

**Structural Complementarity: Entrepreneurial Performance of Founding Teams in  
Late Imperial Russia**

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## **ABSTRACT**

Organizational theorists suggest that fledgling firms face a trade-off between the benefits of occupying a network position in a dense cluster of shared associates, cohesion, versus the advantages of bridging unconnected clusters, brokerage. Whereas being located in a cohesive cluster promotes trust and encourages knowledge sharing among firms, a brokerage position generally leads to greater access to resources and novel information. Hence cohesion and brokerage are both essential to the survival and success of a young firm. We argue that variations in relational composition of the founding team help entrepreneurs reconcile this structural trade-off and contribute to the team's economic performance. In particular, founding teams with structural complementarity, composed of both individuals who contribute brokering relations and individuals who provide access to cohesive clusters, outperform teams with less structural diversity. Supporting evidence for our argument comes from the historical setting of corporate industrialization in late imperial Russia (1869-1913). We show how brokerage diversity in a founding team gives it a competitive advantage in the mobilization of investor capital over more relationally uniform teams.

Entrepreneurial groups face an array of challenges particularly in emergent markets. Emerging markets are highly uncertain economic settings insomuch as they lack formal institutions to monitor business activities, and capital resources are constrained (North, 1981; Yue, 2013). Without formal economic institutions, entrepreneurs must then rely heavily on their network of connections to locate partners, navigate unstable markets, and secure funding for their firms (Stuart and Sorenson, 2005; Greif, 1993). Social networks also provide entrepreneurs with channels to learn private or tacit information from others and undergird reputational systems of past performance to help founders evaluate potential partners (Uzzi 1997; Hillmann and Aven, 2011). In addition to environmental hurdles, entrepreneurs must also identify or create innovations, secure commitments from buyers and suppliers, recruit employees, and gain support from key institutional constituencies (Aldrich and Fiol, 1994; Klepper, 2002). Taken together, these challenges often require complementary knowledge and connections to resources that may not be solely accessible to a lone entrepreneur. And in fact, entrepreneurs in both emerging and mature markets commonly arrange into founding teams (Aldrich and Kim, 2007; Ruef, Aldrich, and Carter, 2003). Yet, to understand entrepreneurial performance, network scholars have predominantly examined either the network position of the firm (Ahuja, 2000; Stuart and Sorenson, 2003) or the individual founder (Haveman, Habinek, & Goodman, 2012) with little focus on the founding team.

Despite the significance of social networks for entrepreneurial success, the optimal network position for a founding team is unclear. Largely organizational theorist frame an entrepreneurial team's relational position as trade-off between the benefits of strong and dense connections, cohesion, versus the advantages of far-reaching

connections, brokerage. Whereas new firms located in cohesive networks experience trust and enriched knowledge transfer (Ahuja, 2000; Shipilov and Li, 2008; Coleman, 1988; Walker, Kogut, and Shan, 1997), entrepreneurial teams in sparse networks gain greater access to resources and novel information (Burt, 1992, 2004; McEvily and Zaheer, 1999). Burt (2005) posits that maximal advantages emerge for new firms that are able to inhabit either closure or brokerage positions at the most opportune times in the corporation's life cycle. For example, early stage development may require that the firm find itself in a dense network of relations but at later stages when greater capital investments are required, the firm should reside in a network of sparse far-reaching ties. However, the switching of network arrangements is unlikely since the relations of founding teams prove sticky across time. Altering relations from cohesion to brokerage or vice versa rapidly enough to effectively improve performance seems unlikely if not impossible.

In this paper, we draw on the group diversity literature to bring theoretical attention to the network characteristics of the new venture teams. Rather than pit brokerage against cohesion to determine which has the greatest explanatory power, we instead investigate the effect structural diversity held by the founding team members on firm's performance. By structural diversity we mean the difference in relational patterns of the members beyond the focal team. For example, one could imagine a team in which all the members share very similar network positions (e.g., all holding the exact number of bridging ties), which would be low relational diversity. In contrast teams in which the members have very different network positions would indicate high structural diversity. Similar to previous research that demonstrates the effects of both local network configurations (i.e. connections within the team) and global network attributes (i.e.

connections among teams), we argue that the variance in individual network positions for a team is an important determinant of performance (Reagans et al., 2004). We find that structural complementarity of brokerage within entrepreneurial teams, where one founder manages a sparse network of ties and another maintains a well-connected set of connection, permits the founding team to marry the benefits of two different individual network configurations.

We examine our arguments in the historical setting of corporate industrialization in late imperial Russia (1869-1913). The economic activity we examine is the founding of all known large industrial corporations (share partnerships and joint-stock companies) during the most important period of industrialization: from the years following the Great Reforms to the eve of the Great War in 1913, which brought both the imperial regime and corporate capitalism in Russia to an end. We examine how structural complementarity contributes to organizational performance using the founding activities of entrepreneurs connected through the networks of their partnerships in 3,762 chartered firms known to have operated in the 1869-1913 period (for more details on the data structure, see Hillmann and Aven (2011)). We have complete information on all our variables of interest for 2,519 (67%) of these new ventures that were established by a team of two or more entrepreneurs. The richness of the data permits us to examine not only the relational diversity of founding teams but also their ethnic diversity. Finally, these data cover the complete population of large firm foundings during our period of interest, making it uniquely suited to for understanding entrepreneurial networks.

Although this entrepreneurial environment may seem a far cry from modern economic settings, both the market conditions at the time and richness of the available

data make it a useful and unique setting for understanding the composition of new venture teams. Emerging economies, as the one studied here, are characterized by high uncertainty and limited capital resources (North, 1981). Since such economies lack formal institutions to police entrepreneurial activities, the community itself is left to implement informal monitor systems to police its members (Greif, 1993). This is not unlike how some have characterized emergent markets in modern economies, where uncertainty is high and reputational information is crucial (Eisenhardt and Schoonhoven, 1990). Additionally, the data used here contain extensive information about founder attributes, namely the ethnic characteristics since the state attempted to regulate certain ethnic rights and interests. This level of detail about entrepreneurial activity is not common to contemporary data and allows us to examine multiple aspects of team diversity.

## **ENTREPRENEURSHIP NETWORKS**

Emerging markets and economies tend to be at once a blessing and a curse for entrepreneurs. On the one hand, they provide seedbeds for organizational innovation and promise abundant opportunities for creating new markets (Klepper, 2002; Powell et al., 1996). On the other hand, nascent enterprises face the obstacle that the political and economic institutions that support market transactions are weak and regulations are poorly enforced (Aldrich and Fiol, 1994; Yue et al, 2013). Especially in the beginning, when entrepreneurship consists largely of learning-by-doing, weak institutional support means that new organizational endeavors and novel modes of organizing business are at an increased risk of failure. In order to overcome these impediments, entrepreneurial firms must assemble teams with the most beneficial relations to help them address and

navigate the difficulties of creating a new firm in emerging markets. These relations provide access to critical information, resources, and political and social support (Hoang and Antoncic, 2003; Stuart et al., 1999). For example, social networks help new firms access capital resources (Aldrich and Zimmer, 1986), permit admission to supporting institutions such as venture capitalists and professional service organizations (Freeman, 1999), and facilitate the identification of entrepreneurial opportunities (Stuart and Sorenson, 2005). In addition, network relations enable entrepreneurial firms to obtain intangible resources such as information and advice (Singh, Hills, Lumpkin, and Hybels, 1999), emotional support (Brüderl and Preisendorfer, 1998), and legitimacy as a reliable partner (Stuart et al., 1999). Further, Stuart and Sorenson (2005) suggest that such social positions also helps potential investors to locate firms and channel resources to them. However the findings on the optimal network arrangement for entrepreneurial endeavors are mixed – some studies find greater benefits to spanning clusters (i.e. brokerage) whereas others argue for the benefit of being situated within a cluster (i.e. closure).

Brokerage allows the focal actor numerous advantages such as access to the novel ideas and information (Burt, 1992; McEvily and Zaheer, 1999), higher evaluations and resources (Burt, 2004), and greater status accumulation (Shipilov and Li, 2008). In order to be competitive in a market, new entrants must identify valuable opportunities and mobilize resources, which is facilitated by sparse networks (Stuart and Sorenson 2005). Therefore, firms who share ties across clusters have better access to more diverse information sources and are more likely to be aware of novel information (Burt, 2004). However, negative influences of brokerage have also been found. Uzzi (1997) argued that excessive structural holes without strong ties deteriorate performance and a balance

between brokerage and closure is essential. Ahuja (2000) showed that structural holes reduces innovation as they are associated with less trust and shared norms of behavior in spite of the strength of bridging ties. Likewise, Shipilov and Li (2008) argued that brokerage negatively affects financial performance because structural holes coincide with a lack of trust within the network.

