrants	% Pop. Immigrants	Ratio
Argentina	1900	80	30	2.7
Brazil	1920–1950	50	16.5	3
Chile	1880	70	2.9	24.1
Colombia (Antioquia)	1900	5	4.7	1.1
Colombia (Barranquilla)	1888	60	9.5	6.3
Colombia (Santander)	1880	50	3	16.7
Mexico	1935	50	0.97	51.5
United States (5% census sample)	1900	31	13.6	2.3
United States (Fortune 500)	various	18	10.5	1.7

Source: Maloney and Zambrano (2017).

among those groups (Hagen 1962), while others emphasize collective learning from the challenges of mining (Safford 1965) and the difficulties of daily life in the steep terrain of the region (Brew 1977).

While the accuracy of these cultural explanations is debatable, they do point to the existence of an extraordinarily active business community that, with its involvement in industry, embodied the classical definition of entrepreneurship—people who engaged in new and risky productive activities (Schumpeter 1934; Knight 1921). This community had forged business experience in mining, farming, and trade for decades, but their participation in modern industry implied a whole new range of challenges and risks that none of them had experienced before.

Those challenges and risks were rooted in the dysfunctional nature of local markets. Entrepreneurs looking to establish industrial companies struggled to gather capital because of the limited reach and strength of financial markets in the region. Moreover, they faced obstacles in acquiring knowledge and technology due to a lack of a consistent supply of skilled labor and technical education. Additionally, physical capital was not supplied locally. Entrepreneurs had to import large and modern machinery from Europe, which required dealing with intermediaries, complex correspondence in foreign languages, and extended trips abroad.

These were some of the limitations that poorly functioning markets imposed on entrepreneurial activity. The evidence presented in this paper demonstrates that, in such types of contexts, personal connections were effective supplements to markets as a mechanism for gathering resources. In particular, global connectivity was crucial since it enabled people to access the wide range of complementary resources that industrial activity required but were unavailable through markets.

The Elite and Its Social Capital

Most studies on the industrial emergence of Antioquia begin with an analysis of the elite, which is typically described as a group of local origins that replaced the European-related class that controlled power and wealth during colonial times. This contrasts with the view of traditional elites in the rest of Colombia, where social prestige is usually associated with political influence and aristocratic origins. Frank Safford alludes to this when introducing Medellín as follows: "Medellín was dominated by a fairly powerful bourgeois group, a group of large capitalists that no other provincial capital had... In Medellín, industry and capital dominated the political frenzy" (Safford 1965, p. 55).

The Antioquian elite was a particularly cohesive community, held together by the symbols and the influence of the Catholic Church. Family was the basic social unit, and a significant portion of social interactions revolved around it, particularly those related to business endeavors. An immediate way to see this is to notice that nearly all firms in urban areas were structured as *casas comerciales*. In this type of partnership, the head of a family would share ownership of the business with their adult children and their spouses. As the family grew, new members would join the partnership. Sometimes, a *casa comercial* had two founders, with one contributing capital and the other providing labor. Both founders' families would be included in the partnership, and it was common for families with business partnerships to have intermarriages.

Moreover, even when direct business partnerships were not involved, the family that a person belonged to was the single most important mark of their social prestige. As such, family represented the key to accessing the majority of the economic opportunities available in the region. As Escobar (2004) notes, Antioquia's economy in the period 1850–1920 was essentially a reflection of how the elite built their economic activities guided by signals of prestige such as surnames.

However, the cohesiveness and business-oriented spirit of the elite in Antioquia had their downsides, including the limitation of diversity and the extension of their community. For instance, in the 1880s, a French traveler, Charles Saffray, noted the lack of cultural events and stagnant life in Medellín, likely due to the elitist and exclusive nature of the community (Saffray 1948). Moreover, the elite was resistant to allowing outsiders into their families, leading to endogamic practices that have been associated with high rates of genetic diseases in the region (see Ochoa Gómez 2017). This pattern was also highly evident in the business realm. As the industrial firms of Antioquia expanded throughout Colombia in the

second half of the twentieth century, conglomerates from other regions tried to acquire them. In response, the Antioquian elite created a *keiretsu*, a system of interlocking shareholdings among the largest companies in the region, to protect themselves from outsiders' acquisitions.

METHODOLOGY AND NETWORK DATA

Local Cohesiveness vs. Global Diversity

In the previous section, I discussed how decades of research suggest that the social capital of the elite played a crucial role in the emergence of industrial capitalism in Antioquia. However, most of this research has focused solely on the importance of social cohesion. Yet, scholars in the social networks field have pointed out that entrepreneurship also benefits from exposure to a broad and diverse network (see Kim and Aldrich 2005; Hillmann and Aven 2011).

In this paper, I seek to explore this duality at the individual level. Specifically, I aim to examine whether industrial entrepreneurship within the elite was more prevalent among individuals who were part of more cohesive networks or among those who had access to more diverse networks.

To discipline this exercise, I will focus on two network metrics: (i) *clustering coefficient*, which captures the number of connections of a node that are connected among themselves, and (ii) *betweenness centrality index*, which captures the number of times a node acts as a bridge along the shortest path between two other nodes.

By using the clustering coefficient, we can determine whether an individual is part of a tightly-knit community where most members interact directly with each other. This metric is useful in understanding how an individual embedded in a dense local network can benefit from it. There are two main theoretical mechanisms that explain how this works.

Firstly, being part of a dense network helps individuals obtain more accurate information. The quality of information degrades as it passes through intermediaries. Increasing the number of direct connections between individuals reduces the number of intermediaries and improves the transmission speed and reception quality of information. For entrepreneurs, this means that crucial information such as business opportunities, new regulations, and supply prices can be disseminated more quickly and accurately in a dense network, leading to increased profitability.

Secondly, being part of a dense network promotes social sanctioning. Dense networks facilitate collective punishment of free-riding behavior, making it easier for individuals to trust one another (Jackson,

Rodriguez-Barraquer, and Tan 2012). This trust reduces transaction costs and generates incentives for developing highly uncertain productive activities, such as entrepreneurship (Amit, Glosten, and Muller 1990).

Empirical studies in social network analysis confirm the advantages of being embedded in a dense network. For instance, Fried and Hisrich (1994) and Shane and Stuart (2002) show that venture capitalists tend to invest in startups they learn of through referrals by members of their inner social circle, including fellow venture capitalists and family members. Entrepreneurs themselves benefit from an embedded network of strong ties to secure crucial resources, as Elfring and Hulsink (2003) show for high-tech companies in the Netherlands. Part of this seems to be related to the regulating capacity of close ties. For instance, Robinson and Stuart (2007) demonstrate in a variety of industrial scenarios that the connectivity of the alliance network effectively captures the ability of firms to penalize misconduct.

Meanwhile, betweenness centrality offers an idea of how important a node is in the communication—or transmission of whatever is flowing through social interactions—in the network as a whole. As most real-life networks have strong homophilic patterns, in which somewhat isolated clusters are common (Watts 1999), a person with high betweenness centrality tends to have the advantage of rapidly bringing together diverse groups of people. In that sense, betweenness centrality provides insight into how well-connected an individual is at a global level.

