

**Entrepreneurship in Fragmented Networks:
Evidence from late Tsarist Russia¹**

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ABSTRACT

Recent studies of the formation of collaborative networks typically identify patterns of cohesive social structures and their benefits for economic performance. Using systematic quantitative evidence on 3,700 corporate foundings and about 8,900 members of the corporate elite in late tsarist Russia (c.1869-1900), our study departs from, and thereby extends this previous research in two important ways. First, we consider economic networks that consistently lacked the kind of social cohesion identified elsewhere, and exhibited social fragmentation into numerous small and isolated clusters instead. Second, prior research has focused on the emergence of new network patterns and hence social change. We demonstrate instead how local strategies of individual entrepreneurs facilitated the reproduction of network fragmentation, and thus prevented social change.

INTRODUCTION

An abundant literature documents the benefits of network effects for economic performance. Much of this research has focused on the beneficial role of network-based collaborations in a diverse series of settings ranging from partnership systems in Renaissance Florence (Padgett and McLean 2006) to strategic alliances in the contemporary fields of biotechnology (Powell, Koput, and Smith-Doerr 1996) and semiconductor development (Stuart 1998). Two positive effects, in particular, stand out. First, especially within research-intensive fields and industries collaboration networks provide effective pathways for the fast transfer of reliable knowledge (Moody 2004; Powell et al. 2005). Second, central positioning and cohesion in networks of repeated partnerships entail reputation effects that facilitate the evaluation of potential future business partners (Podolny 2005; Robinson and Stuart 2006) and help overcoming the commitment problem in contract enforcement (Greif 2006).

Given these benefits of collaboration networks, understanding the formation of alliances has been the natural next step. Initial work in this direction focused primarily on the characteristics of either individual firms or pairs of potential partners (dyad models) to identify predictors of alliance formation. One of the most persistent findings of these studies has been that networks of past collaborations yield future collaborations (Gulati 1995; Gulati and Gargiulo 1998; Powell et al. 1996). More recent longitudinal studies of network collaborations have moved beyond individual or dyad-level accounts toward considering the overall network pattern within which alliance formation takes place. Within this broader framework, a limited range of mechanisms for partner selection has been identified. These selection mechanisms include homophily, preferential attachment

to high status actors, ecological and network constraint, reciprocity, transitivity, and norms that prohibit the creation of particular tie constellations (Bearman, Moody, and Stovel 2004; Powell et al. 2005; Ruef, Aldrich, and Carter 2003; Sorensen and Stuart 2005). The important point for our purpose in this paper is that these studies invariably document how such attachments lead to the emergence of cohesive network patterns over time. In this context, cohesion means extensive connectivity among firms or individual entrepreneurs and investors through multiple alternative pathways within a corporate network (Moody and White 2003).

Our study departs from, and thereby extends this previous research in two important ways. First, we consider economic networks that consistently lacked the kind of social cohesion identified elsewhere, and exhibited social fragmentation into numerous small and isolated clusters instead. Second, whereas prior research has focused on the emergence of new network patterns and hence social change, we address the question how the reproduction of social fragmentation through local strategies of individual entrepreneurs prevented social change over time.

Substantively, we seek to answer the question how entrepreneurship in fragmented networks was possible in the historical context of serial corporate foundings in late imperial Russia (c.1869-1900). While often portrayed as an economic backwater, the late tsarist economy witnessed a veritable boom in the number of companies founded, generated by an upsurge in key corporate sectors such as the railway, textile and metallurgy industries (Gregory 1994; Kahan 1989). However, as social and economic historians of late imperial Russia have long recognized, much of this entrepreneurial effort took place within a fragmented social structure that forestalled the emergence of a

cohesive identity among Russia's rising middle strata. The historical evidence suggests that the merchantry was characterized instead by separate regional and ethnic interest groups with few ties bridging their activities (Rieber 1982; Clowes, Kassow, and West 1991). Much of the existing historical literature has suggested broad macro-level categorical divisions – primarily cultural, ethnic, and religious cleavages – as the sources responsible for the absence of social cohesion among the entrepreneurial middle classes.

Using systematic quantitative evidence on the founding experience of nearly 9,000 entrepreneurs in more than 3,700 firms known to have been operating in Russia at the time, we identify instead a simple mechanism whereby the local strategies of individual entrepreneurs inadvertently facilitated the reproduction of social fragmentation. Examining the founding team partnerships of serial entrepreneurs, we find that a legacy of previous success in raising starting capital for corporate foundings was one of the most substantial factors that significantly influenced future entrepreneurial success. We show that this strong reputation effect prompted the Russian corporate elite to clearly prefer business partners with a known track record of entrepreneurial success. Even repeated and trust-filled partnerships were continued only as long as they proved to be successful in raising spectacular amounts of starting capital for new enterprises. Hence, a continued quest for successful business partners often led entrepreneurs to abandon existing relationships. However, since signals of past success were diffuse, corporate founders limited their search for potential partners and collaborative ties to the social circles and economic environments they knew best. We further document that the (presumably) unintended consequence of their locally rational strategies was the

reproduction of the very fragmented social structure that they were initially designed to cope with.

The remainder of this paper is organized as follows. In the next section, we introduce the institutional setting of economic development and corporate entrepreneurship in late tsarist Russia. We also illustrate the various dimensions of social fragmentation among the Russian middle strata and regional entrepreneurial groups. This historical section is followed by the description of our firm-level and founder-level data on Russian corporate foundings. Next, we establish the extent of network fragmentation. We then turn to regression analyses that document the reputation effect of past success as a corporate founder. Finally, we reveal the extent to which members of the corporate elite confined their continuing search for successful partners to the small economic network clusters they were most familiar with, a process that eventually led to the reproduction of fragmentation. We conclude by situating our account in relation to extant studies of collaborative networks and institutions.

INSTITUTIONAL SETTING

The starting point for most discussions of the tsarist economy remains Alexander Gerschenkron's (1962, 1970) influential thesis that late tsarist Russia struggled with its legacy of economic backwardness relative to its economic and political competitors in western Europe and elsewhere. Gerschenkron's argument rests in important ways on the idea that tsarist Russia was a dual economy that juxtaposed a traditionalist agricultural sector and a modernizing industrial sector.

The backwardness of the Russian economy was perhaps most evident in the agricultural sector, which substantially lagged behind the labor productivity in industry (at a ratio of three to four) and the overall economy (Gregory 1994, p.29). The emancipation of serfs in 1861 may be regarded as the onset of Russian modernization. Yet, for Gerschenkron, the emancipation was only political and social, but did not extend to the introduction of private property rights for peasant families. Agriculture remained communally based for administrative and tax collection purposes. The implication was that the peasant community, and not individual families were responsible for debts and tax burdens. Further, decisions about the allocation of resources as well as the distribution of shares of land also remained in the hands of the community. Hence, the 1861 agrarian reform failed to entail an economic emancipation corresponding to the legal emancipation. Consequently, so Gerschenkron's argument, these communal restrictions stifled agrarian productivity, prevented the development of demand for industrial goods among the peasantry, and suppressed its mobility and hence the emergence of an industrial labor force (Gerschenkron 1970, p.103).

Even under these less than favorable conditions did agriculture constitute a substantially greater share of the Russian economy compared to the industrial sector in the nineteenth century (Gregory 1994; Kahan 1989). Following Gerschenkron, one reason for the backwardness in industrial development was the obsession of the tsarist government with potential sources of social unrest due to the swelling ranks of an industrial proletariat in the cities. Only the military disaster of the Crimean War (1853-56) led the Russian state to eventually recognize the economic, political and military benefits of industrialization, and the expansion of the railroad network in particular.

However, since tsarist governments failed to guarantee private property rights, neither private demand nor entrepreneurship was forthcoming at sufficient levels. The tsarist state thus substituted state demand for missing private demand and entrepreneurial activity (Gerschenkron 1970). On the one hand, this change in industrialization policy was reflected in the large share of government expenditures, especially on the expanding public administration and the military, relative to competing countries in the late nineteenth century. In addition, the state promoted loans and subsidies for private initiatives, sought to reserve contracts for Russian companies, set incentives to attract skilled foreign workers, and imposed tariff barriers to protect domestic goods and to invite direct foreign investment within Russia (Dahlmann and Scheide 1998; Gregory 1994; McKay 1970).

More recent studies in Russian economic history (Gartrell 1986; Gregory 1994; Kahan 1989) found supporting as well as contradicting evidence for Gerschenkron's arguments about Russia's relative backwardness. Agriculture was indeed the most dominant sector of the Russian economy, and except for its textile industry, industrialization lagged substantially behind competing countries in Western Europe as well as Japan and the United States. Still, industrialization did happen, and a number of factors contributed to its rise.

First, the Russian Empire experienced the fastest population increase in Europe, from 73.6 million in 1861 to 165.1 million in 1914 (Kahan 1989). One consequence of such population growth was an increased migration across regions, and in particular from rural to urban areas, a movement that eventually contributed to the growth of the industrial labor force. Second, the expansion of the transportation network, especially the

railroads from 10,731 km in 1861 to 53,234 km in 1900, was the most extensive in Europe and four times that of the United States. Railway construction also stimulated a corresponding growth in the iron industry (Kahan 1989; Gregory 1994). Third, opportunities for industrial enterprise did indeed attract considerable amounts of foreign capital. Yet, such foreign investments rarely followed incentives set by the Russian administration, whose bureaucracy was rather experienced as an obstacle to entrepreneurship. Finally, the textile industry in particular, “the most important in terms of employment and output”, witnessed an increasing concentration within large-scale plants and a development away from smaller family-owned enterprises toward large joint-stock companies (Kahan 1989).

If anything, then, the historical evidence suggests support for Gerschenkron’s (1962) idea that economic latecomers such as Russia tend to accelerate industrialization at faster rates than countries that did not have to cope with the obstacles of economic backwardness when entering modern industrialization. In comparable contexts of nineteenth-century Europe, such industrialization and corresponding urbanization gave rise to distinct middle classes, a bourgeoisie, whose members turned their economic fortunes as merchants, entrepreneurs and professionals into a strong social standing and political influence. In contrast, a distinguishing feature of Russia’s economic and social development in the late imperial period is the lack of social cohesion among the core strata of such a middle class: “despite the superficial resemblance of some leaders of this group to prominent capitalists of fin-de-siècle Europe and the United States, the Russian corporate elite failed to achieve even a semblance of unity in formulation economic

strategies and political attitudes, much less a mature class consciousness” (Owen 1991b, p.76).

The literature on the activities of Russian entrepreneurs during this period has identified a series of often crosscutting fissures that prevented the emergence of a genuine class identity among them and lead to social fragmentation instead (Hildermeier 1986; Owen 1981, 1991b; Rieber 1982; Ruckman 1984). The first fissure was a consequence of Russia’s system of social estates, or *sosloviia* (*soslovie* in the singular), that was implemented by tsarist decree in the eighteenth century to replace the medieval system of hierarchical social order (Freeze 1986). While these estates did not imply the kind of political representation as in Western Europe, they were nevertheless intended to create incentives for social mobility by replacing service for the state for hereditary privileges as the basis of social stratification. However, for administrative purposes, especially tax collection, corporate rights remained wedded to the traditional divisions of Russian society. As a consequence, the merchant commercial *soslovie* – the *kupechestvo* – suffered from increasing mobility and turnover within its own ranks. From below, affluent peasants with their deeply traditionalist views entered the merchantry. At the upper end, successful entrepreneurs aspired to join the lower nobility through the purchase of noble titles.² Likewise, within the top layers of the *kupechestvo*, large numbers of gentry entrepreneurs used their privileged positions to enter corporate business in search for lucrative careers. Since their sense of entitlement and privilege

² Consequently, for the data we discuss below, it is difficult to establish with certainty whether the large number of noble entrepreneurs were merchants who entered the ranks of the nobility due to their entrepreneurial success, or whether these were upper gentry and nobles who engaged in corporate entrepreneurship (see Hildermeier 1998).

rarely matched entrepreneurial and management skills, they were met with disdain by members of long-standing merchant families (Rieber 1982; Hildermeier 1998; Owen 1991b).