Alternatively, closure, when the focal actor's connections are themselves connected has also been found to benefit entrepreneurial teams but the mechanisms cited are different than those cited for brokerage. Ahuja (2000) demonstrated that cohesion is associated with more trust and shared norms of behavior, and thus increases innovation. A firm with sparse network may also find it difficult to receive investments because their network position potentially signals a lack of reliability (Coleman, 1988; Walker, Kogut, and Shan, 1997) and it's easier to mobilize people and resources when the network is cohesive (Gould, 1991). The dense ties that closure encourages also buffers members from uncertainty and opportunism (Granovetter, 1973). Cohesion is often cited as a means for groups to control and sanction opportunism and has the added benefit of facilitating the flow of reputational information where individuals can corroborate information and learn of others successes and failures (Greif, 1993).

Yet, if the firm is too highly constrained it may impede its access to potential sources of investment and information. High closure leads to redundancies of information as members echo back to each other similar information (Granovetter, 1973). The relaying of the same information can impeded creativity and entrance of novel information into the network or group. Closure also introduces rigidity in the network where embedded relations far outlast bridging relations (Burt, 2005). These long standing

relations between entrepreneurs may exact a cost even after they cease to provide utility for the founder. Since both of brokerage and closure are essential to the success of a young firm but run counter to each other, the identification of an optimal position presents a potential dilemma for entrepreneurial groups.

A recent group of studies posit that brokerage and closure operate differently within and between teams (Burt, 2005; Uzzi and Spiro, 2005; Obstfeld, 2005; Reagans and Zuckerman, 2001; Reagans et al., 2004). For example, Reagans and Zuckerman (2001) showed dense ties within a team coupled with diverse ties beyond the team lead to higher performance (Reagans and Zuckerman, 2001; Reagans, Zuckerman, and McEvily, 2004). Similarly, Oh et al., (2004) also consider the network characteristics internal to a team and the broader relational structure outside of the team boundaries. Oh and his colleagues (2004) found increased performance with the same arrangement to Reagans and Zuckerman (2001) where team member's share dense social relations while extending bridging relations beyond the team boundaries improved the performance of the team. These studies highlight that when examining the effects of networks and teams, there are simultaneously internal and external dynamics that affect the performance of the group.

### **STRUCTURAL COMPLEMENTARITY**

One possibility for teams to combine the network benefits of brokerage and closure is for one member of the team to maintain only relationships that span the network, serving as a broker for the team, while another member is embedded within cohesive clusters in the network. In this instance, the trade-off is managed at the team level through member complementarities. This structural diversity may allow teams to simultaneously access

capital via brokerage connections and signal trustworthiness through affiliations with ties to cohesive clusters. In other words, structural diversity may help to strike a balance for the team in terms of navigating the tension of dual network requirements of brokerage and cohesion.

To understand the composition and dynamics of entrepreneurial teams, we argue that it is critical to understand the variance in network positions of the founders as they come together to comprise a team. Broadly stated, most entrepreneurial network studies use the network conversion approach as a method to understand relational attributes and performance (Borgatti and Halgin, 2011; Everett, 2012). Relational diversity within entrepreneurship networks is usually considered in two ways. Beginning with a two-mode network, where founders are connected to firms and vice versa, researchers will commonly project a one-mode network of either the founders or the firms. The conversion method yields a one-mode network of either founders connected via firm foundings or firms that share connections of common founders. This technique is advantageous because it simplifies the analysis and usually makes for more intuitive results; however, this method neglects critical information about the team.

== Figure 1 about here ==

For example, consider the stylized view of firm and its members shown in figure 1. In this example, both teams of founders in firm A and B have the same degree centrality, number of connections, (i.e. 3). Firms A and B also hold almost identical brokerage positions (i.e. .31 and .32 from Burt's (1992) constraint measurement). However, the brokerage diversity score is different for each team. In the instance of Firm A, the networks of the founding team are similar while in Firm B the networks are

varying among the founders. This diversity measure may provide greater insight into the internal dynamics of the team and how network position benefits or hinders the founding team's venture.

By focusing the analysis on the group's network position, researchers artificially mask the dynamics within the group that can affect performance. A firm level measure represents the aggregate of all the founders' previous activity but not the differences among their relational patterns. These one-mode projections obscure the actual relational composition of the team, which may prove crucial to group success. Considering the diversity of the team members' brokerage indices, unpacks critical information about the team's composition that would otherwise be lost (Borgatti & Everett, 1997, Everett, 2012).

## **ENTREPRENEURIAL TEAMS COMPOSITION**

Although both team diversity and network characteristics have been found to be critical for explaining team performance, little has been done to examine how diversity of team member network characteristics influences the outcomes for entrepreneurial teams (Hoang and Antoncic, 2003; Joshi and Jackson, 2003; Stuart and Sorenson, 2003; Williams & O'Reilly, 1999). Generally, the research on founding team diversity highlights the double-edge sword of heterogeneity. Heterogeneity expands the resources available to the team in terms of skills, abilities, and knowledge (Eisenhardt and Schoonhoven, 1990; Finkelstein 2009; Murnighan and Conlon, 1991). Among entrepreneurial team members, heterogeneity provides a range of knowledge, connections to regional business customs, and access to different communities of investors. In general, heterogeneity also improves the ability to react and adapt to market changes

because the team is less likely to be plagued with psychological problems common to homophilous teams like group think (Burt, 2005). By contrast, homophilous teams are also more likely to share common schemas and language, which lends to more efficient and effective group decision-making. Moreover, homophily has been found to generate trust and understanding among group members (Ruef, Aldrich, and Carter, 2003).

We assume that entrepreneurs assemble their teams strategically to improve the nascent firm's likelihood of success, and therefore the composition of the team signals the characteristics that the team members interpret to be crucial for the venture's success (Hitt et al., 2000). As an example, Ruef, Aldrich, and Carter (2003) investigated the formation of firm foundings and discovered that demographic diversity, such as gender and ethnicity tends to be avoided, while diversity along functional roles and experience is sought. Recently, the effects for functional diversity of teams have been linked to improved entrepreneurial performance (e.g. Beckman, 2006; Beckman and Burton, 2008; Ensley et al., 1998). This suggests that founders may in part assemble their teams based the attributes of team members they believe contribute to the firm's success. Furthermore, the finding that some diversity is avoided while other types of diversity are sought implies that founders are not simply cleaving to a simple heuristic of either maximizing or minimizing all diversity.

In this way, team composition may also be a tool that provides members with the necessary means to attain shared objectives. Assembling a team may be viewed as similar to modern portfolio theory. A diversified portfolio of assets helps to minimize risk exposure while maximizing on expected return. Member selection may allow teams to simultaneously acquire the benefits of different network positions within one firm. This

can signal the reliability via cohesion of firm and simultaneously permit opportunity detection and resource mobilization. Therefore, the success in the entrepreneurial group context is driven by the complementarities of network roles, where some members bring with them the benefits of brokerage and others assist the group via cohesion network patterns. Hence, we expect that teams with brokerage diversity will be more successful than teams without brokerage diversity.

### **DEMOGRAPHIC DIVERSITY AND ENTREPRENEURIAL PERFORMANCE**

Ethnicity diversity is not only a commonly investigated attribute for teams but also particularly relevant for the Russian entrepreneurial community. During the period of our research, Russia's cultural and economic landscape was largely comprised of mono-ethnic enclaves (Owen, 2005). In Russia, demographic diversity might have advantaged entrepreneurial team with in regional knowledge about markets or the ability to work with different ethnic groups but ethnic interactions were socially stigmatized. Even in contemporary settings with far less ethnic divisions, a negative relationship has been found for ethnic diversity and team performance (Jehn & Bezrukova, 2004; Tsui, Egan, and O'Reilly, 1992). Ethnic heterogeneity in a team can hinder the generation of norms and internal cooperation (Chatman and Flynn, 2001). Diversity of a founding team may be considered risky by Russian investors, and the new firm may have difficulty in securing the financial support. Given the negative results for demographic diversity and the ethnic intolerance present in Russia at the time, we expect that ethnic diversity will negatively affect performance.

## **HISTORICAL BACKGROUND**

Despite entrepreneurial enthusiasm that surged through Russia's elite between 1869-1913, new corporation faced an array of economic, social, and political challenges. In contrast to comparable industrializing countries, such as US and Great Britain, Russia lacked the financial banking infrastructure to provide capital to support rapid development (Owen, 1991). Socially Russia was plagued with rigid ethnic segregation, which impeded integration of an entrepreneurial elite. A majority of founders sought to start new firms with individuals of shared ethnic backgrounds (Hillmann and Aven, 2011). The Tsarist state sought to benefit from the emerging corporate elite's success but remained distrustful of their power and status. In order to spur development within the nation, state bureaucrats campaigned for greater foreign investments as a means to offset the lack of institutional capital available to local founders. Yet the policies that the tsar official enacted and lack of institutional support undercut entrepreneurial endeavors (Gerschenkron, 1962). Personal connections to others within the entrepreneurial class proved a useful means to address many of these challenges of founding a new firm.