To understand why individuals who act as important bridges at a global level have advantages, consider a context where there are no effective coordinating methods for exchange (no well-functioning markets or any type of centralized assignment institution), no efficient mechanisms of information diffusion (no mass media, no widespread public signals), or high costs associated with interacting with individuals outside of one's social circle. In such a context, potential entrepreneurs who lack a strong position as bridges may not be exposed to resources or information beyond their cluster, limiting their awareness of business opportunities or their ability to exploit them.

Empirical evidence from the social network analysis literature on entrepreneurship supports the existence of these mechanisms. For example, Stuart and Ding (2006) show that scientists with broad collaboration networks more frequently create companies. Renzulli, Aldrich, and Moody (2000) demonstrate that entrepreneurs with networks that spanned "multiple domains of social life" founded new firms with a higher frequency, and Elfring and Hulsink (2003) find evidence that weak ties facilitated the identification of business opportunities.

Data

All the data used in this paper comes from a large-scale historiographical dataset specifically designed for this purpose. The dataset contains information on the elite members of Antioquia during the nineteenth and twentieth centuries, including their relational data and individual attributes. It also includes data on industrial firms established between 1850 and 1930, such as the firms' attributes and the identities of their shareholders. Merging the individual data with the firm data produced a new individual-level dataset that contains information on individuals' location in the network, their attributes, and their industrial entrepreneurship decisions.

RELATIONAL DATA AND INDIVIDUAL ATTRIBUTES

The first part of the dataset comprises information on 1,876 individuals who belonged to the elite of Antioquia during the nineteenth and twentieth centuries. The data provide a comprehensive account of the economic, political, and intellectual activities of each individual. To construct this dataset, I combined two components.

First component: First, I used a snowball approach, a classical method for sampling social networks (Coleman 1958; Goodman 1961). This method involves starting with a few well-connected subjects, then expanding the sample by identifying their social connections, and continuing this process iteratively. This approach is also common outside social network analysis, particularly in studies of hidden populations that are difficult for researchers to access, such as drug users or sex workers (Browne 2005).

I began with the four largest shareholders in the banking system in 1888. As banks were the largest firms in Antioquia at the onset of industrialization, those individuals were likely to be particularly well-connected. I collected information about their lives from various sources, including genealogical records, business reports, and historical narratives, and created a biographical profile for each of them.[1] From these four individuals, I expanded the sample by including their family members and important partners in other activities.[2] The sample ultimately consisted of 953 people, each with a biographical profile and information about their social interactions. The temporal boundaries of the sample were 1740 and 1905.

[1] The sources used included more than one hundred documents located in over 15 archives and around 185 secondary sources. A Spanish version of these data with details on the sources used can be found in Mejía (2012).

[2] An additional criterion for incorporating an individual into the sample was their appearance in at least two different sources. This is to avoid inaccuracies in the identification of individuals.

Second component: The data collected using the snowball method is a reasonable first approximation to the structure of the network but has inherent biases and is not a suitable representation of the elite population. For instance, the sample has a large number of women, even though they had a minor role in public spheres like politics and business during the period analyzed. Similarly, there are other biases related to the overrepresentation of certain families and people associated with banking that cannot be eliminated without disrupting the network configuration.

To reduce these biases, a second component was added, which involves identifying projects that are representative of the elite's public spheres, such as social clubs and intellectual associations, and including their members in the dataset. This information comes from directorates and lists of members of these organizations. Common participation in a project is considered a tie between individuals. The projects were identified using the same criteria as the first component, and there was no particular bias other than what is considered relevant by historiography.

Nearly 60 percent of the individuals recorded in the first component were found in the second component, resulting in the inclusion of 923 additional people in the sample. However, there was no other information available for these new individuals other than their participation in the projects. Therefore, they are part of the social networks constructed, but there will be no controls for them in the empirical exercise.

How representative is this sample? Once the two components are combined, the study has a fairly extensive amount of information on 1,876 individuals, most of whom were in their productive lives in the last two decades of the nineteenth century and the first two of the twentieth century (see Online Appendix Figure A10). The purpose of both components was to capture a significant number of people who can be classified into a classical definition of "the elite": a small group of people who control a disproportionate fraction of the key social spheres in society (Bottomore 1993). Since this definition is rather vague, it is difficult to determine precisely how representative this sample is. Nonetheless, based on available historiographical evidence and newly digitized sources, it appears that this sample accurately portrays the main features of Antioquia's elite.

To begin with, the sample aligns with the qualitative description of the elite presented by various authors, including Brew (1977), Escobar (2004), and Davila (2012). This is a population largely concentrated in Medellín and had an extensive range of occupations, but for whom commercial and banking activities were particularly salient. The surnames in the sample are well known in the literature as being highly prestigious

(Ochoa Gómez 2017). The five most common first surnames are: Uribe (7.8 percent), Restrepo (7.2 percent), Santamaría (3.85 percent), Jaramillo (3.37 percent), and Mejía (2.99 percent). Additionally, around 9 percent of the sample, or 166 people, were founders of industrial projects during the analysis period. This is reasonable for an agrarian society in which industry is still emerging. For instance, this figure is similar to the one found by Bennett et al. (2020) for the United Kingdom between 1851 and 1911.

While the definition of "elite" used in this study is not entirely synonymous with affluence, the Antioquian elite is characterized by a culture focused on wealth accumulation. Therefore, a reasonable representation of this elite would be expected to be exceptionally affluent. By comparing my sample with recently discovered records of wealth censuses conducted in Medellín, it is evident that this group of individuals was indeed quite prosperous. Online Appendix Table A20 reveals that the average member of my sample was approximately twice as wealthy as the average person in the censuses. This pattern increases considerably when examining the top 10 percent of the population (refer to Online Figure A12 for a more detailed distributional comparison).

It is important to note that the individuals recorded in the wealth censuses already represented the upper tail of the income distribution, particularly in the 1890 census. As a point of reference, the per capita income in Antioquia in the mid-nineteenth century was approximately 30 pesos. Given this, it is reasonable to infer that the sample constructed in this study refers to an exceptionally rich group of people.

Overall, considering that the total population of the region at the turn of the century was approximately 600,000, I would prudently think about this sample as a significant portion of the 1 percent most influential individuals in Antioquia.

FIRM DATA

The second part of the dataset provides information on the creation of industrial firms. This part was created using founding charters and secondary sources and includes details about each firm's economic activity, capital investment, location, patents, number of workers, founding and closing dates, and founders' identities. The amount of information available varies widely across the firms. I identified 292 firms involved in industrial activities, for which I know their constitution dates and their activity at a granular level. Of these, 126 had records of their founders' identities and capital structures.

The firms for which I have information on their founders had, on average, 57 more workers and 66 hp more energy capacity than those firms for which I do not know their founders' identities. The firms with records on their founders were also created earlier and survived longer—as shown in Online Appendix Table A21. This is in line with the expectation that larger and more established firms are more likely to have records that have been preserved and noticed by scholars over the years.

Of the 292 firms, 97 of them had shareholders who were identified in my elite database. This indicates that the founders of the remaining 29 firms were either not part of the social circle of the elite or were part of it but escaped my sampling. At the firm level, I found that those 29 firms with founders outside the elite were not statistically different from the others; however, on average, they were smaller according to all metrics.