The second source of fragmentation was deep cultural cleavages between the layers of the merchantry. The largest group, mainly from provincial towns in central and western Russia and Siberia, exhibited traditional patriarchal attitudes, kept smaller family-owned shops, and showed little willingness to be involved in political matters. The second layer numbered about 2,000 merchants, and consisted mainly of first-guild members in the main urban centers. In stark contrast to the first group, they were thoroughly Europeanized in cultural and social attitudes, sought formal schooling for their children, and often aspired to noble status. In business matters, they likewise differed from the first group by preferring to trade at the exchanges in urban centers rather than through small shops. Politically, they generally respected the tsar and the nobility, and sought to gain recognition by running for public office. The topmost layer of the merchantry contrasted with both groups. Geographically, they were concentrated in Moscow, Petersburg and Kiev. In their cultural and political outlook, they were fervently nationalistic and threw their economic weight behind the promotion of “truly Russian” culture. They were primarily involved in banking, industry and foreign trade. They embraced modern technology, but attempted to “russify” western-style capitalism. Following their nationalist views, they boldly engaged in national politics (Rieber 1982; Ruckman 1984).

Beyond estate and cultural differences, the merchant strata were torn by the same ethnic cleavages as Russia’s society at large. Ethnic Russian merchants increasingly

perceived their own position as being encircled by ethnic minorities who supposedly encroached upon their economic domain from the periphery of the empire. The resulting xenophobia as well as anti-Semitism did of course not help to overcome fragmentation within the merchant strata. Religious cleavages between Old Believer Russian merchants, Protestant Germans, and Jewish entrepreneurs reinforced ethnic divisions (Rieber 1982; Ruckman 1984). Further, especially under the last three tsars, the government fuelled these fears through corporate policies that explicitly discriminated ethnic minorities. Jews, Baltic Germans, and Poles, in particular, were thus increasingly restricted from company ownership and shareholding in various industries as well as from leasing and buying rural property (Owen 1991a; Rieber 1982; Dahlmann and Scheide 1998). While the more nationalistic voices among the Russian merchantry certainly lauded these government policies, ethnic divisions ultimately eroded the social cohesion and influence of the merchant *soslovie* at large.

Finally, deep-seated regional identities and resulting economic rivalries between regional centers contributed their share to the fragmentation of the business elite (Dahlmann and Scheide 1998; Joffe 1984). Particularly visible were the struggles between Moscow, Saint Petersburg and southern entrepreneurs for dominance, which emphasized once more their cultural and economic differences. Moscow's nationalistic all-Russian entrepreneurial elite generally preferred family-run enterprises and share partnerships if they had to raise capital beyond family networks. The more cosmopolitan business elites in Saint Petersburg and the South, in contrast, had a taste for large joint-stock companies (Rieber 1982; Ruckman 1984). Similar contentions existed between the Polish industrial center of Lodz and its Russian competitors in the textile and coal

industries. In most instances, regional attachments overrode ethnic attachments such that German merchants in Moscow stood up to defend the interests of all Moscow merchants rather than the mercantile interests of the German minority in Russia at large.

The overall impression, then, is that Russia's economic development was able to gradually overcome the obstacles of initial backwardness. Yet, intense factionalism along social, cultural, ethnic and regional divisions prevented the formation of a collective identity among the Russian corporate elite capable of mobilizing their shared interests once opportunities for political change such as the 1905 revolution appeared. The important point for our purpose here is that nearly all previous studies focused on the question why such economically prosperous and dynamic groups failed to translate their economic leverage into political influence and power. However, the implicit notion is that economic cohesion did exist among the various local merchant groups – the Moscow merchant elite, the Petersburg group, the Odessa group in the South, the German Baltic group in the North and so forth. In contrast, we argue that such cohesive economic relationships did not even exist within locally bounded networks. Our evidence suggests instead that the recurrent quest for business partners with a legacy of entrepreneurial success gave rise to fragmented local networks well before the impact of cultural and ethnic divisions was felt.

DATA SOURCES

Supporting evidence for our arguments comes from the analysis of an unusually rich historical database that constitutes a census of all corporate foundings in late tsarist

Russia, compiled by Owen (1988) from government collections of corporate charters.³ These data contain systematic quantitative information on all companies chartered in late nineteenth-century Russia as well as information on their founders and managers. We first introduce the firm-level data we employ from this source, and then turn to the characteristics of individual merchant entrepreneurs. Table A.1 in the data appendix summarizes descriptions and measurements of all variables used in the analyses reported below.

Firm-level Data

We consider all companies incorporated in our period of interest (1869-1900), to the extent that information on the amount of starting capital was recorded in the corporate charter and the date of the founding can be established. Descriptive statistics for the characteristics of the resulting 3,724 chartered companies are reported in table 1.

<Table 1 about here>

Our main variable of interest with respect to individual entrepreneurial activity is the amount of starting capital raised by founders as it was recorded in the corporate charter as the basic capital of the company.⁴ Where this basic capital consisted of both stocks and bonds, the sum of both amounts is used (Owen 1988). Direct use of these capital amounts for comparison over time and between different companies faces the

³ The entire database, including all incorporations from 1700 through 1914, and is distributed by the Inter-University Consortium for Political and Social Research, Ann Arbor, MI.

⁴ Ideally, one would like to include data on economic performance beyond the founding event. Yet, systematic performance data at the level of individual companies are notoriously difficult to obtain. As an alternative, we sought to link our firm data with listings of companies at the St. Petersburg stock exchange, but only a handful of matches could be identified.

problem that three different kinds of rubles circulated until the introduction of the gold standard in 1897 (Gregory 1994, pp.59-80; Kahan 1989, pp.42-52). The kind of ruble used – silver, copper, or paper assignat ruble – to express the basic capital and the values of shares routinely varied from charter to charter, even within the same year. We therefore standardized all ruble amounts based on the standard ruble of account proposed by Owen (1989). However, the standard ruble of account does not reflect inflation. Throughout our analyses, we therefore specify all standardized ruble amounts in 1913 rubles, based on a commonly used Saint Petersburg price index that covers our years of interest, 1869-1900 (printed in Strumilin 1966, p.90).

The two dominant corporate organizational forms in this period were large joint-stock companies (*aktsionernoe obshchestvo*) and smaller share partnerships (*tovarishchestvo na paiakh*). We do not consider the many small family businesses and trading partnerships that could be set up by any member of a merchant guild and that only required registration with local authorities. Owners of these trade partnerships remained fully liable for the debt of their firms, and merchants were prohibited from being partners in two such firms at the same time. In contrast, the large corporate foundings we consider here entailed limited liability of investors and managers alike, the public sale of shares, and required an official imperial confirmation of the founding charter. Initially, founders and investors could be members of any free estate, but after legal changes in 1884, holders of the top three ranks could not act as founders or officers of the company. Joint-stock companies were favored by the more cosmopolitan Petersburg entrepreneurs. Typically a large number of shares at small individual values were issued. In contrast, Muscovite merchants preferred share partnerships, which typically entailed more intimate

business relationships as indicated by the word *tovarishchestvo*, the old Russian expression for partner or comrade. These partnerships also tended to issue only a few shares at much higher values compared to shares in joint-stock companies (for the foregoing, see Owen 1983; 1991a).

On average, founding teams consisted of three entrepreneurs. Even in the case of larger joint-stock companies, 90% of all corporations were founded by no more than five entrepreneurs. Only in one rare instance, did the charter list the unusually large number of 70 different founder names (not reported in table 1). The number of shares and their prices were also recorded in the corporate charter. The averages reported in table 1 are somewhat biased by the larger proportion of joint-stock companies, which tended to issue greater numbers of shares set at lower values each, compared to share partnerships. In our period, joint-stock issued 7,348 shares, on average, at an average value of about 395 rubles each. Share partnerships, in contrast, issued an average number of 965 shares at about 1,550 rubles each, on average (not reported in table 1).

The corporate-level data also allow us to consider the principal geographical location within the Russian empire where the newly founded company operated according to its charter. As table 1 shows, economic activities were concentrated in and around the three largest urban centers – Odessa in the South, Moscow in the center, and Saint Petersburg and the Baltic cities in the North. Similarly, the charter specified the main function or industry that a corporate enterprise operated in. Table 1 reports the distribution of corporations across the seven largest industries. Clearly, the majority of businesses focused on manufacturing, followed by transport (mainly railroad and steamship development) and the financial sector.

Founder-level Data

The great advantage of these data for our purpose is that they provide matching information on the characteristics of founders to the extent that they were documented in the corporate charters or could be unambiguously established from secondary sources (see Owen 1988). In table 2, we compare summary statistics for these founder-level characteristics for one-time founders (N=8,112) and serial entrepreneurs (N=773) who were involved in the founding of more than one enterprise. The unit of analysis in the underlying data structure is what we call a founder-event. For example, a company that is founded by three entrepreneurs has three entries in the data, one for each founder with his different characteristics. Each of these entries is a founder-event, involving the given founder in the incorporation of the company. Likewise, serial founders pursued foundings of more than one company. Consequently, a founder involved in the incorporation of three companies contributes three founder-events to the data. Since the charter dates are known to use, founder-events can be sorted in time. Our founder-level data can thus be treated like panel data with repeated observations for the same individual entrepreneurs.

<Table 2 about here>

The RUSCORP database identifies a host of different origins, yet more than 80% of all founders fall into one of the three main ethnic groups shown in table 2. We therefore focus on differences between these three principal ethnic groups. It does not come as a surprise that ethnic Russians constitute the majority among all entrepreneurs in this period. Ethnic Germans (mostly Baltic Germans) and Jews contribute the two second largest minorities. Note that Russians and Jews are slightly stronger represented among

serial entrepreneurs compared to one-time founders, whereas Germans have a slightly larger share among one-time founders. The residual ethnic category is not dominated by a single or a few large minorities.

Corporate charters identified not only the names of all founders, but also their social status group. Table 1 reports the distribution of founders across the eight main status groups. As expected, members of the commercial classes made up the lion's share, both among one-time and serial entrepreneurs. Nobles and government officials contributed a slightly larger proportion to serial founders compared to one-time investors. The other noteworthy pattern is that the proportion of members of the landed classes (estate) is considerably larger among one-time founders (13.6%) compared to serial entrepreneurs (7.9%). Here, we should note, however, that social historians have long debated whether people actually identified themselves along the lines of such status groups, or whether these categories were imposed by the imperial government as part of its state-building initiatives, and hence had little tangible impact on people's perceptions of themselves as social groups (see e.g. Freeze 1986).

Beyond these basic characteristics, we exploited the temporal nature of these data and coded a series of indicator variables to consider variation in founding strategies. Since these variables rely explicitly on changes over time, they are available only for serial entrepreneurs. The first three variables – "Success", "Partner's success", and "Repeated partners" – consider strategies of individual founders that we examine in more detail below. In the context of the late nineteenth-century Russian business world, evaluating the prospective success of entrepreneurs was probably diffuse and difficult to grasp for individual investors and potential founding partners beyond the local networks

that they found themselves embedded in. A more tangible marker of potential success is the amount of starting capital raised by an entrepreneur for one of his previous enterprises. Treated as the revealed preference of investors to promote a newly founded enterprise, such past success in raising large amounts of starting capital may thus be used by potential investors to evaluate the prospects of future success. We consider the median amount of starting capital raised by founding teams in the same industry and decade as the yardstick for success. Accordingly, the variable Success is coded as a dummy indicator that is lagged by one founder-event and equals 1 if one or more partners in ego's current founding team (including ego himself) were able to raise starting capital for a previous founding that was equal to or exceeded the median starting capital for enterprises founded in the same industry during the same decade. The variable Partner's success follows exactly the same logic, but excludes the possibility that ego himself was the one involved in a previously successful founding. This dummy indicator thus captures the strategy that less successful entrepreneur may seek out partners who have a history of past success. As the summary results in table 2 suggest, nearly half of all entrepreneurs were part of founding teams that included previously successful partners.

Beyond prior success, continued partnerships may also pave the road to future success. They signal the benefits of shared understandings trust-filled partnerships developed over the course of repeated collaborations. Repeated partners is thus coded as a dummy indicator that equals 1 if one or more of the members of ego's current founding team was also a partner on one or more of ego's previous founding teams. The noteworthy result here is that only 12.4% of founder-events involving serial entrepreneurs were such continued collaborations. This finding suggests that Russian

entrepreneurs either had a taste for establishing new founding teams, or faced conditions that forced them to enter new partnerships. We shall consider this finding in more detail below.