Whether serial entrepreneurs intuited that structural complementarity helped their firms or strategically sought it out, the pattern of success holds even for the historically prominent founders at the time. For example, Fedor Chizhov was one of the most eminent of Russian entrepreneurs; of his four foundings between 1871-1875 we have complete information on three and all of which were structurally diverse. And in the case of Timofei Morozov more than half of his eleven foundings between 1870 and 1888 were characterized by structural complementarity. Morozov's enterprises ran the gamut from

wholesale trade, manufacturing, transportation, and finance and in each instance the team was comprised of other founders who varied in their structural portfolios to one another.

## **DATA SOURCES AND MEASUREMENT**

The period we examine marked a profound transition for the Russian economy development. During our period of investigation, Russia ranked as the fifth largest industrial power, following behind the United States, the United Kingdom, France, and Germany. Between 1885 and 1913, Russia's average annual growth rate of total product (3.25%) was exceeded only by the United States, Canada, Australia, Japan, and Sweden. Moreover, in this historical context, the role of networks as conduits for both information and resources is particularly important. As an emerging industrial economy, Russia lacked many of the institutions and technologies that assist in the business development and growth. Contemporary research on entrepreneurship argues that social networks shape success by providing the additional advantage of private information (Stuart, 1998; Uzzi, 1997; Yue et al., 2013). However, in our context founding teams also contended with the lack of institutional support and nominal public information (Hillmann and Aven, 2011; Owen, 1991). Although personal and kinship ties can provide exclusive access to economic data and reduce the threat of market opportunism, connections to other founders offer access to individuals with relevant information and experience. Hence the network we study here is not the exclusive means to learn about the market but the most germane to the entrepreneurs.

We support our arguments using the RUSCORP database containing the information on all for-profit firms founded in the Russian empire from 1869-1913

(Owen, 1991). Based on the *Polnoe sobranie zakonov (The Complete Collection of Laws)* firms that intended to incorporate required the authorization of an imperial corporate charter. An imperial charter was signed by the tsar and required the approval of the central government, which granted charters only to enterprises that it deemed to be of national economic importance. The advantage of the RUSCORP dataset for examining entrepreneurial teams is that it provides both the initial capital raised by the firm and the matching information on the characteristics of individual founders, to the extent that they are documented in the corporate charters. This dataset includes two types of firms, share partnerships (*tovarishchestvo na paiakh*) and joint-stock companies (*aktsionernoe obshchestvo*). Russian corporate law distinguished these two types of the large firm from the small business and trading firm (*torgovyi dom*) that only required a contract, signed by all partners and registered with the local municipal clerk (Owen, 1991). The *aktsionernoe obshchestvo* (“joint-stock”) enjoyed limited liability and the benefit of offering stock. The *tovarishchestvo na paiakh* (“share partnership”) could also circulate stock but for these firms founding partners held the majority of stock. The price for joint stock would be smaller to encourage public investment (Owen, 1991, p. 52). Two-thirds of our population of 3,762 new corporate ventures between 1869 and 1913 were founded by teams of two or more entrepreneurs, yielding a sample of 2,519 of firms with complete information on all our variables of interest. We rely on the resulting affiliation networks among firms and founders to examine how capital mobilization benefitted from diversity in the portfolio of relationships that founding partners brought to their teams. Our data sources do not indicate how long partnership ties lasted for all firms. Little evidence suggests that ties lasted indefinitely. Yet, we also want to avoid the opposite

bias by arbitrarily cutting off ties. Our solution is to rely on the observed duration between subsequent foundings by the same entrepreneurs. We decay ties in the affiliation network after ten years, which corresponds to about twice the average duration between foundings (4.58 years,  $sd = 6.59$ ), long enough for previous ties to contribute to the portfolio of subsequent founding partnerships. Using this rationale, we then project both the firm-by-firm and the founder-by-founder networks to determine the relational attributes of both.

In the appendix, we report frequencies and descriptive statistics for all firm-level measurements in table A.1, and for all individual founder-level attributes in table A.2.

## **VARIABLES**

***Basic Capital.*** We use the amount of basic capital raised by a firm's founders and recorded in its corporate charter as the outcome variable. The mobilization of capital is among the most important responsibilities of a founding team (McKay, 1970; Carstensen, 1983; Owen, 2005). Systematic evidence from our Russian context indicates that both the expected performance and the longevity of otherwise comparable firms increase in the amount of basic capital raised (Hillmann and Aven, 2011). The basic capital recorded in the charter is the equivalent to the initial public offering used in studies of modern firms (Podolny, 1993; Stuart and Sorenson, 2003). A company could not start its operations before all shares were sold and payments collected (Hillman and Aven, 2010). As the kind of ruble—silver, copper, or paper assignat—and the values of shares routinely varied from charter to charter, even within the same year, all capital values are normalized according to the standard ruble of account (Owen, 1991). We then deflate all

capital values using the standard Saint Petersburg Institute of Economic Research retail price index (Gregory, 1982). All capital values are denoted in thousands of rubles with 1913 as the base year. Where basic capital consisted of both stocks and bonds, the sum of both amounts is used.

### **Independent Variables**

***Firm Constraint.*** We calculate *firm brokerage* using Burt's (1992) constraint measure, which has commonly been used to understand firm brokerage (Shipilov and Li; 2008). For this index the firm-to-firm network was constructed where firms are linked if they share a founding member within a ten-year window. Here, constraint captures the extent of triadic closure among the other firms that a given firm is connected to through joint founding partners. Low constraint means that triadic closure is low, and consequently brokerage opportunities around a focal firm arise. Such brokerage opportunities decrease with increasing closure and constraint. The constraint variable was normalized so that 1 indicates complete network closure for the focal firm and 0 indicates absolute brokerage in that none of firm's alters are connected.

***Founding Team Constraint Diversity.*** The structural diversity of the founding team's brokerage characteristics is our main independent variable. To calculate *brokerage diversity*, we first construct a binary founder-by-founder network where pairs of founders share link if they are both participated in the founding of the same firms prior to the focal firm. These network connections were decayed after ten years. Each founder's brokerage is measured with Burt's (1992) constraint measure of structural holes in the founder network. Each founder's individual constraint score is based on all founding activity prior

to the focal team's founding.

Because a missing value of constraint, such as for first time founders, has a different meaning than zero, we calculate the diversity score using an index that tolerates categorical differences. The constraint value of each founder within a team is included in the Simpson's (1949) diversity index, which is one of the most meaningful and robust diversity measures (Magurran, 2004). The measure is similar to Blau's (1977) index of heterogeneity. The measure is also scale-invariant, which is a central concern for organizational demography. The measure is not sensitive to units of measurement and permits comparisons across different quantities (Allison, 1978; Sorensen, 2002). The diversity index is given in the form of,

$$D = 1 - \sum_{i=1} p_i^2$$

where  $p_i$  is the proportion of individuals in the  $i$ th category and where this Simpson index of zero indicates complete homogeneity. Thus, as  $D$  increases, the diversity increases. We then dichotomized the index, where 1 indicates brokerage diversity and 0 indicates brokerage homophily within the founding team because of the bimodal distribution of the data. The majority of teams were either identical in their member's brokerage scores or completely dissimilar. The diversity of brokerage score is lagged to the team member's position prior the contemporary founding.

***Firm Betweenness.*** Although calculated differently than constraint, betweenness centrality is also a commonly used measure to capture a firm's ability to broker within a network (Cross & Cummings, 2004). Betweenness represents the number of paths that

the individual actor rests on between all members of the network (Freeman, 1979).

***Founding Team Betweenness Standard Deviation (SD).*** We also include the firm's the standard deviation of the team founder's betweenness score prior to the current founding. The standard deviation of a founding team's betweenness centrality confirms that it is the team's ability to broker or span network, which explains performance. The measure reflects the team differences with continuous variance.

***Ethnic Diversity.*** We also include the ethnic diversity of the founding teams because these characteristics were particularly salient for the Russian entrepreneurial community. During the period of our research, Russia's cultural and economic landscape was comprised of mono-ethnic enclaves that greatly influenced Russians day-to-day lives and economic partner selection (Hillmann and Aven, 2011). Given the effects of demographic diversity found in other team studies and its saliency in Russia society, we investigate the effects of ethnic diversity on founding teams. Each charter documented the founders' ethnicity of the team and the demographic diversity scores were calculated for each team using the Simpson (1949) diversity index described above.

***Control Variables.*** A large board is more likely to bring initial success because the size signals to potential investors more access to resources (Certo, Daily, and Dalton, 2001).

*Firm team size* is included as the number of founders in the team. *Shares* measures the number of shares issued at the companies founding. *Joint stock* refers to organizational form of the firm. In other words, whether the team was founded as the form of joint stock (aktsionernoe obshchestvo) or share partnership (tovarishchestvo napaiakh) (Owen, 1991). We also control for the *province* that the firm was located in, the *industry* it operated in, and the *year* of the firm's founding to account for regional, industrial and

temporal variations.

