

# Kinship in the Shadow of the Corporation: The Interbuilder Network in Clyde River Shipbuilding, 1711–1990

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*The authors identify a system of intercompetitor affiliation that helped Clyde River shipbuilding companies to thrive, but was ultimately undermined by the rise of corporate capitalism. They find that connections between companies through their leaders' family ties or friendships were common, and beneficial, as every such tie maintained by a company reduced its annual risk of failure by 10 percent. This average effect, however, masks an important contingency. The direct benefits of interbuilder ties accrued only to family firms, which enjoyed a reduced risk of failure of 34 percent with each tie, and not at all to corporations. The authors maintain that the shift to the corporate form inhibited the operation of the interbuilder network by reducing the autonomy of leaders to work through personal relations with their competitors. The results encourage heightened attention both to the idea that horizontal ties within an industry may be a key determinant of organizational success, and to the idea that some modes of relational governance may be incompatible with corporate governance.*

The perplexing life-cycle of Scotland's great staple trades is nowhere better seen than in the rise and fall of the shipbuilding industry.

—Slaven and Checkland (1986:201)

Modern economic sociology began with a radical premise, that social connections, not transactions, constitute the veins of the economic corpus (Granovetter 1985). Twenty years after Granovetter's initial provocation, research

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attention is still focused on the vertical transactions between buyers and sellers, lenders and borrowers, or organizations with synergistic capabilities. We now understand those transactions to go smoother when governed by close interorganizational and interpersonal connections, but this knowledge has not necessitated an overhaul of influential economic models, which have simply added "relational governance" to the corporate and market governance forms that they previously recognized (e.g., Williamson 1991). In this article we break from the vertical orientation of most network analyses, and from the tacit assumption that relational governance is fully compatible with corporate governance.

Our focus is on horizontal ties—social connections between organizations in the same industry that would normally be characterized as competitors. The idea of social relations between competitors is anathema to economic theories of competition, even oligopolistic competition, which are based on the assumption of structural independence between competitors. By identifying the role that these ties played in a major industry, we hope to elucidate an economic system that emphasized competitor cohe-

sion and fellow feeling as much as efficiency in vertical transactions. Our core claim is that ties between competitors can produce substantial benefits but that their efficacy is contingent on governance structures that give scope to the personal sentiments of organizational leaders. Thus, there is a tension between horizontal relations and corporate governance, as the control procedures associated with the latter may undermine the social foundation of the former.

We find support for this argument in an analysis of the Clyde River shipbuilding industry. It is hard to overstate the significance of this industry in the Victorian and Edwardian eras. In the days when sea power determined who would rule and who would prosper, the most and the fastest ships were built on the Clyde River, where it met the Atlantic near Glasgow. For much of their history, Clyde shipyards represented a dominant force in British manufacturing and wealth generation, and enjoyed the status of world leaders, as pioneers of innovation and shipbuilders of quality. At the turn of the twentieth century this location produced more ships than any other and earned Glasgow the title “Shipbuilding Capital of the World” (Maver 2000). Reaching its production peak around that time, the industry has dwindled since. The ongoing decline transformed into an acute crisis in the 1960s, and the industry that employed more than 100,000 people in its heyday is currently employing merely a few thousands. As the quotation at the beginning of this article indicates, this reversal of fortune has baffled historians, who have tended to focus either on what made the Clyde the epicenter of shipbuilding in the late nineteenth century or what caused it to flounder in the twentieth, but have failed to develop comprehensive, internally consistent accounts of both the rise and fall of the industry.

For example, technological explanations attribute the rise of Clyde shipbuilders in the mid-nineteenth century to their capabilities in making iron steamships, and their decline in the mid-twentieth century to their failure to adjust to the shift to very large vessels and mass-production techniques (Harrison 1990; Lorenz 1991). The relevance of technological capability in this industry is undeniable, but begs the question why (some) Clyde builders were at the vanguard of shipbuilding at certain points, and why they were left behind at others.

Another perspective is presented by Robertson (1974) and Boyce (2003), who highlight builders’ connections to customers as a key to their success, an argument akin to analyses of embedded buyer-supplier relations in economic sociology (e.g., Uzzi 1996). We find that close buyer-supplier ties were important, but they cannot account for the full pattern of the industry’s evolution. Finally, there is economic history’s favored explanation for the decline of British industry, that the United Kingdom was relatively slow to adopt corporate capitalism and reap the coordinating benefits of the managerial visible hand (Erlbaum and Lazonick 1984; Hannah 1976).

While it might be said that the technological and vertical embeddedness accounts explain the greatness of the Clyde but not its decline, the “slow to incorporate” claim does the opposite. Adherents to the latter explanation characterize pre-corporate British industry as dependent on “gentlemen capitalists” appointed due to accident of birth rather than business acumen, and lacking formal education in technology. These amateurs were obviously ill equipped for corporate capitalism, and so it is little wonder that the United Kingdom lagged behind the United States, Germany, and Japan under that model. The real question is how the gentlemen capitalists ever succeeded in the first place. In response, we identify an important benefit of the system of kinship appointments, and technical training through apprenticeship—that they formed the bases of family and friendship links between companies that would otherwise be atomistic competitors. These links translated into better performance through the mechanisms of knowledge sharing and collusion. On average, a builder’s annual risk of failure fell 10 percent with each tie to another builder. Importantly, the benefit of horizontal ties was not constant for all organizations. “Family firms” (partnerships and sole proprietorships) enjoyed a decrease in failure risk of 34 percent for each horizontal tie, while corporations experienced no benefit at all.