The remaining variables in table 1 take the frequency, timing and diversity of foundings by individual entrepreneurs into account. On average, serial entrepreneurs promoted about three subsequent corporate foundings. Since dates are recorded in corporate charters, the duration between subsequent foundings can be documented. On average, then, serial founders waited for about three and a half years before becoming part of another founding team. The average duration between initial and last foundings was about five years. Consequently, entrepreneurial careers were rather short. The last set of variables measure the number of distinct geographical locations and industries that individual founders engaged in. This count equals 0 if all sequential foundings pursued by a serial entrepreneur were located in the same geographical region or industry, respectively. The variable equals 1 if founders promoted companies in two different locations or industries, and so forth for increasing counts. We further weight these outcomes by the total number of foundings an individual entrepreneur was involved in. The results are show in the last rows of table 2 and suggest that, on average, serial founders rarely sought to establish new companies in geographical locations or industries that were unfamiliar to them. At most, they pursued their interests in two different locations or industries, on average. The proportions further support this inference: even if they were engaged in several incorporations, serial entrepreneurs apparently focused their efforts on a few locations and industries.

Network Data

Using both firm-level and individual founder-level data, we further coded affiliation networks of entrepreneurial collaboration for our period of interest. We consider founder-level and firm-level networks separately. Within founder networks, pairs of individual entrepreneurs are connected if they were partners on one or more founding teams. These co-founding relationships are weighted by the number of distinct corporations that both founders jointly promoted. However, we are less interested in the frequency and intensity of repeated collaborations between individual pairs of entrepreneurs. We therefore set the strength of ties between founders aside for now. Instead, we focus on the macrolevel pattern of these partnership networks, and the extent to which they indicate social cohesion or the absence thereof. Figure 1 below illustrates the kind of founder-by-founder networks arising from this data structure for one particular period, 1869-76. The nodes in this graph represent individual entrepreneurs, here colored according to their ethnic origin. The ties connecting them are the joint affiliations in founding teams.

Such affiliation networks have a dual structure – just as founders are connected through their collaboration in the founding of new enterprises, companies are connected if they have one or more individual entrepreneurs in common. Companies form the ties between founders, and founders form the ties between companies (Breiger 1974). As before, ties may be weighted by the number of shared entrepreneurs. Figure 6 below illustrates the resulting firm-level network for the years 1869-76, corresponding to the individual-level founder network in the same period. In the following section, we first turn to a detailed analysis of founder-level collaboration networks, and document the extent to which social cohesion was lacking among these Russian entrepreneurs.

RESULTS I: SOCIAL FRAGMENTATION

Evidence from Co-founding Networks

One substantive puzzle we consider is how merchant entrepreneurs were able to build a reputation of success when the social ties necessary for signaling such a positive evaluation were largely absent due to social fragmentation. The correlate of missing relationships is a lack of social cohesion among members of the merchant entrepreneurial classes as economic and social historians of imperial Russia have long recognized (Dahlmann and Scheide 1998; Owen 1981; Rieber 1982; Ruckman 1984). Here we consider the lack of cohesion by focusing on those networks that arise from the co-founding of new enterprises – arguably one of the principal activities that could constitute the social relational foundation for the identity of merchant entrepreneurs as a social class conscious of itself and willing to pursue its interests. If Russian merchant entrepreneurs were indeed unable to maintain cohesive networks through their main professional activity then this economic fragmentation was likely to have undermined their social and political cohesion as well.

Recall that two founders share a tie if they collaborated in the founding of a new enterprise. To assess changes in the extent of cohesion over time, we select a periodization based on the duration between subsequent foundings reported in table 2 above. On average, subsequent foundings were about three and a half years apart, and the difference between initial and last foundings was close to five years. In fact, the 75 percentile for the duration between initial and final foundings equals seven years (not reported in table 2). We thus split the time-axis into eight-year periods, which is about

twice the average duration between subsequent foundings and comfortably includes the seven-year duration just noted. More substantively, such a periodization yields conservative results for the measurement of network fragmentation because it will ensure that most founding sequences of individual entrepreneurs are contained within the boundaries of each period. Since we do not know when partnerships, and hence ties end, this conservative periodization is likely to overestimate cohesion among founders.

Likewise, collaborations may have started in a previous period, and arbitrarily cutting the time-axis into discrete eight-year durations – 1869-76, 1877-84, and so forth – introduces left-censoring for all such periods. For example, one founder may be involved in a partnership in 1874 and then again in 1878. Using discrete and mutually exclusive periods prevents the joint contribution of both partnerships to network cohesion. We therefore coded the co-founding networks into subsequent periods that overlapped by four years, reminiscent of sliding doors: 1860-76, 1873-80, 1877-84, 1881-88, and so forth until 1900. Again, since we are interested in documenting the extent of fragmentation, this periodization leans toward conservative results that are likely to be biased in favor of the presence of partnership ties, and hence social cohesion.

A convenient way to measure the extent of fragmentation within each period-network is to enumerate the number of components. In graph theoretic terms, components are maximal connected subgraphs within a network. Substantively, components identify mutually exclusive subgroups in a network such that each member of a component can reach every other member by at least one pathway, using one's direct contacts and their subsequent contacts. Each component may be further divided into smaller subgroups with even higher levels of connectivity based on several alternative pathways to reach others

in the network (Moody and White 2003). The important point for our purpose is that the components in a network are not connected to each other. Consequently, a network that consists of a large number of distinct components – disconnected subgroups – exhibits social fragmentation. Table 3 reports the results of this component analysis as well as the size and number of isolated founders for each of the seven overlapping subperiod networks during 1869-1900.

<Table 3 about here>

The results show first ebb and flow in the number of individual founders active in each period, but the general trend suggests an overall increase in the network size over time, especially in the last period, 1893-1900. The important result here, however, is the large number of distinct components across all periods. This finding indicates that Russian entrepreneurs found themselves embedded in isolated social circles that rarely, if ever, crosscut each other. They pursued their corporate activities in a fragmented social world. Further, compared to the overall size of each network, the number of founders in the largest component is very small throughout all subperiods. The largest observed proportion is the 33% of all founders connected within the largest component in 1869-76. This network is therefore the most cohesive among founders over the entire period 1869-1900 – even though it is still at the lower end compared to other known entrepreneurial networks. The network in figure 1 visualizes the lack of cohesion in the 1869-76 subperiod. The network graph is drawn using an iterative spring embedding algorithm that finds an optimal layout by placing founders close to each other that are linked by short paths and through many joint founding teams. For ease of readability, arrowheads are left off since all ties are bi-directional affiliations. The main component is clearly

visible in the center of the network. Also clearly recognizable is the sheer number of disconnected smaller components throughout the rest of the network.

<Figure 1 about here>

Returning to table 3, most of the other subperiod networks are not even close to the same level of cohesion as the one network in 1869-76. The proportion of founders contained in the largest component dips consistently below 20%, and even clearly below 10% for five out of our seven subperiods. For comparison, recent studies of collaborative networks in contemporary U.S. industries routinely report between 80% and 90% of nodes contained in the main component (see, for instance, Powell, Koput, and Smith-Doerr 1996 on biotech collaboration networks). These results thus document that the high degree of social fragmentation in these collaboration networks among Russian merchant entrepreneurs was consistent over time.

Significance of Fragmentation

How significant was this social fragmentation? The first substantive concern is that the unusually large number of components may stem from the presence of a large number of isolated founders as reported in table 3. If they are counted among the components, the more isolates there are, the less connected the networks naturally are. As figure 2 shows, this concern is not supported by the data. The graph compares the proportion of isolates and the proportion of founders connected within the largest component over our seven periods. For comparison, the raw count of total founders in each period is also plotted. The graph clearly demonstrates that, aside from the 1869-76 period, the proportion of founders linked within the main component was consistently low even when the

proportion of isolates was low as well. In other words, while the observable increase in the number of isolates certainly did not help to overcome fragmentation, there is little evidence that they were primarily responsible for the lack of cohesion in the first place.

<Figure 2 about here>

The second concern is that the observed fragmentation arises because existing partnership ties among founders are arbitrarily cut off by imposing discrete periods (even though we sought to accommodate prolonged partnerships over extended time in our periodization). The last row in table 3 considers this concern. The most conservative test would be to assume that all ties and founders last throughout the entire 1869-1900 period. If the splintering into numerous disconnected components persists, the inference of social fragmentation would be even more strongly supported. This is precisely what the results in table 3 document. Even when the decay of ties and nodes is neglected, the largest component contains only 15.4% of all founders in this extensive cross-sectional network.

The further question is, however, how unusual these results really are. Perhaps the observed pattern, despite being crisp, is fairly common for affiliation networks of these dimensions and in fact not that much different from what could be expected by chance alone. While a number of studies have begun to systematically consider macrolevel network dynamics using longitudinal data sets (e.g. Erikson and Bearman 2006; Powell et al. 1996, 2006), we still know comparatively little about expected distributions of component sizes in such large collaboration networks. We therefore compare our observed patterns with distributions of component sizes and proportions of nodes contained in the largest component derived from simulated random networks. To simulate our co-founder networks in each period, we first went back to the original 2-

mode networks that linked each company to its respective founders, and calculated the average degree for each of these observed company-by-founder networks. We then simulated 500 random 2-mode networks in each period that share the same dimensions as the observed 2-mode network (i.e. number of companies, number of founders, and average degree). We then transformed each simulated random network into 1-mode founder-by-founder networks, just as we did with our observed networks. This procedure yields 500 random co-founder networks in each of our ten periods. We then calculated the number and sizes of components for all simulated networks. The results are shown in figures 3 and 4.

<Figure 3 about here>

Figure 3 compares the distribution of the number of founders in the largest components for simulated random networks and the observed networks, arranged by subperiods. The results document that the number of founders connected within the largest component is consistently smaller than in any of the random networks, indicating that the observed extent of structural fragmentation could not be expected by chance alone. The comparison of the proportion of founders contained in the largest component in figure 4 is even more suggestive. We find that this proportion is between 30 and 50 percentage points lower in the observed networks than in the random networks. In sum, what these results amount to is further supporting evidence for the view that the business world of merchant entrepreneurs in late imperial Russia was consistently fragmented into disconnected subgroups throughout our period.

<Figure 4 about here>

One last concern needs to be addressed. Even though the lack of cohesion within their business networks is clearly visible, it is plausible that these Russian merchants relied on alternative network ties that bridged the structural holes between their separate components in the co-founding networks. In other words, there was more connectivity among them, but we cannot see it because we focus on just a single type of relationship. There are two responses to this concern. First, if it were truly the case that one or more alternative types of relationships channeled business relations, and business partnerships were their outcome, then this underlying social network should in fact be expressed in the observed business collaborations. Hence, it would make little sense if some such latent networks bring people together for joint business, but these businesses themselves never materialize. If other networks are salient for economic collaborations they should lead to such collaborations.

Overall, what these results and robustness tests suggest is that social fragmentation was indeed prevalent among merchant entrepreneurs in late nineteenth-century Russia. In what follows, we identify a micro-mechanism that facilitated the emergence and reproduction of this macro-level pattern. To do so, we now turn to an analysis of the different local strategies entrepreneurs pursued to successfully raise starting capital for their enterprises.

RESULTS II: LOCAL STRATEGIES AND THEIR CONSEQUENCES

Reputation and Founding Partnerships

Raising sufficient basic capital to float a newly founded company was one of the core activities of merchant entrepreneurs. On the hand, strict legal requirements with regard to

starting capital had to be fulfilled. Tsarist corporate law dating back to 1836 prescribed that all shares be sold and payments from investors be collected within a specified period before incorporated companies could begin their businesses (Owen 1991a, p.19). These legal prescriptions were primarily intended as a mechanism to protect investors from the consequences of widespread stock jobbing. On the other hand, the ability of founders to successfully raise sufficient funds from investors can send a strong signal to potential investors in future enterprises promoted by these same founders. Such a reputation based on previous success in obtaining basic capital from investors seems especially important in fragmented business contexts such as late imperial Russia where knowledge to evaluate the skills of founders and the potential performance of their enterprises must have been diffuse. The amount of basic capital raised by founders may thus be interpreted as the revealed preference of investors to promote what they perceive as potentially successful enterprises.

With this potential signaling effect of starting capital in mind, what were the kinds of partnership choices founders could pursue to achieve their desired capital amounts? One basic distinction is the one between continued founding partnerships and the establishment of new founding teams. Figure illustrates these basic strategies.