How representative is this sample? Since there was no manufacturing census available before 1945, more than a decade after the end of my period of analysis, it is difficult to determine the extent to which the firms I have observed represent the entire universe of industrial ventures. Nonetheless, the high quality of business-history research in the region provides confidence that the data collected includes nearly all of the large industrial firms founded until 1930.

To support this claim, it is worth noting that the main characteristics of the observed firms (see Online Appendix Figure A11) are consistent with what is known about the industrialization of the period. First, the timing of industrial expansion described by authors such as Davila (2012) and Brew (1977) follows the pattern of my data: a slow increase in the creation of firms in the second half of the nineteenth century, with a small boom during the early 1900s, followed by the massive expansion of the 1910s and 1920s. Second, as widely accepted in the literature, my data reveal a concentration of industrial activity in Medellín and its surrounding area (Caldas, Envigado, and Bello), with a second pole in what is known as the Old Caldas (Pereira and Manizales). Finally, my data describe an industrial sector that is predominantly comprised of light-industry firms focused on food processing and textiles, as extensively shown by Echavarría (1999) and Montenegro (2002), and as confirmed by the 1945 census data—see Online Appendix Table A22.

The industrial firms in the region during the period of analysis were distinct from other sectors of the economy. The urban economy was small at the time, with most economic activity concentrated in rural production. Within the urban economy, industrial firms were technologically advanced and more labor-intensive compared to most other firms, which

were typically family-owned trading companies with a small number of employees. However, industrial firms were relatively small in comparison to banks. The average bank had 61.4 shareholders and an average equity of 143,000 pesos, while the average industrial firm had only 5.4 shareholders and an equity of 16,000 pesos, which was between 200 and 300 times the yearly income per capita of the region at the time (Mejía 2023). Despite their small size, industrial firms were more resilient than banks, with an average survival rate of over 40 years compared to the 20.1-year average survival rate for banks.

In terms of organizational structure, industrial firms were typically family businesses where boards of directors were not commonly used. The founders of industrial firms controlled the operations, and their families retained that control even after the founders retired. Therefore, investing in an industrial firm was not just a financial decision but also an entrepreneurial one, requiring significant involvement in the start-up and daily management of the company.

Networks

Based on the relational data, I can reconstruct the social network and determine the connectivity attributes of each individual in the network. To do this, I categorize social ties into seven different dimensions of interaction, treating each dimension as an independent network. At first, I describe the networks as static objects, which is a common approach in the literature. However, I also analyze the networks as dynamic objects, taking into account their temporal dimension.

STATICS

Table 2 outlines the criteria used in constructing the networks to ensure the accurate identification of important social interactions based on the available information. To illustrate, for the political network, instead of choosing all individuals and defining ties based on partisan affiliation, a stricter definition was applied, selecting only public servants who were part of the same cabinet. While this reduces the size of the network, it provides greater confidence in the type of interaction described since there is not enough evidence to prove that individuals with the same partisan affiliation had genuine interactions. In contrast, there is the certainty that those who were part of the same cabinet had significant interactions in political spheres, thus reducing error type I. The resulting networks are shown in Online Appendix Figure A13.

TABLE 2
CRITERIA USED IN THE CONSTRUCTION OF THE SOCIAL NETWORKS

Network			Nodes	Edges	Weights	Period
Family			All	Parents, couples, children, and siblings	None	1740–1999
Political			Public servants	Members of common cabinets. Direct bosses. Direct subordinates	Number of interactions	1820–1950
NGOs	Civic		Members of the same civic organization	Members of the same organization	Number of interactions	1840–1950
	Guilds		Members of the professional association	Members of the same association	Number of interactions	1880–1935
Business	Modern sector	Banking	Banking shareholders	Shareholders of the same company	Number of interactions	1875–1988
		Modern sector	Shareholders of non-animal driving firms	Shareholders of the same company	Number of interactions	1880–1930
		Urbanization	Urbanization shareholders	Shareholders of the same company	Number of interactions	1880–1930
	Traditional sector	Agriculture	Agricultural shareholders	Shareholders of the same company	Number of interactions	1850–1930
		Husbandry	Husbandry shareholders	Shareholders of the same company	Number of interactions	1850–1930
		Mining	Mining shareholders	Shareholders of the same company	Number of interactions	1750–1880
		Mule driving	Mule driving shareholders	Shareholders of the same company	Number of interactions	1750–1865
Intellectual			Members of intellectual circles	Partners at the same an intellectual project	Number of interactions	1750–1997
Friendship			All	Friend. Member of the same social club	None	1750–1998
Complete			All	All excepting banking edges	Number of interactions	1750–1999

Notes: This table displays the criteria that were used to define interactions. *All* denotes that any individual in the sample could be part of the single network.
Source: Author's compilation.

The trade-off of using strict inclusion rules for ties is the risk of overlooking significant connections in a network. This might intensify the *boundary specification problem* (see Laumann, Marsden, and Prensky 1983). However, this problem applies to every empirical network, and there are ways to mitigate it. Kossinets (2006), for instance, proposes the use of multiple sources of edge nomination and the procurement of multi-modal networks. For their part, Fowler and coauthors suggest collecting multiple sources of evidence and triangulating them in order to overcome the challenges of causal identification in network analysis (Fowler et al. 2011). Drawing on both ideas in a hybrid approach, this paper runs its main results on a *complete network*,[3] which gathers the different dimensions of interactions in a multi-modal spirit, drawing from several independent sources.

Thus, the complete network comprises a broad range of relational patterns, consisting of various types of ties with unique characteristics. These networks differ in the type of relationships they offer, providing diverse resources and information. For example, family ties usually involve frequent and intimate interactions, whereas political ties tend to involve occasional interactions focused on public, rather than private information. The unique characteristics of each network are reflected in their distinct structural features, as presented in Table 3. As expected based on intuition and historical evidence, modern-business networks, which require complex multilateral cooperation and supportive ties, are typically larger and denser than non-business networks, which tend to feature more stable bilateral interactions.

DYNAMICS

While the static analysis provides a comprehensive view of the network, it fails to capture the dynamic nature of social interactions. Individuals are born and die, relationships form and dissolve, and the network structure evolves over time. To address this issue, I conduct a decade-based analysis, which provides an approximate view of the network's evolution over time. Table 4 presents the changes in network size and composition over the decades. As expected from the sampling process, the network grew in the late eighteenth century, reaching its peak in the 1890s, after which it began to decline. Nevertheless, for *the core period* (1850–1930)—when we have industrial entrepreneurship information—the network seems to have a stable pattern.

[3] The complete network includes every interaction, except those generated in the banking business. The reason for excluding banking ties is that they form an exceptionally large and dense network, whose edges might not even represent real social interactions as we understand them. In the Online Appendix, I expand on this.