The changing impact of interbuilder ties as the builders became corporations serves to highlight what is most important about our departure from other analyses of economic systems, social networks, and Clyde shipbuilding. First, the large benefit from interbuilder ties in the industry’s heyday shows that Clyde River ship-

builders flourished as a function of connections in social structure where, according to dominant models of competition, no connections should be. Second, the availability of that benefit to family firms but not corporations suggests that in this instance, relational governance is not fully compatible with corporate governance. Intercompetitor affiliation and corporate integration are not equivalent solutions to the same problems of governance, but rather represent the foundations of distinct economic systems that, at least in Clyde shipbuilding, were in tension. Finally, the eventual decline in the benefit from interbuilder ties means that they can account, at least partly, for the reversal of fortune that leaves the extant historical accounts of the industry only half satisfying.

We begin by describing the network of interbuilder ties on the Clyde. We then develop hypotheses regarding the contingent benefits of those ties, and test those hypotheses with an analysis of shipbuilder failure. We focus on failure not because we think it is the only outcome affected by interbuilder ties, but because it is the only outcome measure available for great and small companies over the long period of the rise and fall of Clyde shipbuilding. We believe that interbuilder ties also affected outcomes such as profitability and employment, but the data necessary to test this belief are unavailable. Nevertheless, failure is a fitting dependent variable; both because the failures of Clyde shipbuilders were socially and economically momentous, and because "keeping the companies alive" is a primary goal of affectively tied competitors (Lisle-Williams 1984).

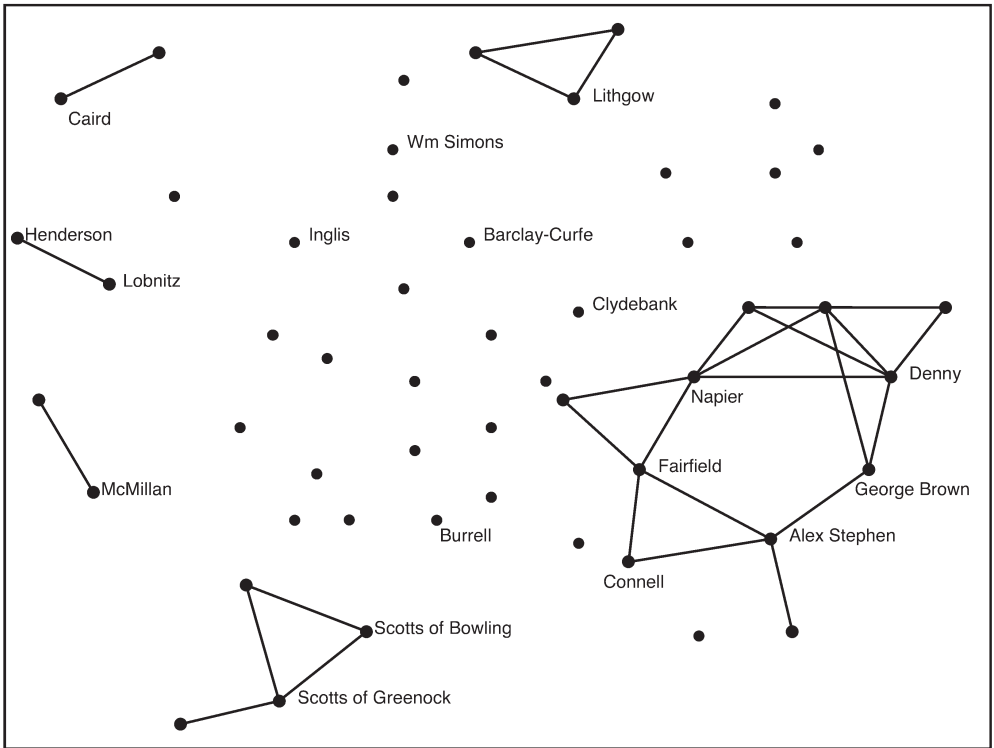
## THE INTERBUILDER NETWORK ON THE CLYDE RIVER

"The overriding impression of this industry is of the importance of family involvement, family continuity and family preferment as a path to ownership and control of the great shipbuilding companies" (Slaven and Checkland 1986:205). The Clyde River shipbuilders were, for most of the industry's history, family firms. Their family character is at the basis of the interbuilder ties that we identified. Figure 1 shows the interbuilder network at the beginning of 1900, the year when there were a maximum number of builders in the industry, and it labels the most historically prominent builders.

We later explain in detail how we operationalized interbuilder ties, but for now we note that they consist of family relationships, or apprenticeship or business relationships that can be expected to seed close friendships between the leaders of shipbuilding companies.