<Figure 5 about here>

The first strategy for serial entrepreneurs to follow is to team up with entirely different partners for each subsequent founding team. One plausible reason for following this route is the lack of success in the first partnership and the prospect of a more promising enterprise with new partners. The second strategy is to continue a past partnership, possibly because it proved to be a successful founding team. Continued

partnerships also provide opportunities for forging trust-filled relationships that ease further collaborations and may send positive signals to potential investors. The third strategy offers a variation of the second strategy to the extent that it also involves continued partnerships. The main difference is that strategy three rests on brokerage between partners from two previous founding teams that ego was a member of. We include the theoretical possibility of brokerage, yet empirically, very few founders actually followed this path.

The main reason for distinguishing these partnership sequences is that they allow us to compare the reputation effect of prior success with the potential advantages of continued partnerships for raising sufficient amounts of starting capital. Both local factors have macro-level implications. If prior success in raising large amounts of starting capital is all that matters for investors to evaluate how promising a current enterprise will be, founders have a strong incentive to seek partners who have been successful in the past. Prior partnerships that no longer meet this yardstick are unlikely to form the basis for new founding teams, and founders will thus favor new and more promising partners. Since old partnership ties are not necessarily abandoned, the quest for new and successful partners should in fact yield higher levels of macro-level network connectivity: founders would form links between their old and new partners. In contrast, if continuing past founding partnerships is valued highly, it should prevent the formation of ties across founding teams.

<Table 4 about here>

In columns (1) through (4) in table 4, we present least squares estimates of the influence of prior success and repeated partnerships on the amount of starting capital

raised for new enterprises founded by serial entrepreneurs. The distribution of starting capital is highly skewed and resembles a star market, wherein a few new enterprises attract large amounts of starting capital whereas the majority of companies are left with a significantly smaller capital amounts. Since we seek to account for the impact of partnership patterns on raising starting capital at large, and not just the higher echelons of organizational founding, we measure starting capital on a logarithmic scale.

Recall that the variable success equals 1 if one or more partners in ego's current founding team (including ego himself) were able to raise starting capital for a previous founding that was equal to or exceeded the median starting capital for enterprises founded in the same industry during the same decade. Partner's success follows exactly the same logic, but specifies that ego was not successful in the past. Repeated partners equals 1 if ego continues collaborating with partners from previous founding teams, and equals 0 otherwise (see table A.1 in the appendix). The estimates in table 4 include all control variables listed in tables 1 and 2, but we focus on our main effects of interest.

We find a very crisp pattern in column (1): including one or more previously successful partners in one's founding team increases the amount of starting capital by 120%, compared to founding teams that lack partners with a history of success. Hence, the reputation effect of previous success is far from trivial: it more than doubles the amount of starting capital. Repeated partnerships also have a positive impact on the amount of starting capital, and increase it by about 60% compared to newly formed founding. However, it is not nearly as strong as the influence of prior success. Certainly, repeated partnerships may have been successful in the past or not. The estimates in column (2) of table 4 take this interaction into account. The results indicate that the key

factor in previously successful repeated partnerships was their prior success, and not the fact of continued collaboration. Summing up the coefficients for the two main terms and the interaction term nearly eliminates the added benefit of repeated partnerships. In other words, whether founding teams entailed continued collaborations or not, it was the prior success of one or more of their members that mattered for persuading investors to contribute to their enterprise. The estimates in columns (3) and (4) confirm this pattern, using the restriction of prior success to ego's current partners. Under this specification, the disparity between the reputation effect of prior success and the influence of repeated partnerships is even more pronounced. Likewise, combining prior success and repeated partnerships had no statistically significant impact.

In the remainder of table 4 we report additional estimates to assess the robustness of this finding. The models in columns (5) through (8) consider the possibility of unobserved heterogeneity across individual founders, using founder fixed-effects estimates. As expected using this specification, the magnitude of the coefficients is smaller overall, compared to our previous results. The basic pattern, however, remains the same: the influence of prior success on the amount of starting capital raised remains consistently stronger than the impact of repeated partnerships.

The second potential bias may come from period-specific differences. We consider this possibility in models (9) through (14), using period-specific samples to estimate the influence of prior success and repeated partnerships separately for each period. Our choice of periodization is the same as the one used for the network analyses discussed in the previous section. However, using partly overlapping periods as before would not allow us to clearly identify the differential impact of our main effects across

periods. Consequently, we maintain the eight-year time windows, but use mutually exclusive periods. As in the previous estimate, the overall pattern of a strong reputation effect based on past success is robust across the varying specifications. The one noteworthy observation is that this reputation effect appears to be the strongest in the last period (columns (13) and (14)). But even in the two previous periods does prior success increase the amount of starting capital by about 83 to 100%. In sum, then, the positive role of prior success is prevalent throughout our entire period of interest, 1869-1900, and not specific to one particular subperiod.

Prior success of one or more partners on a founding team thus could be expected to increase the amount of starting capital by a substantial margin. Yet, did it also lead to success – an amount that exceeds the median capital raised for other companies founded in the same industry at the same time? In table 5, we crosstabulate prior and present success, using this definition of success.

<Table 5 about here>

The first row confirms our regression results: those entrepreneurs who did not succeed in obtaining large amounts of capital compared to competitors in their industry were unlikely to become successful in subsequent foundings. However, as the results in the second row reveal, past success did not guarantee present success. Even for those entrepreneurs with a history of success, the chances for replicating such success essentially amounted to a random draw.

Considering the combination of these various results yields a clear pattern. Since there was comparatively little to be gained from continuing past collaborations, but much from the inclusion of successful partners in a founding team, these entrepreneurs most

likely preferred new partnerships that carried at least the promise of success. The motivation to seek new partners in each new round of corporate founding was further animated by the unclear chances that the promise of success would turn into manifest success. Returning briefly to table 2, the results for serial founders support this conclusion: only 12.4% of all founder-events involving serial entrepreneurs were based on repeated partnerships. In sum, these findings suggest that the quest for successful partners led to a repeated quest for new partners. We now turn to the implications of this pattern for the macro-level network cohesion among entrepreneurs.

Reproduction of Fragmentation

Seeking new partners for founding new enterprises does not necessarily imply that these entrepreneurs abandoned ties to old partners. If anything, the continued search for new, potentially successful partners should create and forge relationships that bridge across the many distinct components that we observed in the co-founding networks in table 3 and figure 1. Yet, even the network displayed in figure 1, the most cohesive co-founding network we observed, obtains its structure primarily from the *absence* of relationships between components. This structural pattern is even more pronounced in the remaining period-networks shown in table 3. What these results suggest is the following mechanism: if merchant entrepreneurs were always busy identifying new partners, but we do not observe bridges across the structural holes between components being built by their activities, they most likely sought to locate their new partners within the same social circles that enclosed them in these components. Locally, from the perspective of the individual entrepreneur, it appears to be a most rational strategy. The overall

fragmentation of the economic networks he found himself embedded in severely constrained a founder's possibilities. First, beyond those connected in the main component, opportunities for locating new partners with access to fresh resources were extremely limited. Second, even if opportunities for new partnerships beyond one's immediate circle presented themselves, considerable uncertainty about their performance history remained since far-reaching communication channels were missing as well in this fragmented social structure. Given the quest for new partners *and* the constraints imposed by social fragmentation, the most reasonable strategy was to forge partnerships within the smaller business and social worlds one knew best. Structurally, the macro-level consequence of this locally rational strategy is the reproduction of fragmentation since merchant entrepreneurs remained within their components. Hence, the dilemma in this setting was that the very strategies they adopted to cope with social fragmentation ultimately facilitated the reproduction of fragmentation.

What remains to be addressed is the categorical basis on which they selected their partners, beyond the desired quality of a successful past. Put differently, did the social circles in which entrepreneurs moved differ systematically along some categorical distinctions? Here we consider two crucial sources of such categorical attachment, a preference for ethnic homophily at the level of individual founders and a preference for seeking partners operating in the same industry within firm-level networks.

Ethnic Homophily

The recognition of ethnic differences was widespread in nineteenth-century Russia, a society that encompassed a wide variety of ethnic and religious minorities such as Baltic

Germans, Jews, Poles, Ukrainians, Greeks, Armenians, Tartars, and many more. Just as much as Russian merchants sought to break what they perceived as an ethnic encirclement by these minorities and foreigners, the tsarist government imposed a series of restrictions on the involvement of ethnic minorities in Russian enterprises. Between 1869 and 1893, ever more encompassing legal prescriptions banned first foreigners, and then Jews and Poles in particular from owning stock in Russian companies, from the acquisition of land, and finally from ownership and corporate control of chartered companies operating in Russia (Owen 1991a; Rieber 1982). With these manifest ethnic discriminations enforced by the tsarist government it would not seem surprising that the choice of business partners was also patterned along ethnic divisions.

To assess the potential influence of co-ethnic ties on the formation of economic ties among partners in founding teams, we constructed such ethnic networks for each of the seven periods distinguished in the component analysis discussed earlier. These networks are coded as binary symmetric matrices where entries for the ties between two founders equal 1 if the two founders belong to the same ethnic group (this includes Jews as a significant minority group), and equal 0 otherwise. We then used QAP random permutation tests to calculate the correlation between the co-founding network and the co-ethnic network in each period. High correlations indicate that economic partnership formation is patterned along ethnic divisions. Table 3 reports the correlations with co-ethnic networks for each period in the next to last column. The results show very low correlations throughout all period networks, indicating that ethnicity is not the primary

factor shaping founding partnerships among these merchant entrepreneurs.⁵ The network in figure 1 illustrates this ethnic heterogeneity: founder nodes are colored according to their ethnic origin, yet no systematic pattern of ethnic segregation emerges from this graph. One potential reason for this result is shown in the last column of table 3: ethnic Russians accounted for nearly half of all founders across all periods. With such an overwhelming majority, chance alone suggests that opportunities for having a Russian partner in a founding team were certainly much more numerous than for someone from a particular minority group.

Industrial Homogeneity

Alternatively, selection into components may have been channeled by a preference for partners operating in the same industry. Entrepreneurship in different industries certainly required increasingly specialized skill sets that could not be easily transferred. On the one hand, such specialization contributed its share to social fragmentation by fortifying the barriers to knowledge transfer across fields. On the other hand, familiarity with the specifics of their industry enabled founders to evaluate the prospects of their new partners with greater ease and certainty. Consequently, in a social world characterized by fragmentation, seeking new partners within the field one knows best is a locally rational strategy to pursue.

<Table 6 about here>

⁵ Another obvious source that may have led entrepreneurs to confine their activities to clearly delimited components are strong family bonds. Our analysis of the extent to which co-founding ties were patterned along kinship ties is currently under way.

Here we consider the possibility of industrial homogeneity within firm-level networks. Throughout, we adopt the same periodization as for the founder-level networks discussed above. Table 6 reports basic measurements of network size and cohesion for these firm-level networks, sorted by period. These results mirror the lack of cohesion we documented for founder-level networks in table 3. While the networks are of course considerably smaller, the size of the largest component as well as the proportion of firms contained within it is again very small. As was the case with the founder-level networks, the first period 1869-76 is also the most cohesive one among the firm-level networks. For comparison, figure 6 maps the firm-level network in this period. In this graph, firms are represented by nodes, which are colored according to their main industries as specified in their corporate charters. Pairs of firms are connected to the extent that they have one or more founders in common. As with the founder-level networks, we set the strength of ties – the number of shared founders – aside to focus on the overall pattern of the network structure instead. The graph is again drawn using a spring embedding algorithm that places firm nodes closer to each other to the extent that they share founders and are linked by short path lengths in the network. Most noteworthy in the resulting graph is the observation that even in this most cohesive firm network only 24% of all firms are included in the main component, whereas the vast majority of firms are contained in a large number of smaller components disconnected from each other.

<Figure 6 about here>

We assess the extent of industrial homogeneity in each of these networks by comparing firms connected cohesively within the main component with firms contained in the numerous smaller components scattered across this fragmented business world.

Suppose it was indeed their preference for partners embedded in the same industrial field that prevented founders from creating connections beyond the confines of their known circles. Under this assumption, we should expect that most firms within the various smaller components in the firm-level networks operated within the same industry. In contrast, the structural reason for the emergence of a main component is that founders located within it were prepared to forge ties that potentially reached across the boundaries of industrial sectors. Consequently, we expect that the main components were considerably more heterogeneous with respect to industrial composition than the remaining smaller components.