TABLE 3
CROSS SECTION: MAIN CHARACTERISTICS OF THE SOCIAL NETWORKS

Network	Nodes	Edges	Diameter	Density	Connected Components	Betweenness	Clustering Coefficient
Complete	1,876	11,717	14	0.003	8	721.1 (1759.1)	26.37 (35.95)
Family	903	4,781	18	0.001	23	630.9 (1365.7)	5.94 (7.61)
Political	228	320	9	0.0009	14	0.798 (10)	1.45 (10.71)
Friendship	184	979	5	0.0003	23	0.106 (1.86)	5.86 (23.19)
Intellectual	153	723	9	0.0002	11	1.17 (15.2)	5.54 (21.96)
Traditional sector	162	738	9	0.0002	15	0.067 (1.1)	7.44 (25.73)
Agriculture	83	469	2	0.0001	15	0.0001 (0.006)	4.24 (20.13)
Mining	57	125	5	0.0004	7	0.014 (0.246)	2.30 (14.57)
Animal husbandry	26	113	1	0.0003	4	0 (0)	1.18 (10.79)
Mule driving	15	37	1	0.0001	4	0 (0)	0.80 (8.92)
Modern sector	685	105,871	5	0.03	3	78.5 (1595.2)	35.15 (47.19)
Banking	651	105,653	4	0.03	1	12 (274.8)	34.16 (47.00)
Urbanization	23	75	2	0.0002	3	0.005 (0.21)	1.20 (10.84)
Modern transport	19	145	2	0.0004	3	0.009 (0.39)	0.13 (1.51)
NGOs	282	4,111	7	0.01	4	0.834 (14.7)	14.46 (34.71)
Civic	193	2,957	7	0.0008	6	0.259 (5.14)	10.00 (29.74)
Guilds	101	1,159	4	0.0003	4	0.009 (0.22)	5.31 (22.32)

Notes: "Nodes" refers to total non-isolated nodes, aggregated across networks, "Betweenness" is the average betweenness centrality (scaled by 10^6), and "Clustering" is the average clustering coefficient (scaled by 10^2), with standard deviations in parentheses.
Source: Author's compilation.

TABLE 4
PANEL: MAIN CHARACTERISTICS OF THE COMPLETE NETWORK

Decade	Nodes	Edges	Density	Diameter	Average Path Length	Betweenness	Clustering Coefficient
1770	30	37	0.085	2	1.1	164.2 (899.3)	64.4 (47.9)
1780	62	103	0.054	2	1.2	176.2 (1091.8)	60.7 (48.6)
1790	93	58	0.014	4	2.1	413.5 (1406.3)	18.2 (37.4)
1800	208	243	0.011	11	4.5	1973.0 (7741.5)	28.6 (40.3)
1810	284	371	0.009	13	4.9	2658.1 (9135.1)	28.6 (39.0)
1820	404	557	0.007	13	4.9	2049.8 (7193.9)	29.5 (38.9)
1830	513	885	0.007	11	4.8	2197.8 (7601.8)	30.1 (37.9)
1840	1,162	3,362	0.005	16	4.5	422.9 (1698.1)	24.8 (38.3)
1850	1,363	3,987	0.004	16	4.8	504.8 (1950.3)	28.4 (39.5)
1860	1,500	4,204	0.004	12	4.8	514.9 (2045.5)	27.8 (38.3)
1870	1,617	5,054	0.004	15	4.9	588.6 (2011.5)	30.4 (38.2)
1890	1,762	4,124	0.003	16	4.7	425.9 (1603.0)	26.1 (36.7)
1900	1,411	3,706	0.004	18	4.6	628.6 (2231.1)	29.2 (38.2)
1910	1,287	3,933	0.005	12	4.1	562.6 (2165.0)	31.6 (39.2)
1920	696	3,580	0.015	13	4.2	2771.1 (8896.1)	53.8 (38.5)
1930	491	2,044	0.017	11	3.9	2427.1 (9570.0)	51.3 (39.7)
1940	338	930	0.016	14	4.5	3089.5 (12771.1)	47.1 (42.2)
1950	180	333	0.021	13	4.8	4120.9 (14666.2)	39.1 (42.8)
1960	79	64	0.021	4	1.4	130.67 (627.35)	28.2 (43.1)

Notes: "Nodes" indicates total non-isolated nodes, "Betweenness" is the average betweenness centrality (scaled by 10^6), and "Clustering" is the average clustering coefficient (scaled by 10^2).
Source: Author's compilation.

The various networks exhibit different behaviors over time, as expected. The duration of connections varies greatly across networks, as shown in Online Appendix Figure A15. This variation is consistent with the types of interactions that make up each network. Non-market ties, such as family, friendship, and intellectual ties, tend to last longer on average than ties with a specific objective, such as political and guild ties. This variation in connection duration implies different flows of resources and information. For example, short-term interactions may not be sufficient to support long-term investments, such as starting a risky business.

It is important to acknowledge that individuals do not simultaneously enter and exit the network, resulting in the network composition at a given moment differing from that of the corresponding decade. At any given time, there are individuals who have not yet been born but will become part of the network for a specific decade, as well as those who have already passed away but were part of the network during that period. This introduces a challenging measurement error that is difficult to quantify and is a common issue encountered in empirical research on dynamic networks. In every relevant context, connections are continuously formed and dissolved, yet the recording of interactions struggles to keep pace with the rapidity of these changes. Hence, it is prudent to

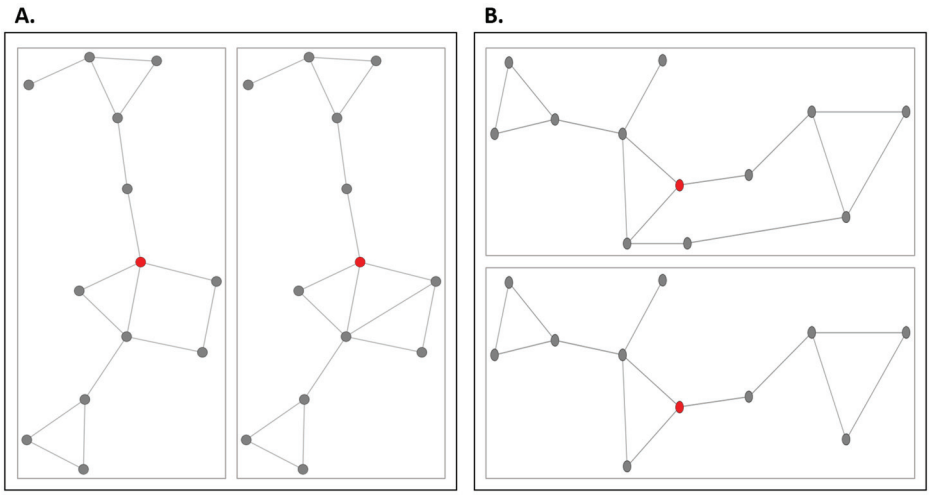

FIGURE 2
IDEAL EXPERIMENTS

Source: Author's compilation.

interpret results derived from dynamic data, particularly when employing statistical inference, with caution, as emphasized in the seminal work by Christakis and Fowler (2013).