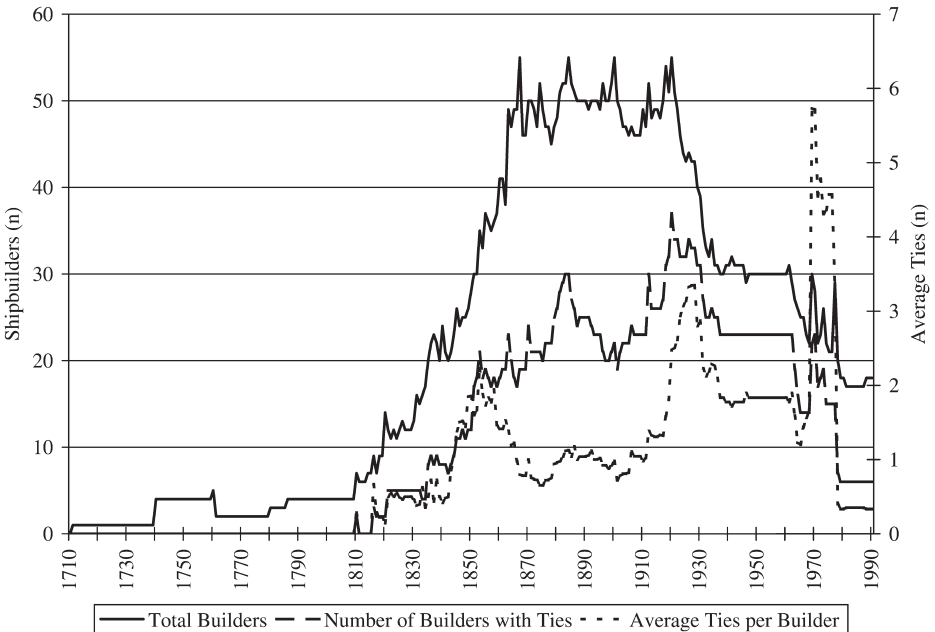
The year 1900 is representative of others in that about half the builders in existence have at least one interbuilder tie. That year is also representative in that it demonstrates a network that is "cliquey," such that a builder with any interbuilder ties tends to be part of a group of interconnected companies. This feature is not surprising since family and friendship ties tend toward closure. The largest cluster on the graph is formed around the companies started by William Denny and Robert Napier, two famed builders who were cousins. Earlier in the 19th century their cluster was larger (20 companies in 1863), as many of their apprentices, sons, and other relatives operated shipbuilding enterprises. The second largest cluster in 1900 surrounded Scott's of Greenock, the oldest builder on the Clyde.

Figure 2 offers some insight into the dynamics of the industry and network. It shows the total number of builders in each year; the number of builders that had at least one tie to another builder; and the average number of ties per existing builder. Between 1711 (when Scott's of Greenock was founded) and 1810, there were never more than a handful of builders, and no ties between them. After 1810, all of the indices begin to climb. The period from 1850 to 1920 represents the peak of the industry in terms of the count of builders. Consistent with our basic claim of the benefit of the interbuilder network, this period also represents the peak of the number of connected builders, and is generally high in terms of the average number of ties that each builder enjoyed. After 1920, there are declines in both industry size and in the network. A spike in both the number of tied builders and their average number of ties occurs in 1969 because two multi-yard companies, Scott's and Lithgow's, amalgamated. The decrease of ties in 1977 occurs because the Scott-Lithgow agglomeration was nationalized in that year. The results that we will report do not depend on the treatment of these perturbations at the end of our window of analysis and results are comparable when we cut off the analysis before 1990, whether in 1969 or 1977.



**Figure 1.** Interbuilder Network on the Clyde River, 1900

*Note:* Historically prominent builders are labeled. The position of builders on the graph was assigned using spring-embedding to place tied builders proximate to each other. The location of isolates and the location of clusters relative to each other were randomly determined and have no significance.



**Figure 2.** Number of Builders and Average Ties between Builders, 1710–1990

## THE BENEFITS OF INTERBUILDER TIES

### *SHARING KNOWLEDGE*

One important benefit of social connections between competitors is the promotion of knowledge sharing between tied companies. These horizontal connections may facilitate the sharing of knowledge by creating opportunities of contact between organizational participants, motivating them to help (a particular issue when they are competitors) and providing richer communication channels braced by empathy (Ingram and Simons 2002). Importantly, the affective nature of the tie plays a particular role in horizontal knowledge sharing, as knowledge given to a competitor costs the giver in terms of relative competitive position. When the competitor is a friend or family member, an altruistic concern for their outcomes may offset this competitive cost.

The significance of interbuilder ties on the Clyde in this regard may be illustrated best by the career of Robert Napier, the man often described as ‘the father of Clyde shipbuilding.’ Napier was born in 1791 to a family of prominent Glasgow engineers. His family ties linked him to a key technological innovator, David Napier, his cousin and brother-in-law, who was the first Clyde shipbuilder to produce an iron ship with a steam engine, the *Agalia* in 1827. By the 1840s, the new technology was adopted and improved by Robert’s yards, those of another cousin, James Napier, and other builders, making the Clyde a leading location for iron and steam shipbuilding (Slaven and Checkland 1986). Later in the century, the Napiers’ early innovations were extended by builders such as John Elder & Co. and J. & G. Thomson, who developed the compound engine and advanced the building of steel ships (Maver 2000; Peebles 1987). These subsequent advances also emerged from the interbuilder network, as both Elder and the Thomsons had worked for Robert Napier before starting yards of their own. The Thomsons’ yards, for example, “were almost slavish copies of the old Vulcan and Lancefield Works of Mr. Robert Napier” (MacLehose 1886).

Administrative innovations also may have been the stuff of interbuilder knowledge sharing. William Denny, another cousin of Robert Napier, was perhaps as distinguished for developing new managerial technologies as the

Napiers were for their engineering innovations. Denny put his whole yard on piece rates in 1876, and quickly realized that a key to making the system work was committing not to ratchet down rates when employees produced well (Bruce 1889). He was also credited as the first employer in economic history to institute a system of rewards for employees who suggested ways to improve production (Dickinson 1932). He promoted these practices through pamphlets and speeches, but there can be little doubt that his friends, relatives, and partners heard more about why they worked and how to implement them. The sharing of human resource policies continued after William Denny’s death, as indicated in a letter in 1918 wherein then manager Maurice Denny asks the manager of a builder to which his company was tied (Alexander Stephen and Sons) for information on wages paid for specific jobs (GUAS DC 114/1/1:1178).