We measure heterogeneity using a version of the standard Hirschman-Herfindahl index of industry concentration (Scherer 1990, p.):

$$H_{it} = 1 - \sum_{j=1}^n p_{ij}^2,$$

where for each component i during period t , p denotes the proportion of companies in industry j . The range of the index is $0 \leq H \leq 1 - (1/j)$. Results equal to 0 indicate perfect homogeneity such that all firms linked within a component belong to the same industry. Heterogeneity increases as values approximate the maximum. The results for all seven periods are plotted in figure 7. For each period network, we compare the heterogeneity score for the largest component with the average score for all other components that contain two or more firms (i.e. all components that are not isolates). Since the index is sensitive to component size, we report each resulting score as the proportion of the

maximum possible heterogeneity given the number and sizes of components included in the calculation.⁶

<Figure 7 about here>

The figure documents two main trends. First, heterogeneity in the composition of firms within the largest component consistently exceeds the average heterogeneity within the many smaller components across all periods. The second trend reveals not only that heterogeneity differs between the main component and the other smaller components, but the extent to which it differs across time. With the exception of the 1873-80 period, industry composition within the main component consistently exceeds 50% of the maximum possible heterogeneity, and even reaches between 70% and 83% of the maximum heterogeneity within the last three period networks. We find the opposite trend for the remaining smaller components, which reach between 52% and 77% of the maximum possible homogeneity of industries among firms. These results thus suggest that a preference for business partners operating in the same industries did indeed lead many entrepreneurs to search for new founding team partners within relatively confined local social circles that rarely crosscut each other.⁷ Since more heterogeneous relationships were limited to the main component, these local choices ultimately accumulated to perpetuate the existing fragmentation at the level of macro network structures.

⁶ For instance, since there are seven main industries in our data, the maximum heterogeneity is reached when the proportion of each industry in a given component equals one-seventh. But this holds only for components containing seven or more firms. Dyads can be shared by only two industries, triads at most by three industries, and so forth.

⁷ This interpretation is further supported by the low average number of different industries that serial founders tended to invest in, as reported in table 2.

DISCUSSION

Despite rapid economic development and often far-reaching political transformation such as the “Great Reforms” under Alexander II, social fragmentation was a perennial feature of late imperial Russia, as social historians have long recognized (Owen 1981; Ruckman 1984). Some historians even go as far as stating that late imperial Russia did not succeed in generating a genuine class structure, but was still entangled in a system of social stratification that resembled a caste system based on local and particularistic interests. While few, if any social strata were spared from it, the consequences of this lack of cohesion was particularly felt among the Russian merchant entrepreneurial classes. As Alfred Rieber (1982, p.418) put it, “no social group in the empire suffered a greater loss of identity and vitality in this unsystematic system than the merchantry.”

In this paper, we have focused on one particularly salient activity that these merchant groups engaged in. As entrepreneurs, forming founding teams to promote the founding and incorporation of new enterprises was one of their core activities. Indeed, it would be difficult to underestimate the role entrepreneurship played for the formation of their identity as a distinct social class. We do not mean to suggest that founding new companies was the sole source for the merchantry to create the ties necessary for forming a cohesive social class. But co-founding relationships provided one of the important building blocks of their social structure. Consequently, the structural fragmentation we document in this particular, yet crucial field of entrepreneurial activity contributed in significant ways to the overall social fragmentation that these social strata faced.

Using systematic quantitative data on the founding histories of Russian entrepreneurs, we have identified a straightforward mechanism that facilitated the reproduction of social fragmentation. Hence, we do not seek to account for the emergence of fragmented networks in the first place, but rather their continued existence despite a flurry of organizational foundings across various industries. Our starting point is the observation that a reputation based on previously successful entrepreneurship, and not necessarily the development of repeated partnerships was critical for the amount of basic capital that founders were able to obtain for operating their businesses. Yet, prior success did not guarantee future success, an observation that led founders to keep searching for new partners, as we have documented above. However, the absence of cohesive social networks severely limited (1) the possibilities of identifying new partners beyond the limits of one's social circles, and (2) access to the kind of information necessary for evaluating the potential performance of new partners, should the latter present themselves. Under these conditions, individual entrepreneurs relied on local knowledge to identify potential new founding team partners within the confines of their local social worlds. From the perspective of the individual entrepreneur this was a natural strategic choice to cope with the surrounding fragmentation of social networks. However, these individual strategies accumulated to macrostructural consequences that ultimately facilitated the maintenance and reproduction of the very fragmentation they were adopted to cope with.

Performance Consequences

One important implication that warrants discussion is how consequential the splintering of these entrepreneurial networks into numerous small, yet relatively homogeneous components really was for economic performance. Phrased in a more positive way, how advantageous for raising capital was the embeddedness of founders in the more cohesive main component in contrast to the fragmented network outside of this main component? The benefits of such network reach in contrast to enclosure in delimited groups with similar others are well theorized and documented in other settings (e.g. Burt 2005; Baldassarri and Diani, *forthcoming*). Here we address this contrast with respect to the average amount of capital raised by entrepreneurs for each of our subperiod networks.

<Table 7 about here>

Table 7 reports the results of means comparisons of starting capital for founders embedded in the main component and those distributed across the various smaller disconnected components. Only in the first (1869-76) and last (1893-1900) periods does the average capital amount achieved by founders located in the largest components significantly exceed the amounts raised by members of the remaining smaller components. In the two middle periods, the average capital amount in the smaller components is even larger than the amount among members of the main component, although this difference is not statistically significant. The likely reason for this pattern is the varying size of the largest component over time, as shown in table 3 above. In the first and last periods, the number of founders embedded in the main component is substantial, especially in comparison to the overall size of the two networks. Diversity of founders, and the benefits that access to them offers, is size-dependent such that a critical mass of founders is necessary to gain an advantage from being embedded in the main

component. In each of the two middle periods, the main component did in fact contain not many more founders than the next largest of the remaining components. Hence, at least for organizational foundings, being linked within the main component does have a strategic advantage. But this advantage is conditional on the size of the main component relative to the number of founders in the overall network. Full advantage, so our results suggest, comes only from large enough main components that provide access to sufficiently diverse resources and opportunities for identifying promising new partners for one's founding teams.

Collaboration Networks and Political Cohesion

To conclude, we draw attention to a clear empirical deviation from the results of previous studies. A large number of studies of collaboration networks, interlocking directorates, and co-ownership networks have frequently found either small world characteristics or social structures dominated by a single cohesively connected component. In the first scenario, small world economic networks are characterized by numerous small clusters of firms that exhibit dense internal connections but only a few sparse links that bridge the structural holes between clusters. This pattern has been frequently observed in otherwise quite different business settings, ranging from Canadian investment bank networks to ownership networks among German firms and corporate interlocks among American companies (Baum et al. 2003; Davis et al. 2003; Kogut and Walker 2001). In the second scenario, recent research of collaboration networks in emergent industrial fields such as biotechnology (Powell et al. 1996, 2005) and in academic disciplines (Moody 2004) tends to reveal another consistent pattern of cohesive networks that are dominated by a

large component. This main component consistently includes the vast majority of actors (whether organizations or the people who populate them) who are cohesively connected through multiple alternative pathways. Such multi-connectivity is often seen as beneficial for improving access to high-value resources as well as the speed whereby they are exchanged in knowledge-based networks.

While the purpose of their ties is similar, co-founding networks among entrepreneurs in late imperial Russia contrast with both patterns. Similar to small world structures, we identified numerous smaller components that tightly connect founders within them. Yet, in contrast to small world networks, bridging relations across such components were completely absent. Locally, the majority of Russian founders were encapsulated within their own small worlds with few, if any connections to outsiders. The larger pattern is of course structural fragmentation. Maximal connectivity is only found within the main component, which carries all the characteristics that previous studies have found in other contexts. However, we consistently find a substantially smaller proportion of firms or founders within this main component than has been documented in previous studies of other settings.

It is important to note that prior research that identified large inclusive main components has usually done so by focusing on the emergence of single industries, for instance, the rise of the field of biotechnology (Powell et al. 1996, 2005). One may therefore counter that we should not be surprised to see such fragmentation since we examine several industries at once: what appear to be fragmented networks may thus simply be the social relational expressions of industry specialization. Our evidence does not support this inference. Given the results of previous studies, such industry

specialization should give rise to a few cohesive components, but not numerous small and disconnected ones. Likewise, the large extent of heterogeneity with respect to industry composition within the largest components does not match this alternative interpretation.

What, then, is the general lesson that can be learned from this seemingly peculiar historical case? It appears that these Russian entrepreneurial networks are a particular instance of a more general phenomenon – namely how local choices that are perfectly reasonable from an individual perspective can give rise to unintended macrostructural patterns that in turn undermine those individual strategies. We have already addressed how such self-reproducing networks eroded economic performance. The implications are even more far-reaching in settings where political organization rests in important ways on such economic networks, as was the case with these Russian entrepreneurs. Just as they blocked the extension of economic collaboration beyond the confines of parochial groups, fragmented networks prevented the political cohesion necessary for the merchantry to develop a collective identity as a distinct social class and to collectively pursue their interests within the changing society of late tsarist Russia. To paraphrase another social theorist whose works would rise to prominence in twentieth-century Russia: the social structure they helped to reproduce placed the members of the entrepreneurial middle strata in similar positions, yet without opportunities for creating cohesive relations with one another – “much as potatoes in a sack form a sack of potatoes” (Marx 1869[1963], pp.123-24).

DATA APPENDIX

<Table A.1 about here>

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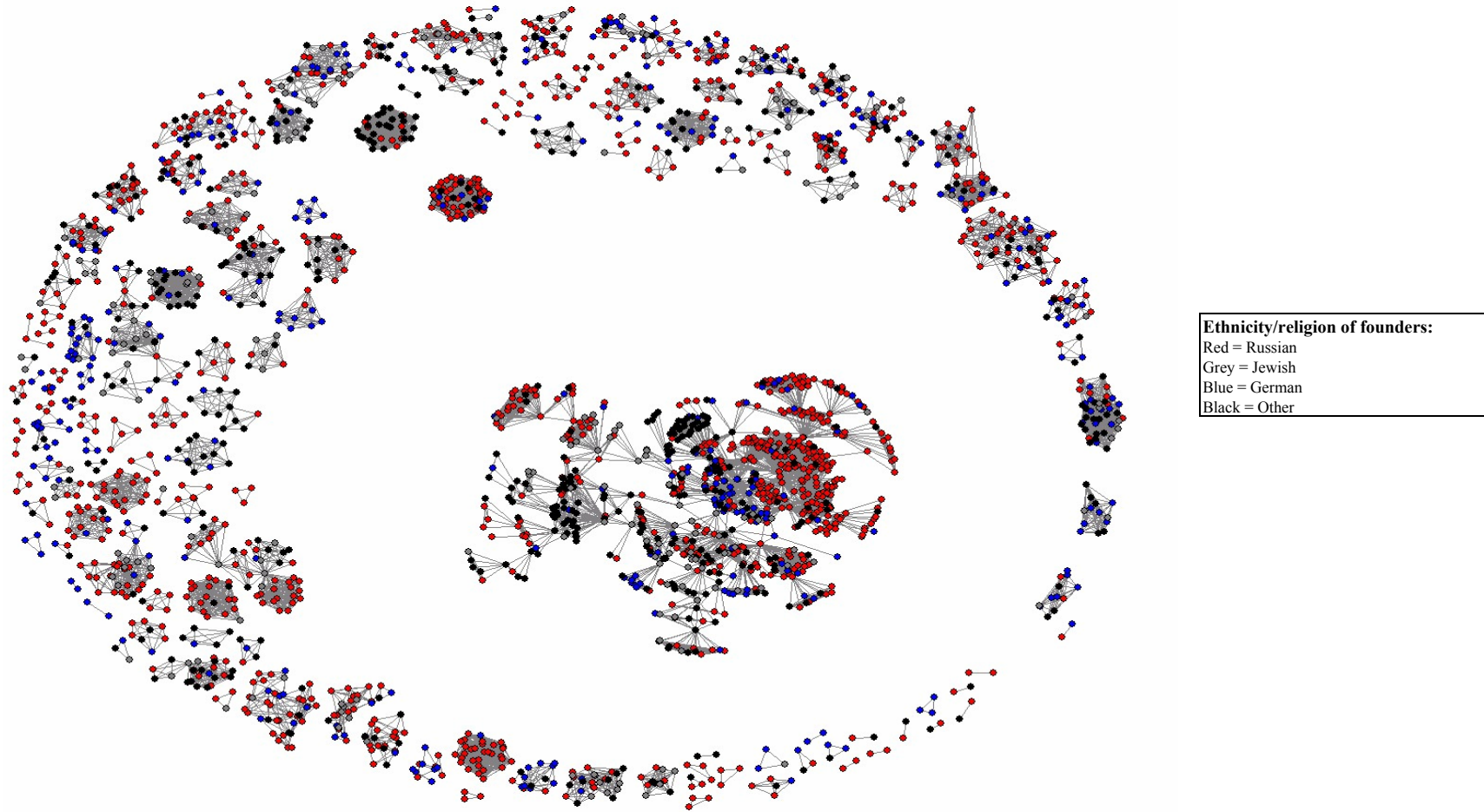
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Figure 1. Most cohesive founder-level network, 1869-76 (N=2311 founders)



*Note: The network graph is drawn using an iterative spring embedding algorithm that finds an optimal layout by placing founders close to each other that are linked by short paths and join in many founding teams. For ease of readability, arrowheads are left off since all ties are bi-directional affiliations. The network includes 34 isolated founders in this period (not shown). The largest component in the center contains 33% of all founders in this period (see table 3 for details).