Estimation and Identification Strategy

Based on the conceptual framework presented earlier, a logical approach to identifying the influence of network position on individual outcomes, such as entrepreneurship, would involve a set of experiments as follows: (i) increasing the clustering coefficient of an individual while keeping other factors constant, particularly their betweenness centrality, and (ii) increasing the betweenness centrality of an individual while keeping other factors constant, specifically their clustering coefficient. Panel A of Figure 2 illustrates an example of (i), while Panel B demonstrates an example of (ii). If systematic differences in entrepreneurship levels emerge from such experiments, it would indicate the significance of global connectivity or local density in relation to entrepreneurship.[4]

Given the limitations of observational settings, I cannot perfectly execute these experiments in my case study. However, I can provide three sources of evidence that approximate them. Each of them has its flaws, but I consider that, jointly, they offer a coherent and reasonable understanding

[4] The full set of estimates underlying this analysis are available through the published replication files (Mejía 2024).

of the importance of individuals' social network positions in their entrepreneurial decisions during the industrialization of Antioquia.

First, I present cross-sectional evidence by examining whether individuals with similar characteristics but different network positions had varying levels of entrepreneurial involvement by the end of their lives. To investigate this, I employ a naive linear model estimated through ordinary least squares (OLS) as follows:

$$Y_i = \beta + \boldsymbol{X}_i\alpha + \boldsymbol{Z}_i\gamma + \varepsilon_i, \tag{1}$$

where Y_i is the number of industrial firms founded by individual i; $\boldsymbol{X}_i$ is the vector that characterizes the network position of individual i—betweenness centrality and clustering coefficient; $\boldsymbol{Z}_i$ represents relevant controls; and ε_i is the error term.

Second, to complement the analysis of cross-individual variation, I employ a longitudinal model to examine whether changes in an individual's network position over time are associated with variations in their level of entrepreneurship. Specifically, for individual i at time t, I estimate the following specification:

$$Y_{it} = \beta + \boldsymbol{X}_{it}\alpha + \theta_i + \phi_t + \varepsilon_{it}. \tag{2}$$

Here, θ_i represents individual fixed effects that aim to account for unobserved factors specific to each individual that do not change over time, and ϕ_t are time fixed effects that control for aggregate events that vary over time.

Finally, I exploit the unexpected deaths of elite members as a set of exogenous shocks to the network. This quasi-experimental approach aims to address deeper concerns about endogeneity and provides insights into potential causal relationships. Specifically, for individual i at time t, I estimate the following model:

$$Y_{it+1} = \beta + \boldsymbol{D}_{it}\alpha + \theta_i + \phi_t + \varepsilon_{it}, \tag{3}$$

where $\boldsymbol{D}_{it} = \boldsymbol{X}_{it} - \boldsymbol{X'}_{it}$ being $\boldsymbol{X'}_{it}$ is the vector that contains the clustering coefficient and the betweenness centrality of individual i in a synthetic network at period t, where nodes that perish unexpectedly during t are removed. In other words, $\boldsymbol{D}_{it}$ captures the gain or loss in the connectivity of individual i during period t, exclusively resulting from the disappearance of an individual from the network. As these deaths are sudden and unexpected, $\boldsymbol{D}_{it}$ should not be correlated with ε_{it}, and its correlation with Y_{it+1} should be

indicative of a causal relationship between the variation of *i*'s connectivity and their entrepreneurial decisions.

MAIN RESULTS

Statics

When examining the data from a static perspective, an interesting observation emerges: industrial entrepreneurship was not a common pursuit among the elite. On average, individuals in the sample founded only 0.15 industrial firms throughout their lifetime, with a standard deviation that is approximately five times larger than that value.

Exploring the relationship between an individual's network position and their lifetime industrial entrepreneurship cross-sectionally, as in Equation (1), reveals two key findings (see Table 5). First, there is a positive correlation between betweenness centrality and entrepreneurship. Individuals who held more influential positions in bridging the network tended to find a greater number of industrial firms. Specifically, individuals with a betweenness centrality measurement one standard deviation higher than the average for identical individuals (in terms of observable variables) founded an additional 0.07 industrial firms. This is a fairly large coefficient, considering that it represents about 46 percent of the industrial firms founded by the average individual. Importantly, this correlation remains statistically significant even after accounting for relevant confounding factors proposed by the literature on the industrialization of Antioquia, such as being a merchant or an immigrant.

The second result reveals that the coefficient capturing the relationship between the clustering coefficient and entrepreneurship is statistically insignificant. This suggests that there is no evidence supporting the notion that individuals embedded in denser networks at a local level were more likely to create new firms over their lifetimes.

It is important to note that these results, although derived from a basic model, already account for a wide range of individual controls, including gender, partisan affiliation, family wealth in 1850, family ethnic origin, higher education, and studies abroad, as well as information on birth, marriage, and death dates and locations.

Dynamics

To exploit the temporal variation in the data, I focus on *the core period* (1850–1930). This period is chosen because prior to 1850 there was no industrial activity, and data on entrepreneurship for the subsequent

TABLE 5
CROSS SECTION: INDUSTRIAL ENTREPRENEURSHIP AND SOCIAL NETWORKS

	Entrepreneurship									
Betweenness	0.090**		0.090**	0.084**	0.091**	0.087**	0.080**	0.090**	0.084**	0.069*
	(0.037)		(0.038)	(0.037)	(0.038)	(0.038)	(0.037)	(0.038)	(0.037)	(0.036)
Clustering coefficient		0.038	0.007	0.004	0.009	–0.007	–0.005	0.006	0.008	0.018
		(0.071)	(0.074)	(0.074)	(0.074)	(0.075)	(0.072)	(0.074)	(0.074)	(0.073)
Banker				0.118*						0.06
				(0.061)						(0.064)
Immigrant					0.173					–0.212
					(0.172)					(0.222)
Engineer						0.293*				0.25
						(0.16)				(0.177)
Miner							0.387***			0.339*
							(0.148)			(0.178)
Politician								0.012		0
								(0.078)		(0.079)
Merchant									0.209***	0.170**
									(0.074)	(0.076)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	954	954	954	954	954	954	954	954	954	954

Notes: The unit of observation is the individual, and industrial involvement is measured as the number of firms founded by an individual during their lifetime. Independent variables are standardized, with robust standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's compilation.

TABLE 6
PANEL: INDUSTRIAL ENTREPRENEURSHIP AND SOCIAL NETWORKS

	Entrepreneurship				
Betweenness	0.121***		0.122***	0.092***	0.060***
	(0.026)		(0.026)	(0.024)	(0.023)
Clustering coefficient		0.017	0.023	0	–0.038**
		(0.015)	(0.014)	(0.014)	(0.016)
Individual FEs	Yes	Yes	Yes	Yes	Yes
Time FEs	—	—	—	Yes	Yes
Network controls	—	—	—	—	Yes
Number of periods	8	8	8	8	8
Observations	11,256	11,256	11,256	11,256	11,256
Number of individuals	1,806	1,806	1,806	1,806	1,806

Notes: The unit of observation is individual-decade. The sample period covers 1850–1930, and industrial involvement is measured as the number of firms founded by an individual during the respective decade. Robust standard errors are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's compilation.

decades is unavailable. Using the panel data approach of Equation (2), I obtain results similar to those of the cross-sectional approach. As shown in Table 6, betweenness centrality exhibits a positive and statistically significant correlation with the establishment of new firms. More concretely, an individual who experiences an increase of one standard deviation in betweenness centrality is associated with the creation of approximately 0.06 new firms within a decade. This increase represents 80 percent more firms compared to the average.