Finally, we consider the possibility that success in mobilizing capital from investors may rather be driven by unobserved heterogeneity across founding teams. Some teams may benefit from being composed of founders who are particularly skillful and experienced in attracting contributions from investors. It may be this compositional advantage—and not variation in brokerage diversity—that gives some founding teams an edge over their competitors who lack members with comparable skill-sets. Elsewhere, we relied on fixed-effects estimates to address the issue of unobserved heterogeneity (Hillmann and Aven, 2011). Here, we do not follow this strategy because founding teams are rarely composed of the same members over successive foundings: only 59 (2%) out of the 2,510 teams in our dataset continue with exactly the same members for a subsequent founding. Consequently, the overwhelming number of our teams are unique cases, and our data lack sufficient within-team variation over time. Instead, we control for variation in the aggregate number of previous foundings that current team members were engaged in. The idea is to capture the potential learning effect and combined experience that entrepreneurs gained from their past foundings and contribute to their current teams.

== Table 1 about here ==

## **RESULTS**

### **Structural Diversity and Categorical Diversity**

Consider first our main argument that founding teams benefit from the diversity of brokerage roles among its members. As noted earlier, the idea is that benefits come from the complementarity of the diverse portfolios of network ties and contacts that each partner contributes to the team. Here we consider the benefits structural complementarity

implies for the mobilization of basic capital for a new enterprise.

Table 1 presents least square estimates of the relationship between such brokerage diversity in founding teams and the mobilization of basic capital, our dependent variable. We measure variation in the dependent variable on a logarithmic scale because the distribution of basic capital is highly skewed. Each specification in table 1 includes controls for the year the firm was founded, the region its headquarters were located in, and the industry sector that it operated in.

Recall that we rely on Burt's (1992) measure of constraint to estimate each founder's brokerage capacity. This means that structural diversity among team members is measured as the diversity in constraint scores across all individual partners within a team. The central finding that emerges from our estimates is that structural diversity, and hence the complementarity of broker roles within founding teams, does indeed have the expected benefits for the mobilization of capital from investors. To illustrate, the estimates in column 1 in table 1 show that mobilized basic capital increases by about 6% with a standard deviation ( $SD=.416$ ) increase in the structural diversity of the founding team. The increase is substantial: using the average basic capital of corporations in our sample, this translates into a 113,375 ruble increase in the basic capital stock. For teams where every single founder plays a different brokerage role, the basic capital even increases by about 15%, which translates into 272,536 rubles (again, all values are deflated and expressed in 1913 rubles). Our findings in columns 2 through 6 in table 1 further show that the estimates for structural diversity remain consistent in their direction

under various specifications that control for additional covariates.<sup>1</sup> Depending on the added covariates, the magnitude of the structural diversity estimates reduces slightly, ranging from a 9% to an 11% increase in basic capital for fully heterogeneous teams. In sum, structurally more diverse teams were likely to raise more basic capital. The result provides support for our argument that teams composed of some members who hold brokerage positions and others who maintain connections to dense clusters outperform teams that lack such structural diversity.

Still, as repeatedly shown in the extant literature and discussed earlier, a number of additional influences are likely to facilitate capital mobilization from potential investors. First, we consider the potential brokerage position of the entire founding team within the organizational peer network of other competing teams. Table 1 indicates that less favorable positioning of teams in this network, as measured by increasing constraint, tends to reduce the expected basic capital (yet, the estimates are not consistent in their precision). The result corresponds to insights from earlier research that the brokerage position of the entire team within the firm-by-firm network is crucial to its success (Reagans et al., 2004).

Second, we consider the relative contribution from what might be termed the categorical diversity of founding teams, as compared to their structural diversity. First among these characteristics is the ethnic composition of founding teams. Our results in columns 4 through 6 show that greater ethnic diversity among founding team partners

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<sup>1</sup> Obviously, rookies of corporate entrepreneurship who never founded a venture before cannot contribute any prior co-founding ties to their teams, and therefore lead to downward bias in the structural diversity of their current teams. However, our findings remain robust once we exclude such rookies from our estimations (results available from the authors).

consistently reduced the expected amount of basic capital for their venture. Increasing ethnic diversity among team members by one standard deviation yields an 8% decrease in expected basic capital. Teams where all partners come from a completely different ethnic origin even face a 21% decrease in expected capital. These findings correspond to historical accounts of widespread ethnic discrimination among the economic and political elites of late tsarist Russia (Nathans 2002; Owen 1991; Rogger 1986).

Just as teams benefit from the structural diversity of their members' prior co-founding ties, there are good reasons to expect that they also benefit from the content of these previous ties. In particular, we would expect that prior experience of founders in a diverse range of industries will be an advantage for the current enterprise. Likewise, prior experience of team partners with ventures in various regions within the Russian Empire should offer current enterprises a competitive advantage, for instance in the form of valuable local knowledge.<sup>2</sup> As columns 5 and 6 in table 1 reveal, our findings confirm the positive role of regional diversity in raising basic capital for a planned venture, while experience in a variety of industries seems to have a weak link to capital mobilization. Finally, based on the number of their previous foundings, the combined experience of team partners had a largely positive influence on the mobilization of basic capital (columns 3 through 5).

The more salient conclusion for our argument, however, is that the capital advantages from structural diversity among team members remain robust even when

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<sup>2</sup> A related argument points to the importance of Moscow and St. Petersburg as influential metropolitan centers. Both cities provided exclusive access to political institutions and government officials who might aid in the firm's success. However, we find no systematic evidence in our estimations that the mere location of a firm's headquarters in Moscow or St. Petersburg provided a clear advantage.

these competing indicators of categorical diversity are taken into account.

### **Differences in Organizational Form**

Two legal forms of business organization served as the dominant blueprints for new industrial ventures in late imperial Russia: the joint-stock company and the share partnership. Merchant entrepreneurs typically favored the joint-stock organizational form to launch large-scale enterprises such as railroads, steamship lines, or banks. To raise the required capital from a broad range of investors, joint-stock companies issued a large number of individual shares that were priced at lower values (about 100-250 rubles). In contrast, founders relied on share partnerships to provide limited liability for more moderate family-based ventures, such as local textile factories. Compared to joint-stocks, such partnerships issued fewer shares at higher values (about 5,000-10,000 rubles) to attract investors from within the partners' narrow social networks. Owen (1991, pp. 51-52) offers two illustrative cases: the Petersburg Discount and Loan Bank, founded in 1869, exemplifies the joint-stock form used for large financial enterprises, with an initial stock offering of 5 million rubles, based on 20,000 shares "priced at 250 rubles to facilitate their purchase by the public." It contrasts with the share partnership of the local Moscow Merchant Bank that issued a mere 252 shares, yet priced at 5,000 rubles each, to mobilize its basic capital of 1.26 million rubles. As Owen (1991, p. 52) notes, the Muscovite bank partnership's "pattern accorded perfectly with the old merchant tradition of solid, cautiously managed, family-centered businesses."

The implication of the differences in organizational form, we suggest, is that initiators of share partnerships tend to view their ventures as more localized and specialist

organizations. Consequently, they will target a highly selective range of network contacts to recruit investors and other potential co-founders. In contrast, joint-stock companies with their large-scale business operations are more likely to be generalists whose initiators will see an advantage in a much wider and more varied net of contacts to attract investors and co-founders. In return, investors in joint-stock companies are probably predisposed to firms that encourage greater public involvement through more publicly held shares and reduced founder control. We therefore expect that structural diversity in the network composition of founding teams is particularly salient for mobilizing investments in joint-stock companies, and potentially more so than it is in share partnerships.

Returning to table 1, the estimates for variation in organizational form (joint-stock vs. share partnership) and its interaction with structural diversity in founding teams support our argument. First, the main effects for organizational form (columns 1 through 6) show that joint-stock companies consistently benefitted from a more than 50% increase in expected capital, compared to share partnerships. The result is not surprising given the investment requirements of such large-scale ventures as the building of railroads and steamship lines. Second, we consider the interaction of organizational form and structural diversity in column 7. In line with our argument that founders of joint-stock companies are more likely to realize an advantage in a wide net of diverse contacts, we find that the capital benefits from structural diversity are indeed most salient in the founding teams of joint-stock companies. Compared to share partnerships, joint-stock companies benefit from an additional 10% increase in expected basic capital, assuming a standard deviation ( $SD = .416$ ) increase in structural diversity. This added benefit is not

trivial, given that the average basic capital amounts to about 1.8 million rubles in our sample (see table A.1).