Figure 2. Comparison of isolates and largest components in founder networks, 1869-1900

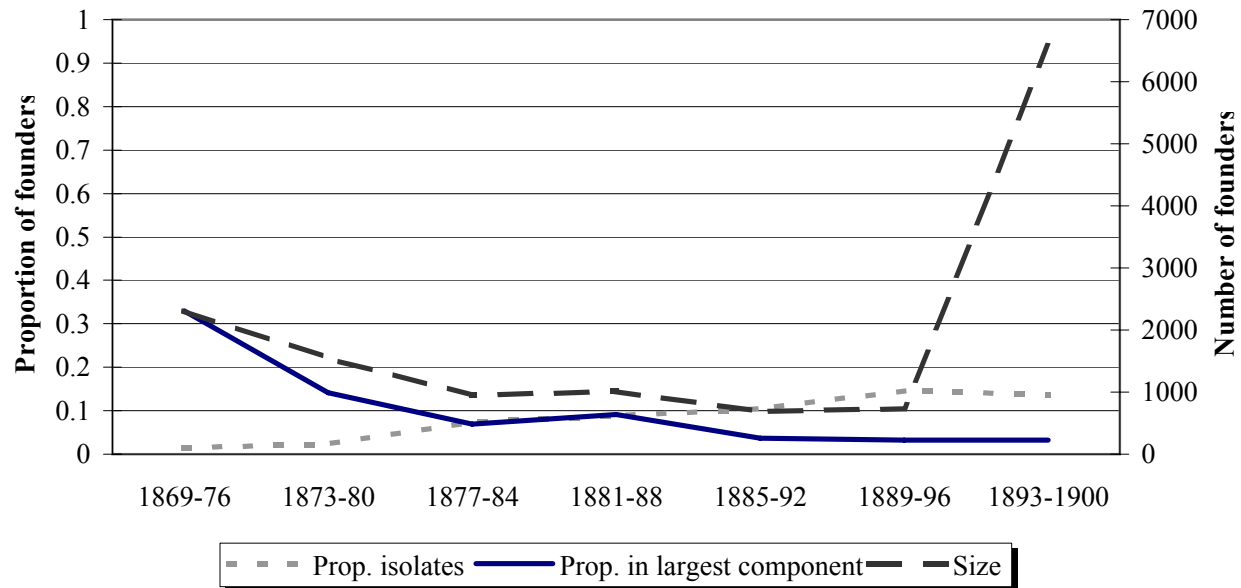
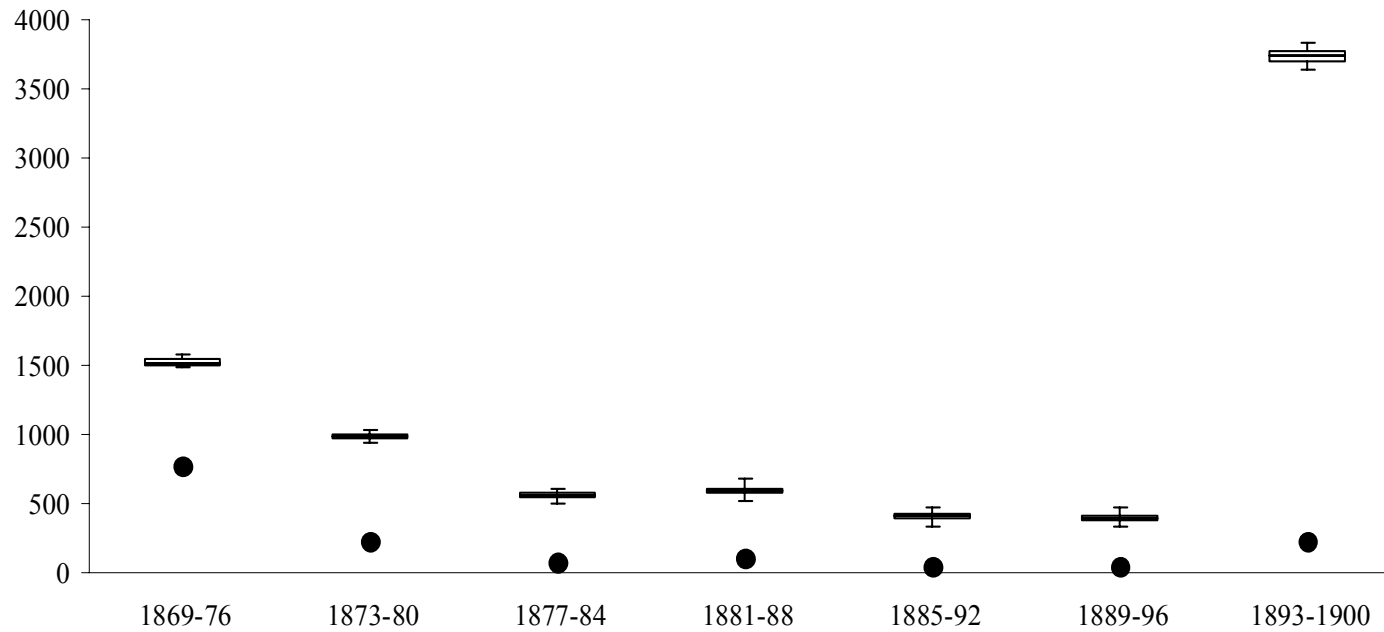
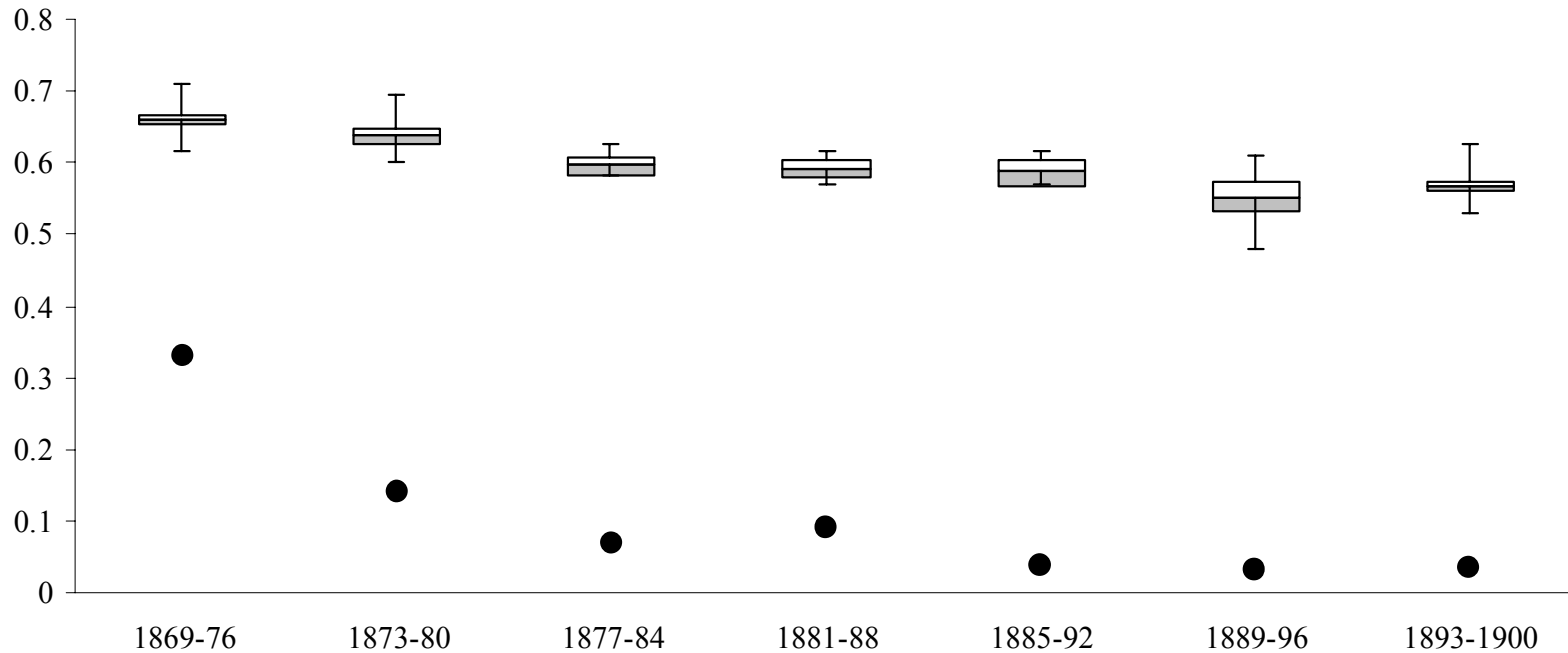


Figure 3. Simulation results: number of founders in largest component



*Note: The figure compares the observed number of founders in the largest component of the founder-level network with results from simulated random networks. For each period, the simulations are based on random 2-mode affiliation networks that include the same number of founders and companies, and assign the same average degree of founders as in the observed network. The simulated 2-mode affiliation networks are then transformed into 1-mode founder networks, and the number of founders in the largest component computed. The box-plots show the distributions for the simulated random networks in each period. The black circles show the number of founders in the largest component in the observed networks in each period (see table 3 for more details).

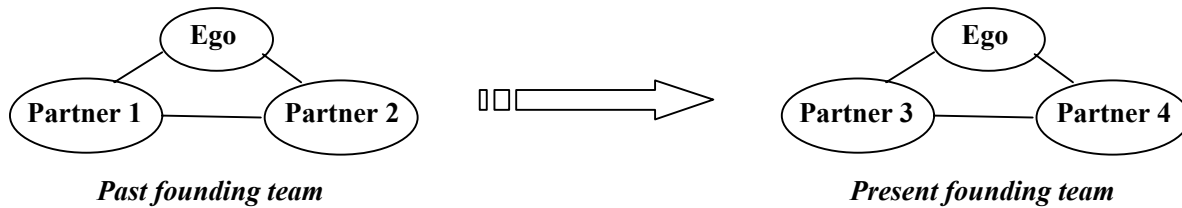
Figure 4. Simulation results: proportion of founders in largest component



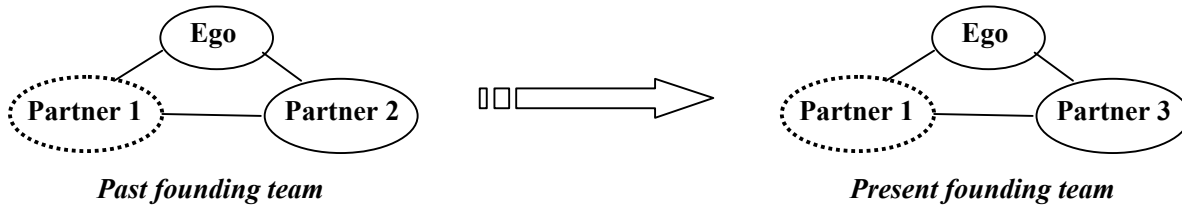
*Note: The figure compares the observed proportion of founders in the largest component of the founder-level network with results from simulated random networks. For each period, the simulations are based on random 2-mode affiliation networks that include the same number of founders and companies, and assign the same average degree of founders as in the observed network. The simulated 2-mode affiliation networks are then transformed into 1-mode founder networks, and the proportion of founders in the largest component computed. The box-plots show the distribution of proportions for the simulated random networks in each period. The black circles show the proportion of founders in the largest component in the observed networks in each period (see table 3 for more details).