In contrast, the coefficient related to the clustering coefficient, while statistically significant in the preferred model, exhibits considerable instability across different specifications. This inconsistency makes it difficult to confidently interpret it as evidence that higher local connectivity was systematically associated with lower levels of entrepreneurship.

Exogenous Network Variation

To address the potential for multiple interpretations arising from the observed correlations, I conducted extensive tests in the Online Appendix. These tests included the incorporation of additional controls, the utilization of different estimation models, and a comprehensive analysis of measurement error. Overall, the results remain highly robust, consistently indicating that individuals with higher betweenness centrality tended to create more firms, while those with a higher clustering coefficient did not.

Furthermore, I employed the timing of firm creation to examine whether the observed correlation could be explained by a reverse causal

effect, wherein entrepreneurship led to subsequent increases in global connectivity. The analysis presented in the Online Appendix reveals that the previous results cannot be attributed to reverse causality.

Despite the narrowing down of plausible interpretations achieved through these exercises, it is important to acknowledge that several endogeneity concerns persist. To address these concerns, I capitalize on exogenous shocks to the network caused by the sudden disappearance of nodes. Specifically, I identified individuals in the sample who experienced unexpected deaths during the core period, referred to as *delta individuals*. A total of 13 delta individuals were identified (see Table A12 from the Online Appendix), and a balance test (Table A13 from the Online Appendix) demonstrates that, apart from the expected difference in age at death, delta individuals did not exhibit statistically significant differences from the rest of the sample.

Using this information, I constructed synthetic networks by removing the delta individuals who died during each period. By comparing these networks with the original network, I could identify non-delta individuals who experienced exogenous variations in their connectivity levels.

Unfortunately, in most cases, the disappearance of delta individuals did not generate systematic variations in clustering coefficient measures. This is because the clustering coefficient describes the immediate neighborhood of an individual in the network, and a small number of deaths are unlikely to substantially alter the structure of local neighborhoods in real-life networks. However, the removal of delta individuals and other random changes in the network did lead to significant variations in the composition of shortest paths and, consequently, a considerable change in the distribution of betweenness centrality.

This identification strategy, similar to the one employed by Mohnen (2022) to estimate heterogeneity in peer effects among research scientists, represents the first application of this type of variation to estimate global connectivity effects, to the best of my knowledge.

Based on this, we can observe that, with the exception of the 1920s, individuals whose betweenness centrality increased due to the disappearance of delta individuals consistently created more firms in the subsequent period compared to those whose betweenness centrality did not experience such an increase (see Figure 3).

This variation provides further support for the findings presented previously. Given that the disappearance of delta individuals is sudden and unexpected, we could understand the variation in the betweenness centrality that results from it as exogenous and the higher creation of firms as, most likely, a cause of this variation.

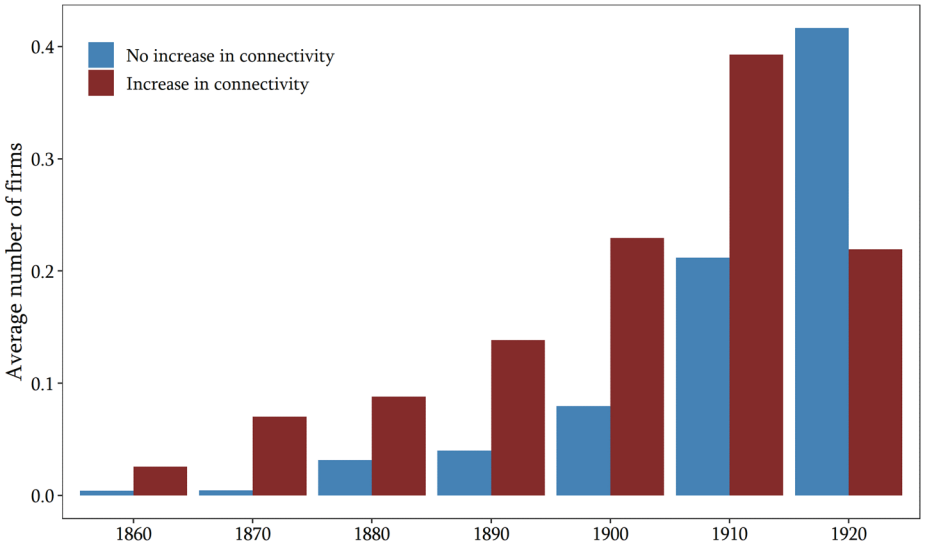

FIGURE 3
CREATION OF NEW FIRMS. INCREASE VS NON-INCREASE
IN GLOBAL CONNECTIVITY

Notes: This figure displays average firms created by decades, differentiating individuals with increased betweenness centrality due to delta individuals' disappearance (red) from those without increase (blue).
Source: Author's compilation.

Table 7 presents estimates of Equation (3), which confirm the robustness and statistical significance of this result throughout the entire core period. On average, individuals with a one standard deviation higher betweenness centrality in the synthetic network, compared to the original network, created 0.013 new firms in a decade. This represents approximately 17 percent more firms than the average.

In the Online Appendix, I present a series of validity tests to demonstrate the soundness of this quasi-experiment. I show that the obtained result is not contingent on the specific composition of the delta individuals. I also include a placebo test, which indicates that the shocks under consideration do not impact other outcomes that are not expected to be affected.

MECHANISMS

This section combines quantitative and qualitative evidence to investigate the reasons why members of the Antioquian elite with higher betweenness centrality were more involved in entrepreneurship. The

TABLE 7
QUASI-EXPERIMENT: INDUSTRIAL ENTREPRENEURSHIP AND SOCIAL NETWORKS

	Entrepreneurship			
Change betweenness	0.014*	0.014*	0.013*	0.013*
	(0.007)	(0.007)	(0.007)	(0.007)
Individual FEs	Yes	Yes	Yes	Yes
Clustering coefficient control	—	Yes	Yes	Yes
Time FEs	—	—	Yes	Yes
Network controls	—	—	—	Yes
Number of periods	8	8	8	8
Observations	11,241	11,241	11,241	11,241
Number of individuals	1,805	1,805	1,805	1,805

Notes: The unit of observation is individual-decade. The sample period is 1850–1930. Entrepreneurship is measured as the number of firms founded by an individual during the considered decade. Robust standard errors are in parentheses. Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: Author's compilation.

findings point towards a compelling explanation: social connections were leveraged to overcome the limitations of imperfect markets in resource acquisition. Given the complex nature of entrepreneurship, which necessitates a diverse range of complementary resources not readily available at the local level, individuals who held a prominent bridging role in the network had a distinct advantage. Their ability to access and integrate various resources more efficiently enabled the creation of robust industrial firms. In the Online Appendix, I provide evidence on the implausibility of several alternative mechanisms.

Global Bridges Were Not More Innovative, But More Successful

It is worth noticing that insights from the literature on networks and innovation suggest that global bridges serve as channels for creativity and technological advancement (Fleming, Mingo, and Chen 2007). The idea is that bridges, by being exposed to diverse ideas, have the potential to combine them and generate new methods or technologies, thereby facilitating deeper involvement in entrepreneurship. However, this does not seem to be the case during our period of analysis, at least not in a direct manner.