Interbuilder ties were probably better for the sharing of some types of knowledge than others. In particular, the foregoing examples suggest that while the network allowed good technological and managerial ideas to diffuse, it was not the basis of intense interorganizational research and development collaboration of the form associated with contemporary industries such as biotech and semiconductors. Even so, the leaders of shipbuilding companies were often deeply involved in technological advancement, and so their connections would have contributed to the creation of new ideas as well as their diffusion. Further, sometimes ties between leaders led to collaboration deeper in the organization, for example, joint participation by the employees of Napier and John Brown in experimental tests of materials (Schwerin 2004).

### *COLLUSION: IN PRODUCT AND LABOR MARKETS*

Another significant benefit of social connections between competitors is the facilitation of collusion against customers. As with knowledge sharing, intercompetitor relations are imperative for the success of collusion efforts, as current sociological accounts have pointed out (Baker and Faulkner 1993; Ingram and Roberts 2000). These accounts differ from economic treatments of collusion, which treat meetings among competitors as just one mechanism to coordinate output, and allow for collusion

without overt communication (e.g., Jacquemin 1987). In contrast, sociologists attend to the social content of intercompetitor relations, recognizing that affect among tied competitors can brace collusion by enabling normative sanctions that encourage producers to observe collusive agreements (Granovetter 1995; Ingram and Roberts 2000; Podolny and Scott-Morton 1999).

There is evidence of extensive, if informal, efforts by Clyde shipbuilders to coordinate their approaches to the merchant (civilian) ship market.<sup>1</sup> Members of the Denny family, leaders in the most prominent cluster in the network, kept since the mid-nineteenth century extensive records of tenders and awarded contracts for Clyde-built ships (GUAS UGD 3/25/1, 2). These records include plans for ships, and tenders or proposals of many Clyde builders. This information came from the builders themselves, from the customers, and occasionally from public sources. These records sometimes included “explanations” by builders for low tenders, suggesting that they were the basis of some control over the bidding process. The convergence of sealed bids for major contracts often seemed highly unlikely, as when the top four bidders for the *Exmouth* in 1914 came within 1 percent of each other, with the three Clyde-based leaders all within £50, while there was a spread of almost £35,000 between the highest and lowest bid (GUAS UGD 3/25/2). In 1928 a more formal coordinating structure was established, a “Shipbuilding Conference,” followed by the formation of its rationalization vehicle, the “National Shipbuilders Security Limited.” These organizations “arranged for confidential exchange of information on merchant tenders and the imposition of levies to recompense unsuccessful bids for the cost of preparing tenders” (Peebles 1987:136 n. 88) and acted to reduce shipbuilding capacity (and thereby reduce competition). Indicative of the familial

character of the industry, Maurice Denny, a fourth-generation shipbuilder from the family that “kept the books” on bidding, was active in this group and became its chairman in 1940.

As for warship building, Peebles (1987) cites repeated efforts at collusion from the late nineteenth century through World War II. Exemplary in this regard are the activities of the Warship Group (a subcommittee of the Shipbuilding Conference) to resist efforts of the Admiralty to audit their costs. The largest shipbuilders on the Clyde were part of this group, which shared cost and production data, and presented a united front in negotiations with the Admiralty. A memo describing the group’s efforts is indicative of the social processes at work:

“[Our] labours are greatly facilitated by the teamwork that now prevails in our Warship Group, and by the spirit of accommodation that exists whereby dissentient views are not unduly pressed and the decision of the majority is accepted and loyally maintained.” (GUAS GD 319/12/1/9)

By evoking teamwork, the spirit of accommodation, the suppression of dissent, and loyalty, the author, an executive of Scott’s of Greenock, makes clear that the group was not merely an avenue for information exchange, but closer to what Granovetter (1995) calls a “moral community” that achieves collective action through affect-based cohesion. Such cohesion may be fostered by bilateral ties, but can also transcend them and spill over to all competitors if the density of affective relationships in an industry is high enough. In other words, if enough positive relations exist among competitors, the tone of competition can shift to benefit the whole industry.

The collusive efforts of Clyde River shipbuilders were not restricted to the ship market, but extended also to their role as buyers in the labor market. Although collusion in labor markets has received much less research attention, it seems critical in this industry, where labor relations were notoriously contentious (Kenefic and McIvor 1996). In 1877 William Denny tried to organize an employers’ association in an attempt to match the growing power of labor unions. Denny’s plan met with some opposition and was never formally implemented (Bruce 1889). In the early twentieth century there was a Clyde Shipbuilders’ Association through which the employers presented a common front in negotiations with regard to work policies and

<sup>1</sup> Modern antitrust law was not established in the United Kingdom until 1956. Before that, combinations of competitors were legal, and from time to time, encouraged by the government (Peebles 1987). Often, however, shipbuilding contracts were awarded by sealed bid, and so collusion with respect to the bidding process was contrary to the expectations of the buyers.

pay. Indicative of the relevance of social cohesion to the association's approach was an urgent telegram sent to the manager of a yard that was about to break from a lock-out of boilermakers in 1923: "[It is] in the interests of all federated firms necessary that any action or step be uniform" (Strathclyde Regional Council n.d.:134). There is also evidence that tied builders shared information regarding trouble-making employees, wages, and work rules (e.g., GUAS DC114/1/1:1178).

The mechanisms of knowledge sharing and collusion support the following prediction:

*Hypothesis 1:* Clyde shipbuilders will have lower rates of failure if they have more ties to other shipbuilders.

We will also examine whether the interbuilder network created a diffuse benefit for all competitors, as it might if affective ties among some builders were the basis of industry-wide cohesion and collusion.