Figure 5. Three basic partnership strategies for serial founders

Strategy 1: Ego aligns with new partners for subsequent findings



Strategy 2: Repeated partnership -- Ego aligns with one or more previous partners for subsequent findings



Strategy 3: Brokerage -- Ego brings previous partners from different founding teams together for subsequent findings

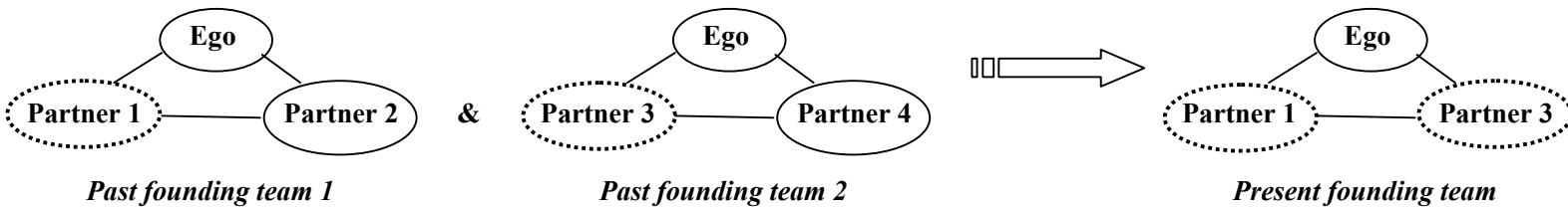
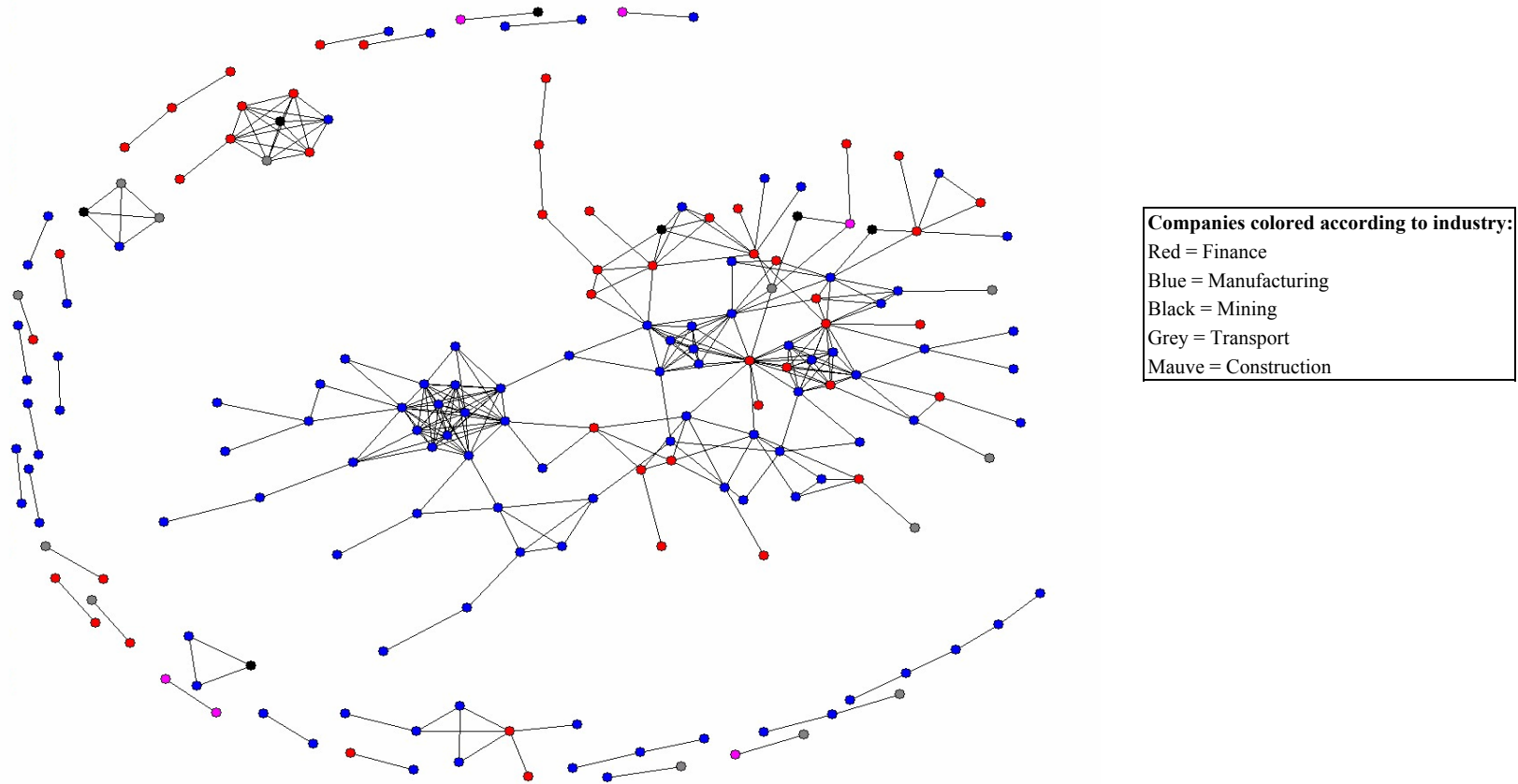
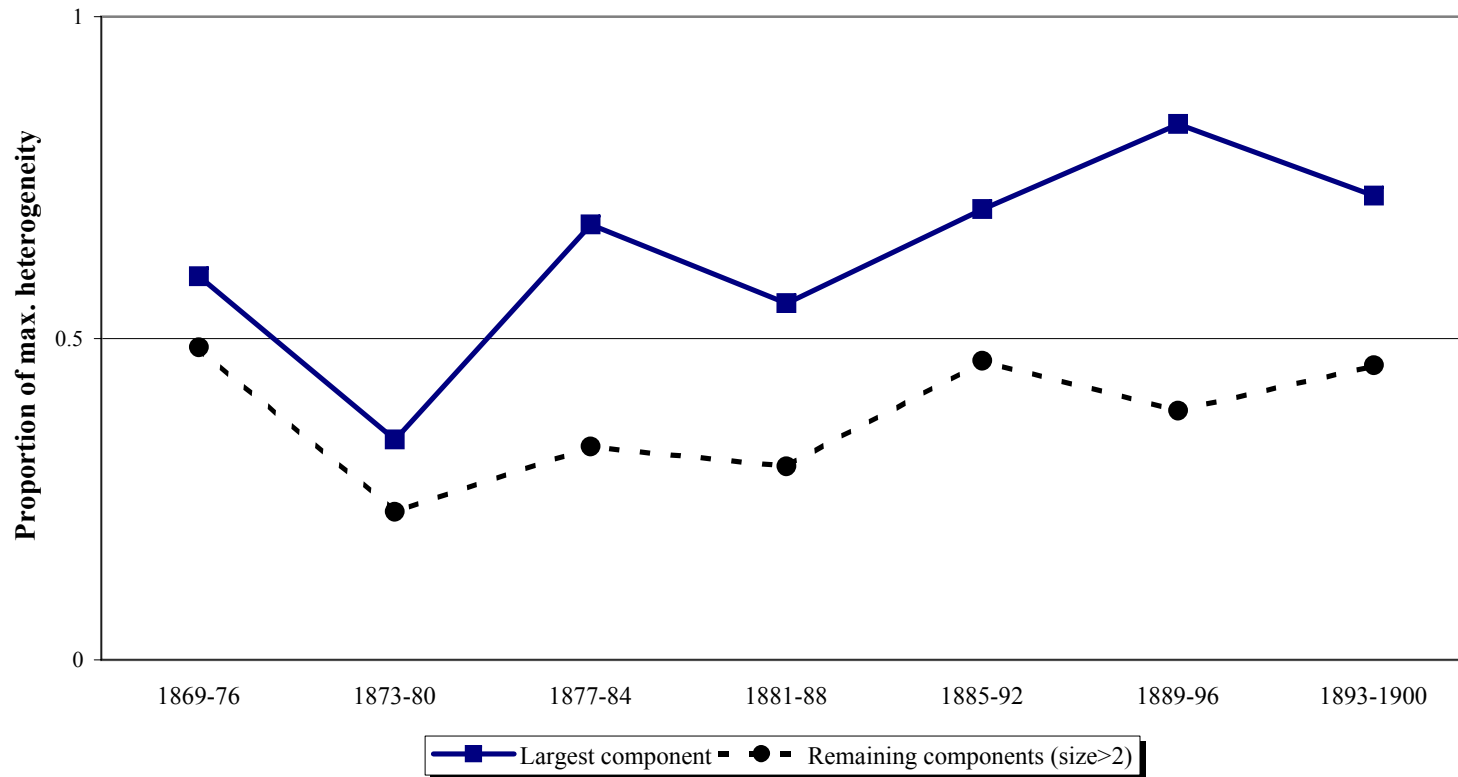


Figure 6. Most cohesive firm-level network, 1869-76 (N=424 companies)



*Note: The network graph is drawn using an iterative spring embedding algorithm that finds an optimal layout by placing companies close to each other that are linked by short paths and have many founders in common. For ease of readability, arrowheads are left off since all ties are bi-directional affiliations. The network includes 244 isolated companies without connections to any other company in this period (not shown). The largest component in the center contains 24% of all companies in this period (see table 6 for details).

Figure 7. Industry heterogeneity in components of firm-level networks, 1869-1900



*Note: Heterogeneity of industries among companies within components is measured using a version of the Hirschman-Herfindahl index of concentration. Since the index is sensitive to component size, we report scores as the proportion of the maximum possible heterogeneity given the number and sizes of components included in the calculation. The proportion for the largest component in each period is calculated for that one component only. The proportion of the maximum heterogeneity for all remaining components that contain two or more firms is calculated using the average heterogeneity over all such components in each period. See main text for details.

Table 1. Firm-level characteristics, 1869-1900

Variable	Number of firms	Mean (sd)
Starting capital (in 1913 Rubles)	3,724	115,584.8 (30,8749.2)
Number of founders involved	3,724	3.11 (3.59)
Number of shares	3,666	5,134.79 (13858.11)
Share price (in Rubles)	3,667	796.3 (1491.2)
<i>Organizational form:</i>		
■ Joint-stock (<i>aktsionernoe obshchestvo</i>)	2,452	0.6565
■ Share partnership (<i>tovarishchestvo na paiakh</i>)	1,276	0.3416
■ Company (<i>kompaniia</i>)	4	0.0011
<i>Main regions:</i>		
■ South	774	0.2070
■ Center	762	0.2038
■ Volga - Ural	256	0.0685
■ North	812	0.2172
■ Kingdom of Poland	447	0.1196
■ Caucasus	258	0.0690
■ Central Asia	65	0.0174
■ Siberia	311	0.0832
■ Grand Duchy of Finland	15	0.0040
■ Other countries	27	0.0072
■ Unspecified location in Russian Empire	12	0.0032
<i>Main industries:</i>		
■ Mining	232	0.0622
■ Construction	73	0.0196
■ Manufacturing	2,424	0.6500
■ Transport	399	0.1070
■ Wholesale	214	0.0574
■ Finance	381	0.1022
■ Public sector	6	0.0016

*Note: The table reports descriptive statistics for all corporations chartered in 1869-1900 and included in our analysis. Starting capital amounts are standardized and deflated to 1913 rubles. Share prices are given in the standard ruble of account (see Owen 1989). For the first four variables, the second column reports the number of corporations for which these data are available. For all other variables, the second column reports the number of corporations in each category, given that such data are available. For these variables, the third column reports the proportion of corporations in each category.