However, the main point here is not that founding teams of the big joint-stock companies in tsarist Russia, by their very nature, exhibited greater diversity in their network composition than the founding teams of share partnerships.<sup>3</sup> We still observe a main effect of joint-stock teams in column 7. Likewise, column 1 in table 1 shows that the influences of organizational form and structural diversity are additive and not substitutes for each other. Hence, the conclusion is rather that, given the same level of brokerage role diversity within their founding teams, joint-stocks profited much more from this structural diversity than share partnerships when it came to mobilizing investors and capital. Once again, the reason appears to be that founders of joint-stock companies tend to be generalists and more likely to realize the advantage in such structural diversity. Put differently, a varied role structure within a team may not always be the result of strategic choice. Just as likely, seeing the variation in existing role structures may give rise to strategic choices.

### **Period Effects: Changes in Tsarist Government**

Another alternative argument links the impact of structural diversity on capital mobilization to the timing of founding. The argument suggests that variation in brokerage diversity is primarily tied to abrupt shifts in the political government and institutional environment, in particular with the ascension of a new tsar to the Russian throne. A new

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<sup>3</sup> Nor is the observed interaction effect merely a size effect. Certainly, founders of joint-stock companies tend to form larger teams than founders of share partnerships, and more team partners imply more opportunities for diverse brokerage roles. But all our estimates in table 1 control for team size.

tsar did not necessarily mean that his government continued existing economic policies, but more often than not that it replaced them with new initiatives and new legal directives (see Owen, 1991 for examples). While entrepreneurs may have expected some of these shifts in economic policies, it was hardly possible for them to predict all of their consequences. One strategic response to this institutional uncertainty is for founding teams to cast a wide and diverse network of contacts. A broad and diverse range of network ties serves as a safety net that facilitates both adaptation to potential institutional changes and the spread of political risk. Following this argument, we would expect that structural diversity within founding teams is particularly salient in times of political regime changes, measured here by the ascensions of Alexander III in March 1881 and Nicholas II in November 1894.

== Table 3 about here ==

We consider this alternative argument of political period effects in table 3. As before, we estimate variation in the basic capital raised from investors, controlling for the same organization-level covariates as in table 1. First, we address the argument that the benefits from structural diversity vary systematically between the successive periods of imperial reign. As columns 1 through 3 in table 3 show, we find no evidence that supports this argument: neither the main effects for the three periods of imperial reign, nor their interactions with structural diversity in founding teams have a significant influence on capital mobilization. Second, we consider the related argument that political uncertainty is most intensely felt in the short period immediately following the succession of a new tsar to the crown. While government policies and their consequences may become more tangible in the long run, they are much less predictable right after a change

in government. Consequently, if structural diversity did indeed serve as a safety net in times of political uncertainty, then we would expect its advantages to be most visible in the early years of an imperial reign. To address this argument, our specification in column 4 estimates to what extent the benefits of structural diversity are particularly salient during the first three years of a new tsar's reign. As our results show, we find no evidence that the benefits of structural diversity are systematically tied to such period effects of changes in the political government.

### **Long-run Consequences of Structural Complementarity**

Our findings reported above show that diversity in brokerage roles mattered for capital mobilization from investors. The evidence suggests that the diverse contact networks that partners contributed to their founding teams complemented each other. And capital mobilization benefitted from this structural complementarity of brokerage roles.

Still, mobilized basic capital expresses primarily an expectation that both founders and investors share about the economic performance of their new enterprise in the years to come. Basic capital is not a direct indicator of a firm's performance. In contrast, a well-recognized indicator of long-run organizational performance is the persistence or survival of a firm, especially amidst heightening competition from its peer firms, as it was the case in the Russian corporate landscape. Here we use entries in corporate directories that are available for the years 1869, 1874, 1892, 1905, and 1914 to assess the longevity of firms (Owen 1992). For example, a company founded in 1870 is considered to have survived until 1874 if it is listed in the corporate directory of that year. The company survived further until 1892 if it is also listed in the 1892 directory. If it is not

listed in the 1905 directory, it is coded as having failed by 1905. We rely on this discrete-time measure of survival to examine to what extent structural diversity at the time of corporate founding influenced the long-run persistence of firms. Unfortunately, the RUSCORP database does not include this information for all 2,519 firms in our sample, but we were able to obtain it for a subset of 1,573 firms (in the appendix we compare the two datasets and address potential selectivity concerns). Table 4 reports our discrete-time estimates of firm survival rates.<sup>4</sup>

== Table 4 about here ==

Turning first to our main covariates, we find that joint-stock companies apparently did not enjoy a long-term benefit from their initial success in mobilizing large amounts of capital. Translating estimated coefficients into hazard ratios, our results show that the hazard of joint-stock companies was in fact between 63% (column 3) and 80% (column 1) greater than for share partnerships. We likewise find that increasing ethnic diversity among founding team partners increased the failure rate of their firms in the long run. To illustrate, a standard deviation increase in ethnic heterogeneity ( $SD=0.398$ ) yields a 14% increase in the hazard. This finding confirms the negative impact of ethnic discrimination on corporate entrepreneurship, and in particular discriminatory policies imposed by the tsarist state that have long been recognized by economic historians (Nathans 2002; Owen 1991; Rogger 1986). Lastly, increasing the regional diversity among team partners also

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<sup>4</sup> Because there are no strong substantive historical reasons to expect that the probability of failure varies over time, we opt for a parsimonious solution and use a proportional hazard rate specification. Still, we also estimated piecewise-constant hazards, using changes in the tsarist government (1869-1880; 1881-1894; 1895-1913) for our periodization. The results remain consistent in direction and magnitude, in particular for structural diversity in teams (coefficient = .325; SE = .192, if we replicate model 2 in table 4 using a piecewise-constant specification).

appears to have increased the failure rate of firms, but the estimates are not as precise as those for variation in organizational form and ethnic heterogeneity.

Most important for our argument, we also find that structural diversity among team partners at the time of founding had a negative influence on their firm's survival in the long run. Substantively, increasing the diversity of brokerage roles on a given team by one standard deviation ( $SD=0.416$ ) leads to a 15% increase in the firm's hazard. The estimates remain largely consistent in size and direction under varying specifications (table 4, columns 1-3).

What explains this negative long-term trend in structural diversity, in particular given its initial positive link to capital mobilization at the time of corporate founding? The answer, we suggest, lies in the age-dependence of corporate entrepreneurship that can be observed in our historical setting and elsewhere (Carroll and Hannan 2000; Stinchcombe 1965). Our rationale is that the influence of structural diversity on delaying the failure of an enterprise will depend on the maturity of the industry within which a founding team situates itself. To illustrate the argument, consider first those entrepreneurs we might call the pioneers of a new industry. They typically find themselves in a field that is still in the process of gaining recognition from potential suppliers, peer producers and consumers as well as from the market-supporting institutions of the state. Structural diversity in our historical setting rests on co-founding ties. Precisely because they operate in a new industry, pioneers are rarely able to achieve structural diversity in their teams by enlisting prior co-founding ties from within this same new industry. Instead, nearly all of them will have little choice but to draw upon their prior co-founding partners from extant industrial fields. Thus, structural diversity in pioneering teams within new industries

usually means drawing almost exclusively from a diversity of outsider ties, and the team partners are unlikely to be familiar with all of these diverse outside contacts. More often than not, then, pioneering team partners will have to confront some lack of trust as well as problems of translating and evaluating the information and other resources coming from these diverse outside contacts. In contrast, later entrepreneurs who seek to assemble founding teams within an established field are less likely to face such liability of newness constraints. Precisely because they operate within a mature industry with an established history of enterprises, late entrants are able to draw upon a broad range of diverse contacts from within their own field. Founding partners who are late entrants thus are likely to have more experience in their industry, a better sense of what to expect, whom to trust and how to read valuable information than pioneers in the same field.

== Figure 2 about here ==

The graphs in figure 2 offer suggestive evidence in support of our age-dependency argument. The graphs contrast Kaplan-Meier survival estimates for structurally diverse and homogenous founding teams, and compare this contrast for pioneers and late entrants.<sup>5</sup> We classify teams who were among the first 25% established within their industry as pioneers, and classify the remaining 75% of teams as later entrants into this industry. A substantive comparison of the differences in survival rates indicates that the negative long-run influence of structural diversity on firm survival was indeed more pronounced among pioneering teams than among late entrants. Among pioneering teams, the two survival functions clearly diverge over time, whereas the two functions remain

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<sup>5</sup> We use the mean value (.76) of structural diversity within teams as our cut-off to distinguish structurally diverse from homogenous teams. The observed differences in survival rates in figure 2 hold if we use the median as our cut-off.

close to each among the late entrants.<sup>6</sup> To conclude, structural diversity among founding team members appears to offer an initial benefit during the mobilization of capital from investors at the time of founding. Subsequently, however, pioneering founding teams in particular are likely to suffer from a liability of newness of their industry. Because pioneering teams have to draw almost exclusively on prior ties from outside their industry, they face reliability deficits in how to assess information and other resources coming from these outside channels. And these deficits are likely to prevent structurally diverse founding teams from delaying the failure of their enterprise.