## GOVERNANCE FORMS AND THE CONTINGENCY OF INTERBUILDER TIES

The typical interpretation of the persistent influence of the family firm in British industry is not as a source of cohesion through kinship and friendship, but as a source of fragmentation and inertia. For example, Erlbaum and Lazonick (1984) in their account of twentieth-century decline of the staple industries in Britain, the so-called "British disease," point to a lack of managerial, industrial, and government coordination compared to the emergent industrial economies in Japan, Germany, and the United States. They claim that the British failed to apply the visible hand of coordination because of institutions left over from "the nineteenth-century era of relatively atomistic competition" (p. 567), by which they mean the trappings of family capitalism. Hannah (1976) reaches comparable conclusions through his Chandlerian analysis of the late rise of corporate capitalism in the United Kingdom. Although we see family firms on the Clyde as employing alternatives to managerial hierarchy to achieve coordination and cohesion, we nevertheless agree that Britain's strained transition from family firms to professionally managed corporations points to a tension between two approaches to capitalism.

Specifically, we see a disconnect between the mechanisms we described earlier, which rely on interpersonal affect between the operators of tied shipbuilders, and the corporate form that ultimately displaced the sons and friends of dynastic shipbuilding families with professional managers and boards of directors. Coleman (1990) documents the complexities of interactions between natural persons and corporations. He explains that even though corporate actors are represented by individuals, those natural persons are typically constrained by governance structures designed to limit the influence of their personal interests on corporate decisions. Those control structures depersonalize to some extent the role of the manager (Merton 1957), and compromise the role-holder's capacity to develop and employ personal relations for economic purposes.

In support of this idea, Perrone, Zaheer, and McEvily (2003) show that buying agents have less *personal trust* in purchasing managers to the extent that the latter are constrained by bureaucratic rules limiting their autonomy to interact as individuals. Roy (1997:11–12) puts it this way when describing the rise of the corporate form: "[R]ather than freeing those who run enterprise to become 'soulful,' managers are constrained to maximize profits for those to whom they are ultimately accountable." Furthermore, corporate functionaries may find it more difficult to employ social relationships at work because they are more transient in their roles than owner-operators (Perrone et al. [2003] also show that short managerial tenure undermines trust). Our point is not that professional managers and other corporate functionaries never strike up personal relations related to their employment—this, in fact, happens all the time (e.g., Ingram and Roberts 2000). Rather, we are making a relative argument: because of the governance constraints they face, corporate agents are less likely to employ intercompetitor relationships to further their organizations than are the more autonomous leaders of family firms.

In the United Kingdom, the legislative foundation of the corporate form is the Joint Stock Companies Act of 1844, which established registered companies as distinct legal entities, combined with the extension of limited liability to corporations in 1856. Early on, critics recognized these institutional developments as a social threat exactly because they created a sep-

aration of the corporation from its owners and operators. In a parliamentary debate over the extension of limited liability, Walter Buchanan, MP for Glasgow, foresaw a “fatal blow to mercantile honour and morality.” He pointed to the risk of depersonalizing business in an exhortation that the law not undermine “social disqualifications” for bankrupts, pointing to the functionality of earlier practices of ostracism (Great Britain Parliament 1863:col. 1885).

Moreover, although some shipbuilding families maintained influence on their firms after incorporation (a common pattern in British industry), incorporation invariably resulted in the inclusion of more diffuse shareholders with an incumbent reliance on managers and corporate governance systems. Indicative of the shift to managerial control, many Clyde shipbuilders incorporated because their founder/operators were becoming less active, as with Fairfield, which first incorporated when its leader became an MP and left for London, or Harland and Wolff, which went public in response to a crisis resulting from the death of its patriarchal leader.

The reduction of commitment and autonomy associated with incorporation has direct implications for the mechanisms of knowledge sharing and collusion that are behind the benefits of interbuilder ties. Knowledge sharing, as it occurred on the Clyde, was never a matter of quid pro quo exchange of idea for idea, or idea for some other current compensation. Rather, it was more akin to social exchange, where a favor in the present was returned with goodwill and, presumably, a favor in the future (Blau 1964). Clearly, a shipbuilder who represented the third generation of his family to head his firm was a more promising partner for such intertemporal, off-the-books transactions than would be the general manager of a corporate builder, who might be sacked or transferred at any moment. Increased hierarchy in the corporate structure may have also undermined knowledge sharing. Unlike the leaders of family firms such as Napier, Denny, Elder, and the Thomsons, the heads of shipbuilding corporations were professional managers and not directly involved in innovation. So, even if they were willing and able to share their secrets, they probably had less valuable knowledge to pass on.

Similar problems could undermine collusion. As we have explained, part of the role of an

interpersonal tie in promoting collusion is to facilitate sanctioning. The efficacy of a social sanction to encourage a builder to observe a collusive agreement should be greater for someone who is more deeply tied to the industry and the community (and who reasonably expects his children to continue his role) than a more transient manager. Indeed, one notable attempt at collusion between twelve shipbuilders in July 1897 failed because one company, Clydebank, would not go along with the plan (Peebles 1987:38). Clydebank was one of only two public companies on the Clyde at the time.

Corporate managers may also be more constrained by their responsibilities to multiple shareholders, who may frown on shipbuilder collusion due to their interests in other industries, including those that supply or buy from the shipbuilding industry. Interesting in this regard is a description of a subsequent Clydebank manager, Sir Thomas Bell, who became managing director in 1909: “[H]e was not master of his own, or his shipyard’s destiny. He was a salaried manager of a division in a giant vertically integrated steel and armaments combine, operated from the Sheffield head office” (Slaven and Checkland 1986:209). Other large corporate builders, such as Harland and Wolff, were forward integrated into the shipping industry. For a vertically integrated company, collusion by one division may be at the expense of its other divisions.