There is no compelling evidence to suggest that individuals with higher betweenness centrality were more inclined toward innovative entrepreneurship. In other words, a higher betweenness centrality was not significantly associated with the creation of firms that obtained more patents or engaged in activities with a greater level of technological intensity (as shown in Table 8).

TABLE 8
CROSS SECTION: FIRMS' PERFORMANCE AND SOCIAL NETWORKS

	Patents		Tech Intensity		Success	
Betweenness centrality	0.002	0.0003	0.014	0.007	0.077***	0.066**
	(0.017)	(0.016)	(0.014)	(0.013)	(0.027)	(0.026)
Clustering coefficient	–0.072	–0.097	–0.022	–0.052	0.111	0.047
	(0.088)	(0.096)	(0.081)	(0.079)	(0.131)	(0.134)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Extended controls	—	Yes	—	Yes	—	Yes
Observations	115	115	115	115	115	115

Notes: The unit of observation is the individual entrepreneur. Patents are measured by the total number of patents registered by firms founded by the entrepreneur before 1930, divided by the total number of firms founded by the entrepreneur over their lifetime. Tech intensity is measured by the total number of high-technology firms founded by the entrepreneur, divided by the total number of firms founded by the entrepreneur over their lifetime. Success is predicted by a principal components analysis that considers the number of firms that (i) did not reach one year of existence, (ii) did not reach their expected lifespan, (iii) went bankrupt, and (iv) closed during the Great Depression, divided by the total number of firms founded by the entrepreneur over their lifetime. Robust standard errors are in parentheses. Significance levels: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: Author's compilation.

Nonetheless, entrepreneurs, who were more important as bridges, created more successful firms. This implies that the benefits linked to enhanced global connectivity extend beyond the realms of technological adoption and innovation. Instead, they encompassed factors that contributed to the overall existence and longevity of entrepreneurial endeavors.

The Need for Complementary Resources

To understand what made an industrial firm resilient and successful and how that related to the position of its founders on the social network, consider again the challenges of industrial entrepreneurship mentioned earlier. By examining these challenges, it becomes evident that they need to be overcome simultaneously. Merely possessing capital without the ability to efficiently import supplies and machinery was insufficient for establishing a modern industrial firm capable of long-term operation. Therefore, achieving success as an industrial entrepreneur was not solely a matter of possessing the right "ingredient"—a specific skill or resource. Rather, it entailed the capacity to access and combine a wide array of diverse ingredients. I will call this the *complementary nature* of inputs in industrial activity.

Furthermore, the necessary ingredients for industrial production were not concentrated in the hands of a single group. Each challenge required

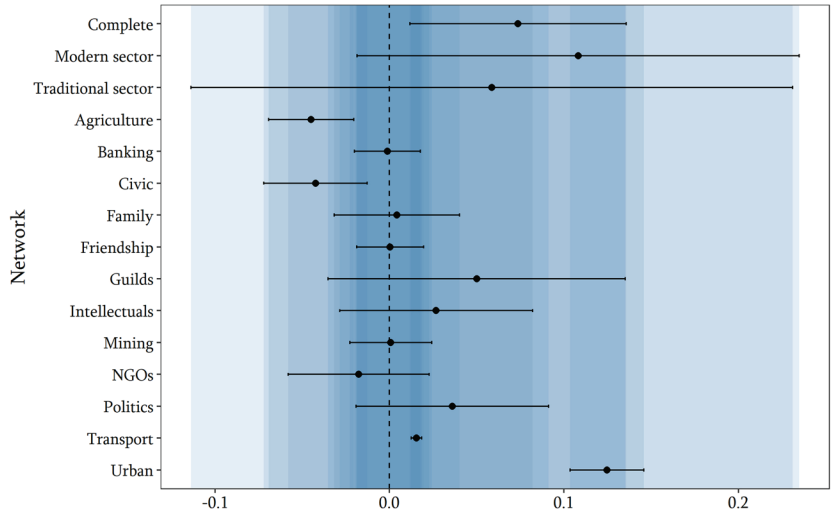

FIGURE 4
CROSS SECTION: INDUSTRIAL ENTREPRENEURSHIP AND SOCIAL NETWORKS.
COEFFICIENT PLOT

Notes: This figure presents results of 14 separate regressions, each assessing a different network metric's impact on industrial involvement, while controlling for other factors. Dependent variable: firms founded per lifetime. Independent variables are standardized. Estimates include 95 percent confidence intervals. Each regression replicates 9th specification from Table 5, considering controls but not confounders.
Source: Author's compilation.

specific types of resources that were dispersed throughout society. For example, bankers possessed the capital, merchants had local distribution knowledge, and politicians held the power to overcome entry barriers. I will call this the *decentralized nature* of inputs in industrial activity.

The complementary and decentralized nature of inputs in industrial activity implied that, in order to create a functional and resilient industrial firm, an individual needed to bring together several types of connections that offered the variety of resources required. In that sense, a network position that permits the efficient connection of several types of nodes should have offered an advantage for industrial entrepreneurship. This could explain why individuals were more important, as bridges in the global network create more firms that are also more resilient.

Figure 4 shows evidence of this. It presents the results of replicating the cross-section estimation on each dimension of interaction independently. This analysis reveals that individuals with higher betweenness centrality in the complete network, which encompasses connections across different dimensions of interactions, were significantly more entrepreneurial. In

contrast, higher betweenness centrality in specific networks showed little to no positive correlation with entrepreneurship.

This supports the notion that the type of global connectivity necessary for entrepreneurship facilitated the combination of resources that were widely distributed throughout society. This task was not accomplished by merely connecting individuals within a specific community (having high betweenness centrality in a single network), but by bridging individuals across different communities (having high betweenness centrality in the complete network).

Social Interactions Supplemented Markets

A final step in this effort to understand why global bridges were more deeply involved in entrepreneurship is to demonstrate that social interactions were indeed used to acquire resources. Evidence in this regard is derived from examining spatial variation in the economic structure. Specifically, if the assertion that global connectivity influenced entrepreneurship by facilitating the combination of diverse resources not readily available in markets holds true, betweenness centrality should have a greater impact on entrepreneurs in communities with lower levels of market development. A map of the spatial distribution of market development is provided in Online Appendix Figure A17.[5]

To investigate this, Table 9 presents regression specifications similar to those in Table 5, incorporating market development as an independent variable and introducing an interaction term between betweenness centrality and market development. As anticipated, market development exhibits a positive correlation with industrial involvement, indicating that individuals in locations with more developed markets founded more industrial firms. Moreover, once confounding factors are taken into account, the interaction term is found to be negative and statistically significant. This suggests that the association between betweenness centrality and industrial involvement becomes more pronounced as market development decreases, supporting the proposed mechanism.

Overall, global bridges seem to have been more involved in entrepreneurship because they were in a privileged position to easily combine a

[5] I measure market development as the ratio of the number of *empleados* over the number of *jornaleros* for municipalities in the 1912 Census. *Empleados* were wage workers, mostly located in urban areas. They operated in a fairly similar way to any current office job. Instead, a *jornalero* was a worker hired through a traditional labor relationship, closely tied to ancestral serfdom-like institutions. *Jornaleros* were mostly agricultural workers paid by the day. Frequently, they were paid a fraction of the production. Therefore, the ratio of these two types of labor is a scale-free proxy of the relative importance of markets in the economy.