## **DISCUSSION**

In this paper, we draw on the group diversity literature to bring theoretical attention to the effects of structural complementarity on founding teams. By examining the firm's network characteristic as based on the portfolio of members' relational attributes, we explicate our theory of structural complementarity and introduce a novel method of applying diversity indices to groups in networks. Our findings demonstrate that founding teams with greater structural diversity of brokerage are more successful in emergent markets. Teams with structural complementarity, composed of members holding brokerage positions and others maintaining ties to clusters, outperform teams comprised of all the brokers.

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<sup>6</sup> The late divergence of survival rates seems to result from our discrete-time data. A firm founded in 1870 may be included in the 1874 directory, indicating a four-year survival. But afterwards, we would have to wait until 1892 to see if the same firm survived even longer. Even if the firm is no longer included in the 1892 directory, we have no information when exactly the firm ceased to exist in between 1874 and 1892. Our discrete-time data are thus likely to be upward biased and to overestimate survival time. The actual longevity of firms is likely to be much shorter than suggested in the survival graphs.

Similar to previous research we find that ethnic diversity undermines a founding teams performance (Jehn & Bezrukova, 2003; Tsui, Egan, and O'Reilly, 1992). These findings correspond well with economic historians' accounts of Russia at the time (Owen, 2005). Russian society was highly segregated into mono-ethnic enclaves, which lead them to be highly distrustful of other ethnic groups. Market actors would have been wary of founding teams that represented multiple ethnicities, and thus be less likely to invest. However, founding teams comprised of citizens from various backgrounds increased the firm's basic capital. At the time, the Russian state was eager to close the economic gap separating it from competing countries and was solicitous of foreign investors (Carstensen, 1983; Gerschenkron, 1962; McKay, 1970). Rather than be suspicious of outside entrepreneurs, investors appear to have been positively swayed by the campaigns of Russian government officials that encouraged foreign partnering and investments.

In our view, three contributions emerge from this study. First, we contribute to entrepreneurship research by underscoring the effects of teams within entrepreneurial networks. Although understanding how the relational composition and processes of founding teams contribute to firm success are central issues among organization and entrepreneurship scholars, the extant research largely treats founding teams and their compositions as a "black box" (Burton and Beckman, 2010). We examine founding firms' structural diversity in contrast to more commonly studied diversity measures, such as ethnicity, to determine the effects on firm performance and highlight the importance of internal configurations of new venture teams.

Second, this study extends network research by introducing the concept of team

structural diversity. By analyzing the group's network characteristics based on the portfolio of individuals rather than on aggregate presents a new means to understand both team processes and network dynamics. Given the increased attention to teams, these techniques could be applied to a host of team endeavors. And this particular context is highly relevant to the emerging economies whose economic institutions are yet to be established. Nevertheless, the application should be carefully considered. Tsarist Russia was indeed a unique historical case and future research would investigate the application of network complementarities across different market settings and cultural contexts. Third, we contribute to the team diversity research by showing both the negative effect of demographic diversity on the entrepreneurial performance. Ethnic diversity not only creates internal challenges such as emotional conflicts that can arise from the lack of shared norms, language, and customs, it also may make investors wary of contributing. The market actors' perceptions of the team are also critical to its performance and ethnicity more so than structural position would be salient to investors. Given the Russian preference for ethnic segregation, an ethnically homogeneous founding team may be considered more reliable and thus preferable to the potential investors. Hence entrepreneurial teams are not only saddled with the challenges of performing as a team but also how investors perceive their ability to execute as a successful team.

## **APPENDIX: ROBUSTNESS CHECKS**

### **Selectivity Concerns in the Firm Survival Dataset**

Above, we have examined the long-run impact of structural diversity and complementarity of broker roles on the duration of firm survival. For our estimates, we

have relied on corporate directories for the years 1869, 1874, 1892, 1905, and 1914 that are available in the RUSCORP database (Owen 1992). Our full dataset consists of 2,519 founding teams (see table A.1, columns 1 and 2). As noted earlier, we have complete information on firm survival for a subset of 1,573 teams that founded firms at some point within our 1869-1913 period (table A.1, columns 3 and 4). One potential concern is that some unobserved selection process other than firm survival is responsible for a firm's inclusion in the corporate directories. To address this concern, we compare our full dataset and our survival subset along our key variables of interest. The results in table A.1 show that the observations in both datasets are largely comparable. The few smaller differences point to a slightly larger average amount of basic capital and a slightly greater average betweenness centrality for firms included in the survival dataset. One noticeable caveat is that firms located in Poland tended to be excluded from the corporate directories, and are therefore underrepresented in the survival dataset. In contrast, overrepresented are firms where we do not know the exact location of their headquarters in the Russian Empire. The percentage differences are close: 12.6% vs. 0.5% Polish firms and 0.3% vs. 13.7% firms with unknown headquarter locations. With all the necessary caution in mind that such historical data warrant, the differences may indicate that the firms without known headquarter locations in the survival dataset were in fact firms operating in Poland.<sup>7</sup>

== Table A.1 about here ==

== Table A.2 about here ==

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<sup>7</sup> Even a systematic exclusion of Polish firms is unlikely to alter our findings about the role of structural diversity in firm survival: a means comparison of the degree of structural diversity between Polish teams (.743, SD=.433) and all other teams located elsewhere (.761, SD=.414) shows virtually no difference ( $t = .752$ ).

## **Endogeneity Concerns**

Another concern is the direction of the causal sequence that links diversity in the founding team's network composition to the basic capital needed to establish a firm, as recorded in its charter. We argue that the basic capital for the intended venture increases with greater diversity in the tie portfolio that partners contribute to their team. The counter-argument suggests that it may well be the capital requirements for a planned venture that dictate what kind of network contacts will be needed, and hence what partners and what mix of ties will be ideal for assembling a successful founding team. To address this potential endogeneity issue we exploit exogenous variation in Russian corporate law (for a similar strategy, see Hillmann and Aven 2011). In particular, we rely on a catalogue of discriminatory legislations that the tsarist state had successively instated by 1899 with the explicit purpose of excluding mostly Jews, but also other ethnic minorities and some foreigners from corporate entrepreneurship. The discriminatory laws entailed restrictions of property rights and on the place of residence, exclusion from leasing land or holding titles to land, and prohibiting Jews from holding shares or managerial positions in a company (detailed in Owen 1991, pp. 122-49). Systematic evidence shows that, by 1899, these discriminatory laws had become so severe that they dictated the choice of business partners whenever entrepreneurs sought to assemble a founding team: after 1899, both the proportion of business ties that Russians maintained with Jewish founding partners and the proportion of successful Jewish entrepreneurs were cut short by about 50% compared to the years before 1899 (full results available from the authors upon request).

Here we use the impact of these legislations on partnership formation to address

the endogeneity issue noted above. Our rationale is the following: after 1899, state-sponsored discrimination dictated much of the variation in partner choice, and consequently the expected capital requirements for a particular venture could not have been primarily responsible for the composition of founding team members and their network ties. The results in table A.3 support our reasoning. For our main effects of interest, we compare the estimates before and after the full impact of the discriminatory laws in 1899. Otherwise, we use the same specifications as in our main estimates in table 1 above. The main result of interest here shows that basic capital still increases by about 8% (or 143,440 rubles, on average) with a standard deviation increase in the diversity of the network composition of founding teams once we let legal discriminations constrain the selection of founding team partners after 1899.

== Table A.3 about here ==

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**FIGURES**

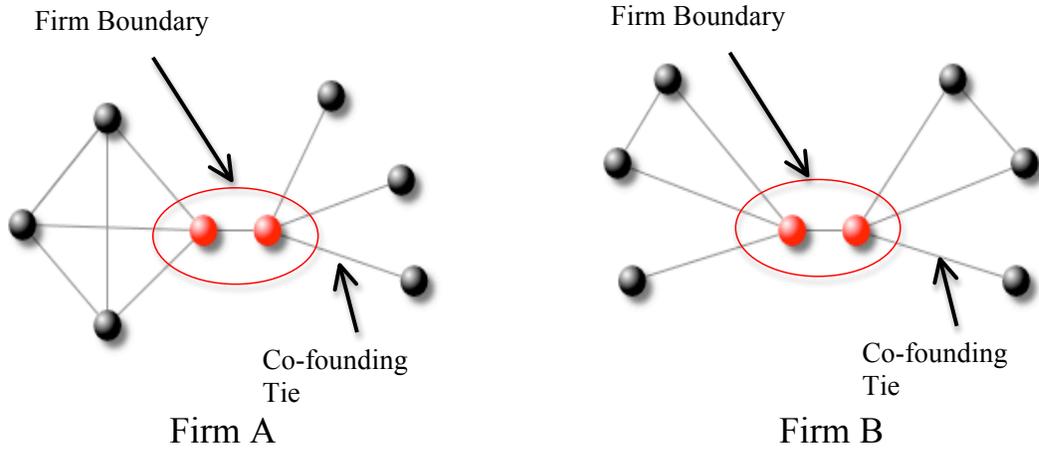


Figure 1. Structural complementarity of two similarly situated founding teams.