In January 1929 Maurice Denny highlighted exactly these factors in a rich letter to a Newcastle-based shipbuilder, wherein he analyzed the challenges to competitor cohesion, which he saw as the root of crisis for the industry (GUAS DC 114/1/6:91). Denny identified the *managers* of public companies as a barrier to intercompetitor trust, and speculated that it might be easier to deal directly with the owners and their representatives on the board of directors. He also recognized vertical integration as an inhibitor of horizontal coordination: “I do not ignore that there are complications in respect of yards and engine works owned or controlled by shipping lines [and] yards and engine works which are upheld to a considerable extent by other industries operated by the same company.” This letter, coming from the scion of the first family of Clyde shipbuilding, shows the confusion and frustration that the rise of the corporation evoked among those

who had mastered the industrial system based on competitor affiliation (Denny concluded that the industry had become irrational).

To be clear, our argument here is about the influence of the transition to the corporate form on the mechanisms that made interbuilder ties beneficial. We think those mechanisms will be less effective for corporations than for family firms, because the former allow less scope for managers to develop, maintain, and employ interpersonal affect in relationships with competitors. Our prediction therefore concerns the *interaction* between interbuilder ties and corporate form, and we are open to the possibility, consistent with the arguments of Hannah (1976) and others, that the corporate form has its own advantages.

*Hypothesis 2:* The effect of interbuilder ties to reduce the failure of Clyde shipbuilders will be less if those shipbuilders are corporations as opposed to family firms.

## METHODS

### DATA

The data we used came mainly from a set of documents entitled *Clyde-Built Ships*, housed at the Archives of the University of Glasgow. This collection is the result of years of effort by a team of historians and archivists, aided by assistants who were funded through a government program to put young people to work.<sup>2</sup> The creators of those documents estimate that they were able to identify 90 to 95 percent of the ships built on the Clyde, with completeness increasing over time such that their yard lists (a

summary of the output of a shipyard) are comprehensive from the mid-nineteenth century onward. We combined their yard lists with a web resource that lists Clyde-built ships (<http://www.clydesite.co.uk/clydebuilt/>). Ultimately, we had sufficient production data to include in our analysis 299 of the 308 builders listed in the original archival documents. The nine which did not make it into our analysis left no record of their output in any of the many sources that were used to build the data, which suggests that they were minor builders at best.

### VARIABLES

**INTERBUILDER TIES VARIABLE.** Hypothesis 1 is tested with the total number of interbuilder ties that a given builder had to other builders. Information on the ties between builders, which we code as symmetrical, comes from the description of each builder in the *Clyde-Built Ships* documents and other historical and archival sources. There are three subcategories of interbuilder ties, which we label family (46 percent of interbuilder ties), friendship (13 percent), and business (41 percent). Histories of the industry indicate that these subcategories all represented affective connections between the leaders of shipbuilding operations, and we believe that they operated similarly as the bases of knowledge sharing and collusion.

Two builders were coded as having shared a family tie when their leaders were relatives. We treated builders as tied through friendship when their leaders had worked together earlier in their careers, either in joint shipbuilding ventures, or if one had worked (typically apprenticed) for the other. Apprenticeship on the Clyde was often associated with enduring patronage, consistent with evidence elsewhere that co-working can seed subsequent friendships that span organizational boundaries (Ingram and Roberts 2000).

Due to reasons of data availability (specifically, that we did not always know how active the founder of a shipbuilding company was in its ongoing operations), we treated two organizations that were tied through family and friendship as continuing to be thus tied as long as both organizations continued operation. The count of family or friendship ties for a builder is time varying in that it increased when a family member or friend started a new organization, and decreased when a family member or friend's

<sup>2</sup> The leaders of this remarkable effort were Anthony Browning, Richard Dell, Michael Moss, John Hume, John Shaw, and William Lind. The first stage of their work involved identifying all the ships built on the Clyde. The sources used for this purpose included the original yard lists, Lloyds Register of Shipping, Janes Fighting Ships, Brasseys Naval Annual, as well as clippings from various local newspapers and shipping publications. The resulting lists of ships were then combined with a number of lists of builders, business directories, maps, and company histories to determine the identities, locations, and operating periods of the builders.

organization failed. Nevertheless, it is possible for a tie to outlive the individuals who forged it. For family ties, this is less of a concern because given the nature of managerial succession in this industry, if two companies shared a family tie in their first generation, they could be expected to share one in the second or third. On the other hand, the idea of a multigenerational friendship needs more consideration. We believe that, given the practical constraints, our coding of friendships is justified for three reasons.

First, while multigenerational friendships occur in our data, they were not common. Only 13 percent of our interbuilder ties represented friendships, and most builder-organizations did not survive for multiple managerial generations. Second, there is historical evidence to indicate that “friendly” relations established by the leaders of two organizations often outlived them because they had established organizational routines for cooperation between their organizations. For example, after the deaths of John Elder and Robert Napier (Elder had apprenticed with Napier), subsequent managers of the companies that they founded demonstrated high awareness of and sympathy toward each other’s operations (e.g., GUAS DC 90/2/5/22). Third, we tested the assumption of persistent family and friendship ties in supplementary analysis by examining whether these ties had lessened impact for older shipbuilders and found they did not.

We coded two builders as being connected through a business tie if the older had a stake in the younger at the time of its founding, and treated the tie as continuing until one of the builders failed or was bought by an unrelated builder. Such arrangements occurred most often when builders operated multiple yards within the same partnership or corporation. In such circumstances it was the common practice for each yard to operate separately, under the guidance of a family member or trusted friend, rather than be integrated in the modern sense of centralized decision-making and operational interdependence between the yards. This is operationally equivalent to the pattern of family/friendship ties established by shipbuilders like the Dennys, where different friends or relatives would operate yards under separate partnerships. For this reason we believe that in this industry business ties represented the same affective connections as family and friendship

ties, and we therefore included them as interbuilder ties. This belief is supported by analyses that show that business ties are associated with friendships between managers (Ingram and Roberts 2000). In the analysis that follows we tested this position by examining whether business ties affected builder failure differently from friendship/family ties; they did not.