TABLE 9
CROSS SECTION: INDUSTRIAL ENTREPRENEURSHIP AND SOCIAL NETWORKS—MARKET-DEVELOPMENT INTERACTION

	Entrepreneurship					
Betweenness	0.211***	0.223***	0.189***	0.184***	0.171***	0.169***
	(0.064)	(0.068)	(0.062)	(0.061)	(0.058)	(0.058)
Market development	0.106*	0.115**	0.090	0.088	0.099*	0.099*
	(0.055)	(0.058)	(0.060)	(0.059)	(0.057)	(0.058)
Betweenness × Market development		–0.043	–0.038	–0.050*	–0.072**	–0.072**
		(0.030)	(0.028)	(0.030)	(0.029)	(0.029)
Banker			0.688***	0.715***	0.631***	0.635***
			(0.213)	(0.210)	(0.218)	(0.221)
Engineer				0.437	0.193	0.191
				(0.355)	(0.370)	(0.371)
Miner					1.200***	1.200***
					(0.320)	(0.318)
Politician						0.068
						(0.250)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	926	926	926	954	926	926

Notes: The unit of observation is the individual, and market development is measured at the municipality of birth. Industrial involvement is measured as the number of firms founded by an individual during their lifetime. Independent variables are standardized, coefficients indicate log-differences for one SD increase, with other predictors held constant. Robust standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's compilation.

diverse set of resources through their social interactions, having a higher chance to overcome the constraints that poorly functioning markets imposed on industrial activity.

CONCLUDING REMARKS

The coexistence of traditional and modern elements in Latin American economies has long intrigued scholars, and elites have been at the center of many of these reflections. The interest of those elites in preserving their privileges under the status quo seems to conflict with their appetite for taking advantage of the opportunities that modernity provides. Their historical involvement in the emergence of modern industry is an essential piece of this conversation, which has not been extensively explored using individual-level data.

In this paper, I contribute to the study of this issue by examining one of the most notable instances of industrialization in Latin America—Antioquia, Colombia—for which I bring new archival data on the social interactions among elite members. With those data, I investigate how the structural characteristics of the elite as a network relate to the business ventures of its members in the industrial sector.

I find that social connections among the elite in Antioquia served as supplements to address the shortcomings of ineffective markets. Industrial entrepreneurship was a complex endeavor that required a diverse range of complementary resources. However, markets alone were insufficient in providing all these resources. As a result, elite members relied on their social interactions to acquire them. Individuals who held network positions that facilitated the combination of a wide array of resources had a distinct advantage in industrial entrepreneurship. Meanwhile, having the supportive social circle that came with a highly cohesive local network did not guarantee access to all the necessary resources, and, therefore, such types of network positions did not provide an equivalent advantage for entrepreneurship.

Hence, the members of the elite of Antioquia were constrained by both social and economic factors. Their ability to engage in productive activities was limited by the absence of efficient markets, and the diversity of their social capital led to varying outcomes among them. This perspective of constrained non-monolithic elites not only enhances our understanding of the economic history of Latin America but also brings lessons to the growing research on social mobility and the long-term influence of elites (Winters 2011; Marcassa, Pouyet, and Trégouët 2020; Goñi 2023).

In contrast to most existing work in economic history that focuses on social networks and business activity, my analysis covers a wide range of social interactions, approximating the elite's real *social milieu*. This allows me to show that social ties served as extensive channels for mobilizing resources beyond information and capital in a context where markets could not fulfill this role effectively. Through their networks, elite entrepreneurs recruited skilled labor, gained access to tacit knowledge, obtained political favors, imported machinery and supplies, overcame legal barriers, and distributed and advertised their products in remote markets.

The evidence presented in this paper, along with the described mechanisms, can provide insights into the emergence of entrepreneurship in various other contexts. In their comprehensive overview of entrepreneurship throughout history, Landes, Mokyr, and Baumol (2010) highlight that challenges such as financial constraints, limited access to knowledge, difficulties in recruiting skilled personnel, and numerous other obstacles faced by entrepreneurs in Antioquia were common in diverse historical episodes. Moreover, the key behaviors exhibited by Antioquian entrepreneurs can be observed in the emergence of industry in numerous other contexts as well. For instance, in the same volume, Joel Mokyr emphasizes that entrepreneurs in the United Kingdom also grappled with what I have referred to in this paper as the complementary and decentralized nature of inputs in industrial activities. They had to navigate the complexities of gathering necessary resources by utilizing both markets and social interactions:

> "The successful entrepreneur in the Industrial Revolution, as I shall argue, was not necessarily a many-sided person who could do it all, as maintained by Charles Wilson (1963, 175). What he represented was one side of the business (either technical or managerial), having the ability to identify a need or an opportunity, then cooperate with others who possessed a different comparative advantage to take advantage of it. Such cooperation often took the form of partnerships or market transactions at arm's length, although a personal element was rarely missing altogether... Entrepreneurial success was based on such successful transactions, not necessarily on a multitalented genius who could do it all." (Landes, Mokyr, and Baumol, 2010, p. 186)

Finally, it is important to acknowledge that this paper has several limitations and raises numerous unanswered questions that future research should tackle. First and foremost, the study focuses on a population of interest that is inherently vague: the elite. Defining and studying the elite empirically is a challenging task for which there are no clear-cut methods. Additionally, representing their interactions from a network perspective

presents further difficulties, exacerbated by the scarcity of historical data.

Consequently, I approach the question through unconventional sampling methods and inference techniques with intrinsic weaknesses. In particular, the snowball sample and panel regressions may introduce non-classical estimation errors. While I demonstrate that the data patterns are highly robust and that most reasonable biases do not significantly impact the results, it is crucial to acknowledge these risks and consider them when interpreting the findings.

An avenue of research that holds promise for addressing these challenges and limitations lies in exploring the formation and evolution of partnerships within the region. It is essential to make concerted efforts to collect and systematize comprehensive data on firms in the area, following the methodologies employed by scholars such as Hilt and O'Banion (2009) and Artunç and Guinnane (2019). The work that several archives have done in recent years to order and digitize their records provides potential for advancing this agenda. Doing so would shed light on how the business network operated beyond the elite and how non-industrial entrepreneurship emerged in the region.

Another crucial area for exploration is the quantitative analysis of the elite as a community. Traditional historiography has put forward various hypotheses regarding the origins and nature of the elite in Antioquia, but most of these arguments rely on small-scale data research or qualitative analysis. Conducting larger-scale studies that use innovative automated matching techniques and leverage individual-level data would greatly enhance our understanding of the attributes of the elite, independent of the question about entrepreneurship.

Finally, conducting additional statistical analyses that incorporate new data on the social interactions of the elite would help address the bias concerns associated with the current network inference, particularly those related to dynamic data. With advancements in the aforementioned research agendas, for example, it becomes feasible to conduct year-level analyses, which would offer a broader scope for testing the accuracy and reliability of the estimations.

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