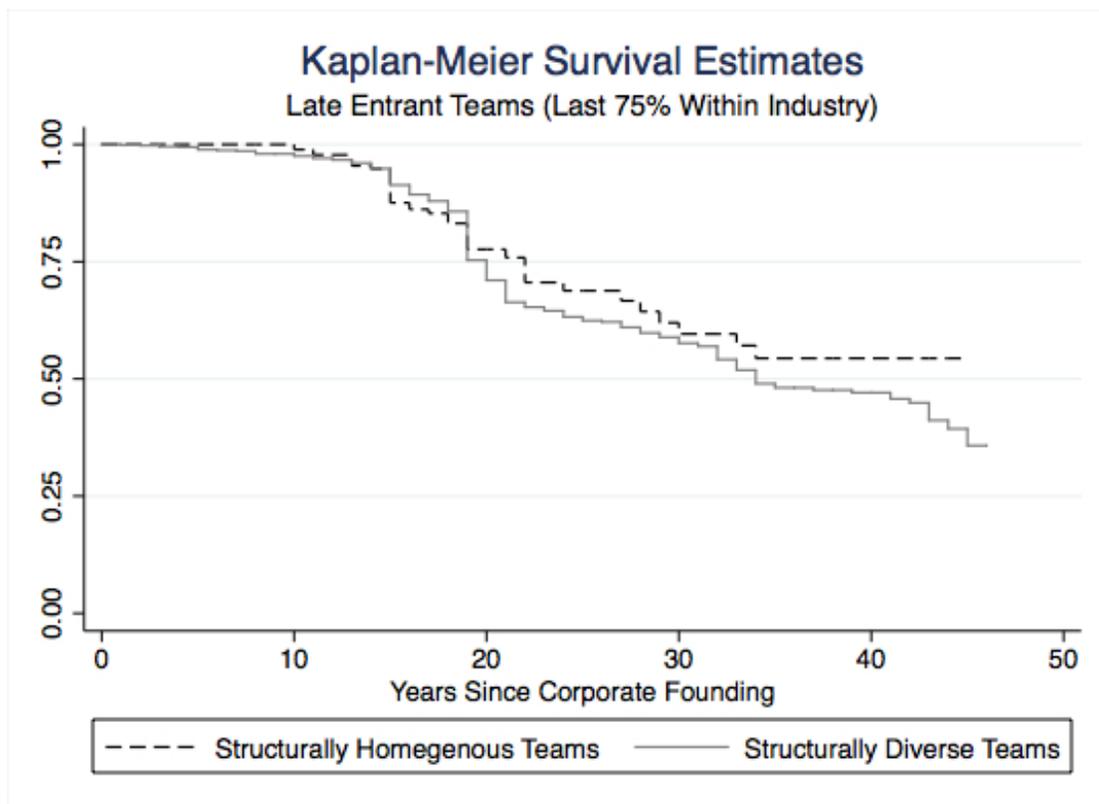
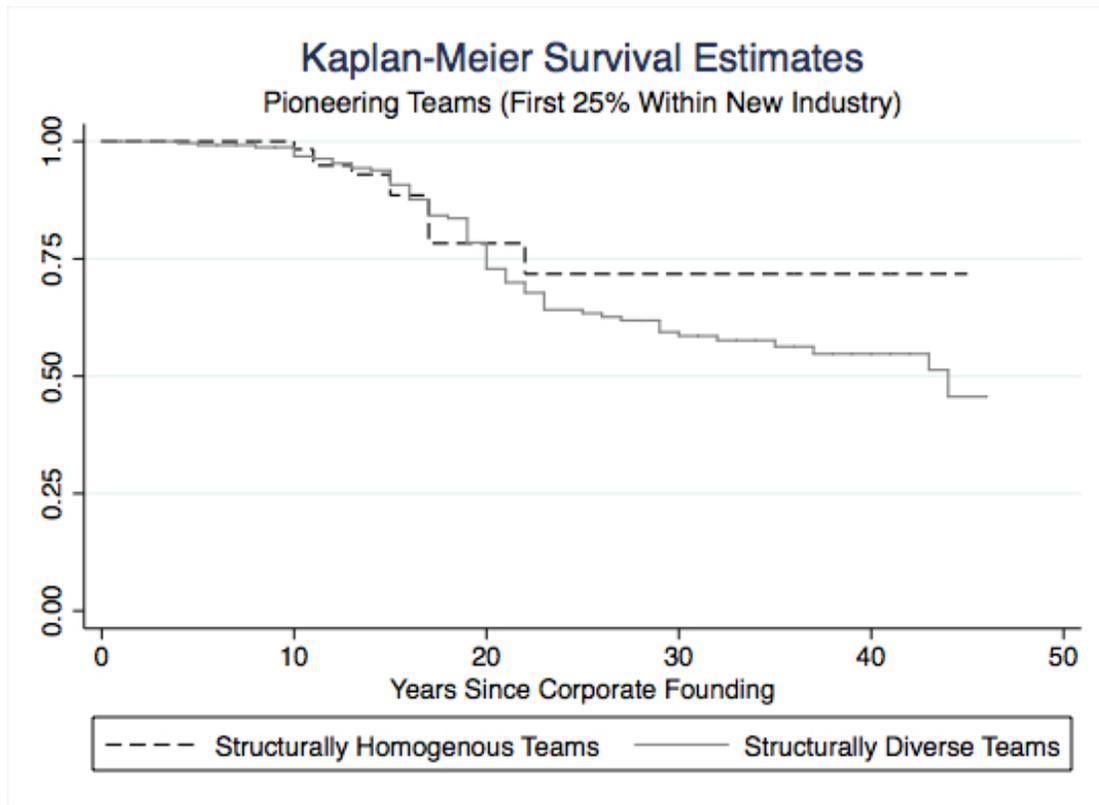


Figure 2. Comparison of survival rates of structurally diverse teams between pioneering teams (N= 380) and late entrant teams (N=1,193). Total number of failure events is 350.

Tables

TABLE 1  
Least Square Estimates of Basic Capital Raised By Founding Teams, 1869-1913

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Firm Team Size	-0.016** (0.006)	-0.020*** (0.005)	-0.079*** (0.013)	-0.077*** (0.014)	-0.062*** (0.014)	-0.062*** (0.014)	-0.063*** (0.014)
Joint-stock Organization	0.527*** (0.050)	0.510*** (0.050)	0.514*** (0.049)	0.530*** (0.050)	0.525*** (0.050)	0.524*** (0.050)	0.344*** (0.092)
Firm Team Constraint Diversity	0.152** (0.052)	0.093* (0.052)	0.113** (0.052)	0.109** (0.052)	0.101* (0.052)	0.096* (0.053)	-0.066 (0.088)
Firm Constraint		-0.652*** (0.096)	-0.206 (0.133)	-0.258* (0.136)	-0.148 (0.139)	-0.102 (0.165)	-0.136 (0.139)
Firm Team Experience			0.055*** (0.011)	0.053*** (0.012)	0.039** (0.012)	-0.062*** (0.014)	0.039** (0.012)
Firm Team Ethnic Diversity				-0.207*** (0.053)	-0.207*** (0.053)	-0.208*** (0.053)	-0.207*** (0.053)
Firm Team Regional Diversity					0.343*** (0.099)	0.337*** (0.100)	0.335*** (0.099)
Firm Team Industrial Diversity						0.059 (0.113)	
Joint-stock Organization X Firm Team Constraint Diversity							0.246** (0.104)
Firm Location controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Industry controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Founding Year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firms	2,519	2,519	2,519	2,446	2,446	2,446	2,446
R-squared	0.167	0.182	0.190	0.195	0.199	0.199	0.201
Adjusted R-squared	0.146	0.160	0.168	0.173	0.176	0.176	0.178

Note: Standard errors are reported in parentheses and adjusted for autocorrelation using the Prais-Winsten transformation. The dependent variable is the logged basic capital of firms, standardized and deflated to the 1913 ruble. The source for all information is included in the RUSCORP database (Owen 1992).