All three subcategories of interbuilder ties represent “deep” relationships, in the sense that ties were forged when organizations were founded, and represent close connections among leaders. Of course, there may be other sources of significant interbuilder ties. For example, knowledge may have been shared when lower-level employees switched jobs, and leaders may have forged friendships in ways other than co-working. We do not have sufficient data to examine these types of connections. Although we may not capture all relevant interbuilder ties, there is an advantage in our reliance on “deep” connections in that it avoids the problem of reverse-causality. It cannot be argued that William Denny’s apprenticeship to Robert Napier or that they were born cousins, resulted from the fact that they later became very successful shipbuilders. The only sensible way to point the causal arrow is from the deep tie to the subsequent organizational success.

**IDENTIFYING CORPORATIONS.** We tested Hypothesis 2 by interacting the interbuilder ties variable with an indicator variable capturing whether the builder was a corporation. We identified whether and when Clyde shipbuilders became corporations by searching the *Times* of London, which reported on significant corporate transactions and meetings, and by consulting archival (e.g., records of ship sales, telling because corporate sellers were required to attach “Limited” to their names as a warning to transaction partners) and historical sources (e.g., Ritchie 1992).

**BUILDER CONTROL VARIABLES.** Close buyer-supplier relationships have been argued to aid both parties, in terms of lower transaction costs, customized products, steady business, and quicker and fairer resolution of problems (Uzzi 1996, 1997). We operationalized relationships between builder and customer using the yard list data, which include information on the buyers

of the ships. In the analysis here we use the variable *Repeat Customers*, which is a count of the number of customers that had bought more than one ship from a builder over the previous five years. As Larson (1992) argues, repeat contact in an exchange relationship is a foundation for trust, reciprocity, and understanding.

Previous analyses of organizational failure have identified size as a key influence (larger organizations are less likely to fail). *Current Production in Ships* is a contemporaneous measure of size. In this capital-intensive industry it is worthwhile to consider capacity, so we also included *Capacity in Tons*, which is the log of the maximum annual output in tons of the builder over the previous twenty years. *Builder Age* is the age of the yard in years. Age has been found variously to increase, decrease, or have a non-monotonic influence on organizational failure (see Barron, West, and Hannan 1994). In the absence of a strong expectation in this industry, we use a piecewise specification of age, which allows for any of the alternatives.

INDUSTRY CONTROLS. Following the norm of analyses of organizational failure, we included a count of the total number of builders on the Clyde in a given year, called *Density*. Often, failure is found to have a U-shaped relationship to density, a pattern argued to represent the mechanisms of legitimation and competition (Carroll and Hannan 2000). In a preliminary analysis, we examined first- and second-order specifications of density but found the influence to be monotonic, with failure increasing as a function of density. This suggests that density in this industry represents competition, but not legitimacy.

The period of the two world wars is recognized as a boom time for Clyde shipbuilders, and so we included a *World War* indicator variable (Peebles 1987). We also included *Total Scottish Corporations*, a time series of the number of corporations registered in Scotland obtained from assorted historical and government sources. We intend this variable to capture diffuse benefits of the rise of the corporate economy. We have logged this variable because it is skewed. The variable *Foreign Competition*, the share of the world's ships that were built outside of the United Kingdom, is included to capture one of the oft-identified causes of the decline of Clyde River shipbuilding. Foreign competition may present a particular problem for close-knit indus-

tries (Sull 1999). For years after 1892, this variable comes from statistical summaries provided by Lloyd's Register of Shipping. We extended the variable back from 1892 using a wide range of historical estimates and interpolation (for descriptive statistics and correlations for all variables, see Table S1 in the Online Supplement to this article on the *ASR* Web site: <http://www2.asanet.org/journals/asr/2006/toc050.html>).<sup>3</sup>

### ANALYTICAL MODEL

ORGANIZATIONAL FAILURE. We modeled builder failure using  $r(t)$ , the instantaneous risk of failing. This hazard rate of failure is defined as the limiting probability of a failure between  $t$  and  $t + \Delta t$ , given that the builder was operating at  $t$ , calculated over  $\Delta t$ :

$$r(t) = \lim_{\Delta t \rightarrow 0} \text{Pr} \left( \frac{\text{failure } t, t + \Delta t \mid \text{operating at } t}{\Delta t} \right) \quad (1)$$

Parametric estimates of the hazard rate require assumptions about the effect of time (in these models, age) on failure. We used the piecewise-exponential model, which allows the rate of failure to vary in an unconstrained way over pre-selected age ranges. Constants (baseline failure rates) are estimated for each age period. The form of the model is as follows:

$$r(t) = e^{\beta X} e^{\alpha_l}, \text{ if } t \in I_l \quad (2)$$

where  $X$  is the vector of covariates,  $\beta$  the associated vector of coefficients, and  $\alpha_l$  is a constant coefficient associated with the  $l$ th age period. Life histories of each builder were broken into one-year spells to incorporate time-varying covariates, yielding 6,228 spells. Among these there were 205 failure events, which we defined as the cessation of operation of a builder. This

<sup>3</sup> In supplementary analyses we examined additional control variables, including location on the Clyde River, localized measures of density, whether the builder had an engineering origin, production experience, the builder's dependence on its best customer, and whether corporate builders were public or private. These variables are tangential to our theoretical claims, and their inclusion in models does not affect the results we report below.

definition excludes the ending events of 76 builders that moved their yards to another place on the Clyde, or participated in an equal-strength merger; these are included in the analysis but treated as right censored when they end. Eighteen builders were left at the end of 1990, and were also treated as right censored.