Table 2. Founder-level characteristics, by serial and one-time founders, 1869-1900

Variable	One-time founders (N=8,112)		Serial founders (N=773)		Sig. diff.
	N founder-events	Mean (sd)	N founder-events	Mean (sd)	
Starting capital (in 1913 Rubles)	8,112	106,813.1 (295,513.2)	1,856	156,405.3 (393,144.2)	-6.0996***
<i>Main ethnic and religious groups:</i>					
■ Russian	3,841	0.4735	982	0.5291	18.6957***
■ German	1,387	0.1710	272	0.1466	6.4975**
■ Jewish	896	0.1105	249	0.1342	8.3484***
■ Other	1,988	0.2451	353	0.1902	25.3110***
<i>Main social status groups:</i>					
■ Nobility	467	0.0576	159	0.0857	20.2621***
■ Government	913	0.1125	313	0.1686	44.0584***
■ Military	384	0.0473	43	0.0232	21.5187***
■ Educational/Professional	904	0.1114	213	0.1148	0.1676
■ Commercial	4,011	0.4945	890	0.4795	1.3465
■ Estate	1,108	0.1366	147	0.0792	45.1962***
■ Religious	1	0.0001	0	0	
■ Organizations	324	0.0399	91	0.0490	3.1275*
Success			838	0.4515	
Partner's success			868	0.4677	
Repeated partners			230	0.1239	
Number of foundings			1,856	2.8589 (1.6171)	
Years between subsequent foundings			1,097	3.5579 (5.9109)	
Years between first and last founding			759	4.9513 (6.9812)	
Number of regions			1,273	0.4729 (0.8474)	
Prop. different regions over all foundings			1,273	0.1622 (0.2418)	
Number of industries			1,262	.5008 (0.8062)	
Prop. different industries over all foundings			1,262	0.1730 (0.2370)	

*Note: Starting capital amounts are standardized and deflated to 1913 rubles. Success is lagged by one previous founding and equals 1 if one or more members in a founder's current partnership generated starting capital for a previous company that was equal to or exceeded the median starting capital for all other companies founded in the same industry, region, and decade. Previous success may refer to Ego or any of his current partners. Partner's success also measures previous success, but Ego's previous success is not taken into account, only his current partners' previous success. Repeated partners equals 1 if one or more of Ego's current partners were also Ego's partners in a previous founding team (see table 1). For each variable, founder-events count the number of unique foundings for which data are available. Serial founders contribute to more than one founder-event. Significant differences compare means (t-statistic) and proportions (chi-2, df=1) between one-time and serial founders.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3. Founder-level network characteristics by period, 1869-1900

Period	Network Size	Number of components	Number of isolates	Size of largest component	Prop. in largest component	QAP corr. with co-ethnic network	Prop. Russian
1869-76	2,311	274	34	763	0.330	0.039	0.498
1873-80	1,543	268	37	218	0.141	0.031	0.462
1877-84	944	276	70	66	0.070	0.038	0.474
1881-88	1,012	304	89	92	0.091	0.034	0.467
1885-92	691	212	72	25	0.036	0.045	0.507
1889-96	735	273	107	24	0.033	0.058	0.457
1893-1900	6,577	2,228	905	216	0.033	0.024	0.413
Cumulative network, 1869-1900	10,269	2,769	999	1,586	0.154		

*Note: All networks contain serial as well as one-time founders. The number of components includes all isolates.

Table 4. Regression of starting capital raised by companies with serial founders, 1869-1900

	All periods (1869-1900)								OLS period-specific					
	OLS				Fixed effects				(1869-76)		(1877-92)		(1893-1900)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Success (<i>t-1</i>)	1.202 (0.054)***	1.257 (0.054)***			1.102 (0.049)***	1.154 (0.048)***			0.830 (0.105)***	0.944 (0.100)***	0.993 (0.072)***	1.008 (0.075)***	1.360 (0.060)***	1.397 (0.059)***
Repeated partners	0.607 (0.087)***	0.753 (0.097)***	0.139 (0.054)***	0.221 (0.082)***	0.529 (0.068)***	0.639 (0.074)***	0.100 (0.051)*	0.162 (0.076)**	0.426 (0.111)***	0.618 (0.135)***	0.527 (0.162)***	0.563 (0.178)***	0.731 (0.129)***	0.845 (0.145)***
Success*Repeated partners		-0.682 (0.155)***				-0.451 (0.160)***				-0.637 (0.175)***		-0.351 (0.261)		-0.565 (0.243)**
Partner's success (<i>t-1</i>)			1.224 (0.051)***	1.244 (0.051)***			1.125 (0.046)***	1.141 (0.046)***						
Partner's success*Repeated partners				-0.154 (0.107)				-0.117 (0.112)						
Founder fixed-effects	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Company controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Founder controls	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Constant	10.193 (0.067)***	10.135 (0.066)***	10.118 (0.061)***	10.109 (0.061)***	10.075 (0.069)***	10.033 (0.069)***	10.070 (0.067)***	10.059 (0.067)***	10.407 (0.140)***	10.266 (0.147)***	10.159 (0.129)***	10.154 (0.128)***	10.155 (0.098)***	10.120 (0.096)***
Number of firms	1,264	1,264	1,264	1,264	1,264	1,264	1,264	1,264	203	203	271	271	790	790
Number of serial founders	773	773	773	773	773	773	773	773	193	193	258	258	529	529
Founder-events	1,831	1,831	1,831	1,831	1,831	1,831	1,831	1,831	386	386	392	392	1053	1053
R-squared	0.682	0.689	0.703	0.703	0.630	0.635	0.639	0.639	0.757	0.768	0.739	0.740	0.713	0.717

*Note: Clustered standard errors, allowing for correlation within founding teams, are reported in parentheses. The dependent variable is the starting capital of newly incorporated companies, measured on a log-scale for all estimates. Starting capital amounts are standardized and deflated to 1913 rubles. Success is lagged by one previous founding and equals 1 if one or more members in a founder's current partnership generated starting capital for a previous company that was equal to or exceeded the median starting capital for all other companies founded in the same industry, region, and decade. Previous success may refer to Ego or any of his current partners. Partner's success also measures previous success, but Ego's previous success is not taken into account, only his current partners' previous success. Repeated partners equals 1 if one or more of Ego's current partners were also Ego's partners in a previous founding team (see table A1 in the data appendix). Company controls include number of founders, number of shares, organizational form (joint-stock=1, otherwise=0), region, and industry. Founder controls include ethnic and religious background and social status group.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. Influence of past success on likelihood of success in current partnership

	Current founding		Sig.diff.
	No success	Success	
Unsuccessful past founding	815 (0.5679)	620 (0.4321)	chi2 (df=1) = 5.9860 p = 0.014
Successful past founding	264 (0.5057)	258 (0.4943)	

Note: N=1,957 serial founders in the period 1869-1900. Row proportions reported in parentheses. Success is defined as generating starting capital for a new company that is equal to or exceeds the median starting capital for all other companies founded in the same industry, region, and decade.

Table 6. Firm-level network characteristics by period, 1869-1900

Period	Network Size	Number of components	Mean component size	Number of isolates	Size of largest component	Prop. in largest component
1869-76	424	274	1.547	244	102	0.241
1873-80	355	268	1.325	240	49	0.138
1877-84	329	276	1.192	241	10	0.030
1881-88	366	304	1.204	271	20	0.055
1885-92	243	212	1.146	189	5	0.021
1889-96	307	273	1.125	247	4	0.013
1893-1900	2746	2228	1.232	1984	63	0.023

*Note: All firm-level network statistics are measured based on affiliations among serial and one-time founders. The number of components includes all isolates.

Table 7. Means comparison of starting capital, 1869-1900

Founder-level network in period	Founders in main component			Founders in remaining components			T-test
	Founder-events	Mean	SD	Founder-events	Mean	SD	
1869-76	960	167,514.10	537,398.20	1,689	123,315.10	315,031.60	-2.6685**
1877-84	112	86,017.34	91,847.73	1,129	119,725.30	355,606.00	0.9995
1885-92	39	76,268.07	65,167.01	881	106,709.60	175,841.60	1.0774
1893-1900	305	138,763.70	147,198.50	7,046	108,256.30	258,095.90	-2.0498*

*Note: The table compares average starting capital raised for corporate foundings where founders belong to the largest component in the founder-level network with foundings where founders are not connected to the largest component. See table 3 for characteristics of founder networks in each period. Starting capital amounts are standardized and deflated to 1913 rubles.

* significant at 5%; ** significant at 1% (one-tailed)

Table A1. Description of data and measurement

Variable	Description
Firm-level:	
Starting capital	<ul style="list-style-type: none"> Amount of basic capital specified in the company charter. Ruble amounts are standardized using the standard ruble of account (Owen 1989), and deflated to 1913 rubles, using the St. Petersburg retail price index (Strumilin 1966). Where starting capital included both stocks and bonds, their sum is used.
Number of founders involved	<ul style="list-style-type: none"> Count of the number of founders named in the company charter.
Number of shares	<ul style="list-style-type: none"> Count of the number of shares issued by the company.
Organizational form	<ul style="list-style-type: none"> Indicators for organizational type: joint-stock (<i>aktsionernoe obshchestvo</i>), share partnership (<i>tovarishchestvo na paiakh</i>), or company (<i>kompaniia</i>). Indicators =1 if company equals organization type, =0 otherwise.
Region	<ul style="list-style-type: none"> Indicators for primary geographical location: South, Center, Volga-Ural, North, Kingdom of Poland, Caucasus, Central Asia, Siberia, Grand Duchy of Finland, other countries, other locations within Russian Empire. Indicators =1 if company operated primarily in given region, =0 otherwise.
Industry	<ul style="list-style-type: none"> Indicators for primary function of the company: mining, construction, manufacturing, transportation, wholesale, finance, public sector. Indicators =1 if company operated primarily in given industry, =0 otherwise.
Founder-level:	
Ethnic and religious groups	<ul style="list-style-type: none"> Indicators for ethnicity (religion) of founders (to the extent that it can be determined): Russian, German, Jewish, other. Indicators =1 if a founder belongs to the given group, =0 otherwise.
Social status	<ul style="list-style-type: none"> Indicators for social status of founders, as specified in the charter: nobility, government official, military, educational/professional classes, commercial classes, landed classes (estate), church official, representative of other organizations. Indicators =1 if a founder belongs to the given group, =0 otherwise.
Success	<ul style="list-style-type: none"> Lagged indicator: =1 if a founder, or partners in a founder's current founding-team generated starting capital for a previous company that was equal to or exceeded the median starting capital of all other companies founded in the same industry, region, and decade; =0 otherwise. Success is lagged by one founding event.
Partner's success	<ul style="list-style-type: none"> Lagged indicator: =1 only if partners in a founder's current founding-team generated starting capital for a previous company that was equal to or exceeded the median starting capital of all other companies founded in the same industry, region, and decade; =0 otherwise. This does not take a focal founder's previous success into account. Success is lagged by one founding event.
Repeated partners	<ul style="list-style-type: none"> Indicator of repeated partnerships: =1 if a founder's current founding-team includes members who were partners of that founder in previous founding-teams; =0 otherwise.
Number of foundings	<ul style="list-style-type: none"> Count of the number of distinct foundings a founder was involved in.
Years between subsequent foundings	<ul style="list-style-type: none"> For serial founders, count of the number of years between subsequent foundings.
Years between first and last founding	<ul style="list-style-type: none"> For serial founders, count of the number of years between initial and last founding.
Number of regions	<ul style="list-style-type: none"> For serial founders, count of the number of different geographical locations a founder operated in (=0 if all foundings in the same location, =1 if foundings in two different locations, =2 if foundings in three different locations, and so forth) measured by firm-level region dummy indicators (see above).
Number of industries	<ul style="list-style-type: none"> For serial founders, count of the number of different industries a founder operated in (=0 if all foundings in the same industry, =1 if foundings in two different industries, =2 if foundings in three different industries, and so forth), measured by firm-level industry dummy indicators (see above).
Networks:	
Founder-by-founder ties	<ul style="list-style-type: none"> Two founders are linked if they are members of the same founding-team, i.e. both are named on the same company charter. Ties are weighted by the number of founding-teams they are both members of.
Firm-by-firm ties	<ul style="list-style-type: none"> Two companies are linked if they share one or more founders, i.e. one or more founders named on both company charters are identical. Ties are weighted by the number of founders that pairs of companies have in common.

*Note: The source for all data is the RUSCORP database (Owen 1988).