\*  $p < .10$ ; \*\*  $p \leq .05$ ; \*\*\*  $p \leq .01$

TABLE 2  
Least Square Estimates of Basic Capital Raised By Founding Teams, 1869-1913  
Alternative Measures of Stuctural Diversity ( $N=2,466$ )

	(1)	(2)
Firm Team Size	-0.045** (0.018)	-0.077*** (0.014)
Joint-stock Organization	0.529*** (0.050)	0.528*** (0.050)
Firm Team Experience	-0.045** (0.018)	-0.077*** (0.014)
Firm Team Ethnic Diversity	-0.208*** (0.053)	-0.205*** (0.053)
Firm Team Regional Diversity	0.369*** (0.097)	0.381*** (0.097)
Firm Team Degree Centrality	0.046* (0.026)	
Firm Team Degree SD	-0.029 (0.033)	
Firm EigenVector Centrality		-0.326 (0.408)
Firm EigenVector Centrality Diversity		-0.165 (0.144)
Firm Team Betweenness Centrality SD		
Firm Betweenness		
Firm Location controls	Yes	Yes
Firm Industry controls	Yes	Yes
Founding Year controls	Yes	Yes
R-squared	0.199	0.198
Adjusted R-squared	0.176	0.175

Note: Standard errors are reported in parentheses and adjusted for autocorrelation using the Prais-Winstone transformation. The dependent variable is the logged basic capital of firms, standardized and deflated to the 1913 ruble. The source for all information is included in the RUSCORP database (Owen 1992).  
\*  $p < .10$ ; \*\*  $p \leq .05$ ; \*\*\*  $p \leq .01$

TABLE 3  
Least Square Estimates of Basic Capital Raised By Founding Teams, 1869-1913  
Period Effects: Changes in Tsarist Government

	(1)	(2)	(3)	(4)
Firm Team Size	-0.065*** (0.014)	-0.062*** (0.014)	-0.063*** (0.014)	-0.062*** (0.014)
Joint-stock Organization	0.553*** (0.050)	0.524*** (0.050)	0.524*** (0.050)	0.525*** (0.050)
Firm Team Constraint Diversity	0.070 (0.054)	0.099* (0.053)	0.091* (0.055)	0.090 (0.056)
Firm Constraint	-0.112 (0.139)	-0.149 (0.140)	-0.153 (0.140)	-0.149 (0.140)
Firm Team Experience	0.042*** (0.013)	0.039** (0.012)	0.040** (0.013)	0.039** (0.012)
Firm Team Ethnic Diversity	-0.196*** (0.053)	-0.207*** (0.053)	-0.207*** (0.053)	-0.208*** (0.053)
Firm Team Regional Diversity	0.382*** (0.099)	0.342*** (0.099)	0.341*** (0.099)	0.343*** (0.099)
1869-1880 Period, Tsar Alexander II	0.212 (1.057)	0.522 (1.017)	0.523 (1.017)	
1881-1894 Period, Tsar Alexander III	0.346 (1.015)	0.493 (1.244)	0.547 (1.219)	
1895-1913 Period, Tsar Nicholas II	-0.204 (1.013)	-0.145 (1.032)	-0.265 (1.050)	
1869-1880 Period X Firm Team Constraint Diversity	0.275 (0.315)			
1881-1894 Period X Firm Team Constraint Diversity		0.053 (0.244)		
1895-1913 Period X Firm Team Constraint Diversity			0.123 (0.198)	
First Three Years of New Tsar's Reign				0.400 (0.309)
First Three Years of New Tsar's Reign X Firm Team Constraint Diversity				0.071 (0.144)
Firm Location controls	Yes	Yes	Yes	Yes
Firm Industry controls	Yes	Yes	Yes	Yes
Founding Year controls	Yes	Yes	Yes	Yes
Firms	2,446	2,446	2,446	2,446
R-squared	0.179	0.199	0.199	0.199
Adjusted R-squared	0.170	0.176	0.176	0.176

Note: Standard errors are reported in parentheses and adjusted for autocorrelation using the Prais-Winstone transformation. The dependent variable is the logged basic capital of firms, standardized and deflated to the 1913 ruble. The source for all information is included in the RUSCORP database (Owen 1992). Tsar Alexander II's reign began in 1855, but our data are left-censored at 1869 so that we can deflate ruble values. Likewise, Alexander II ruled until March 1881, but we need to distinguish periods using yearly breaks. Thus, his reign is coded until 1880. Similarly, Nicholas II ruled from November 1894, but again, our periodization is based on yearly breaks, so his reign is coded to begin in 1895. Finally, Nicholas II's rule lasted until his assassination in 1918. We end his reign in 1913 because our dataset is right-censored at 1913.

\* p < .10; \*\* p < .05; \*\*\* p < .01

TABLE 4  
Long-run Impact of Structural Diversity: Cox Proportional Hazard Rate Models of Firm  
Failure, 1869-1913

	(1)	(2)	(3)
Firm Team Constraint Diversity	0.334*	0.311	0.301
	(0.191)	(0.193)	(0.193)
Firm Constraint	0.201	0.328	0.406
	(0.374)	(0.388)	(0.394)
Firm Team Size	0.029	0.024	0.039
	(0.035)	(0.035)	(0.038)
Joint-stock Organization	0.591***	0.494***	0.489***
	(0.139)	(0.143)	(0.143)
Firm Team Experience	-0.033	-0.025	-0.040
	(0.030)	(0.031)	(0.033)
Firm Team Ethnic Diversity		0.340**	0.341**
		(0.156)	(0.156)
Firm Team Regional Diversity			0.326
			(0.249)
Firm Location controls	Yes	Yes	Yes
Firm Industry controls	Yes	Yes	Yes
Founding Year controls	Yes	Yes	Yes
Firms in Risk-Set	1,573	1,530	1,530
Firm Failures	350	335	335
Log-Likelihood	-2067.975	-1955.065	-1954.241
$\chi^2$	267.327	277.156	278.803
Model d.f.	53	54	55

Note: Standard errors are reported in parentheses. The dependent variable is the likelihood that a firm failed in year T, given that it did not fail in year T-1. We measure failure as a discrete-time event, based on entries of firms in corporate directories for the years 1869, 1874, 1892, 1905, and 1914. The source for all information is included in the RUSCORP database (Owen 1992).

\*  $p < .10$ ; \*\*  $p \leq .05$ ; \*\*\*  $p \leq .01$

TABLE A.1  
Firm Characteristics, 1869-1913: Comparison of Complete Firm Dataset and Survival Subset

	Complete Dataset N=2,519		Survival Subset N=1,573	
	Mean (Percent)	SD	Mean (Percent)	SD
	(1)	(2)	(3)	(4)
Basic Capital (in '000 Rubles)	1.793	4.547	2.016	5.339
Firm Team Constraint Diversity	0.759	0.416	0.779	0.402
Firm Team Constraint	0.860	0.226	0.852	0.234
Firm Team Experience	5.329	5.181	5.652	5.763
Firm Team Ethnic Diversity	0.378	0.398	0.360	0.394
Firm Team Regional Diversity	0.114	0.278	0.121	0.281
Firm Betweenness Centrality	33.683	507.680	44.969	617.181
Firm Team Betweenness Centrality Diversity	0.132	0.331	0.136	0.376
Firm Team Size (Number of Partners)	4.141	3.985	4.331	4.448
Joint-stock Organization	0.644		0.610	
Firm Headquarter Located in Major City	29.97		29.24	
Regional Location of Firm Headquarter				
Caucasus	7.23		7.50	
Center	19.33		20.66	
Central Asia	1.59		1.78	
Finland	0.44		0.45	
North	20.92		19.77	
Poland	12.66		0.57	
Siberia	8.46		6.80	
South	22.19		21.81	
Volga-Ural	6.27		6.87	
Foreign Countries	0.64		0.13	
In Russian Empire, but exact location unknown	0.28		13.67	
Industrial Sector of Firm				
Beets	7.62		9.73	
Chemical	3.22		3.50	
Construction	2.02		1.53	
Finance	12.15		10.17	
Malt	2.30		2.29	
Metal	2.70		2.42	
Mining	5.44		5.15	
Manufacturing	46.33		45.96	
Transportation	6.31		6.23	
Public Administration	0.20		0.06	
Railway	2.06		2.61	
River	2.22		2.29	
Textile	2.14		2.54	
Wholesale	5.12		5.47	
Unclassifiable	0.16		0.06	

Note: The table compares descriptive statistics for the 2,519 firms included in our main dataset (see tables 1-5) and the 1,573 firms in the survival subset derived from corporate directories in the years 1869, 1874, 1892, 1905, and 1914 (see table 6). The source for all data is the RUSCORP database (Owen 1992). Basic capital is standardized and deflated to the 1913 ruble. For the measurement of all other variables, see the section on Data and Measurement in the present article. We report percentages for categorical variables and mean and standard deviation (SD) for continuous variables. Estimated variance inflation factors for the above variables do not exceed a value of VIF=5.27, indicating that collinearity is not a concern.

TABLE A.2  
 Founder Characteristics, 1869-1913  
 (N=10,186 Founders in the Complete Dataset of 2,519 Firms)

	Mean (Percent)	SD	Min	Max
Number of Foundings	1.16	0.63	1.00	11.00
Years between Foundings	4.52	6.51	0.00	41.00
Founder Constraint	0.75	0.25	0.06	1.00
Founder Betweenness Centrality	0.00	0.00	0.00	0.01
Founder Ethnicity				
Armenian	2.34			
German	17.70			
Jewish	10.59			
Norweigan	8.03			
Russian	45.21			
Other Ethnicity	16.13			

Note: The source for all data is the RUSCORP database (Owen 1992). We report percentages for categorical variables and mean and standard deviation (SD) for continuous variables.