Figure 3 shows shipbuilder failures by decade. It distinguishes failed builders according to whether they were family firms or corporations, and whether or not they had any interbuilder ties. The figure indicates quite clearly that the failures of family firms were much more likely to be among those with no interbuilder ties. Considering the number of one-year spells associated with family firms without (this isn't shown on the graph, but is 2180) and with (1589) ties, the basic failure rate is 5.9 percent per annum for the former group and 1.5 percent for the latter. Conversely, the figure shows that for corporations, ties were less effective at forestalling failure. The raw failure rates were 3.1 percent for corporations without ties, 2.2 percent for corporations with ties (there were 814 corporate spells without and 1645 with ties). The figure is also notable for the temporal pattern of failure that it shows—clearly, there were

plenty of failures in the period we refer to as the heyday of the industry, and some of the highest failure counts occur then. Partly this is because there were simply more builders in the late nineteenth century than there were 100 years later. It is also that the types of builders failing were different in different historical periods. In the late 1800s the failures were overwhelmingly among unconnected family firms. These tended to be young, small, and forgettable, and they contrasted with the tied builders—the Dennys, Napiers, and others—who were the basis of the industry's renown, and who had very low failure rates in this period. In the corporate era, there was no class of very fragile companies, but neither was there a class of very robust ones. This is a point that is most clearly illustrated by our multivariate analysis.

The results reported in the next section are maximum-likelihood estimates obtained using STATA's piecewise exponential module (Sørensen 1999).

## RESULTS

Model 1 in Table 1 includes control variables and the interbuilder ties variable, which is sig-

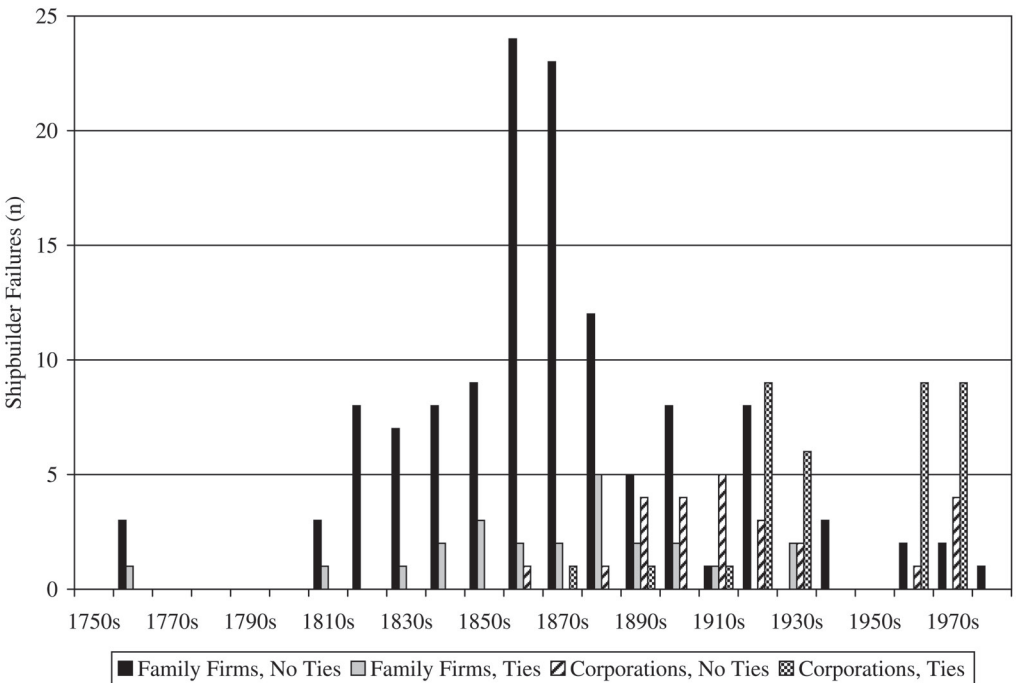


Figure 3. Builder Failures by Decade

**Table 1.** Influence of Interbuilder Ties on Shipbuilder Failure, 1711–1990

	Model 1	Model 2
Interbuilder Ties	-.100** (.042)	-.409** (.108)
Interbuilder Ties * Corporation	—	.406** (.117)
Repeat Customers	-.188** (.067)	-.167** (.067)
log(Capacity in Tons)	.170** (.046)	.164** (.046)
log(Current Production in Ships)	-.337** (.054)	-.324** (.054)
Corporation	-.286 (.225)	-.628* (.251)
Density	.042** (.009)	.045** (.009)
World War	-.956* (.457)	-.968* (.458)
Foreign Competition	.936* (.458)	1.033* (.452)
log(Total Scottish Corporations)	-.041 (.024)	-.054* (.025)
Builder Age, 0 to 5 years	-4.878 (.523)	-4.880 (.514)
Builder Age, 5 to 10 years	-5.462 (.526)	-5.457 (.518)
Builder Age, 10 to 20 years	-5.609 (.543)	-5.552 (.534)
Builder Age, 20 to 80 years	-5.541 (.621)	-5.370 (.617)
Builder Age > 80 years	-6.043 (.689)	-5.898 (.684)
Log-likelihood	-393.94	-386.27

Note: Standard errors are shown in parentheses.

\*  $p < .05$ ; \*\*  $p < .01$  (one-tailed tests for hypotheses, otherwise two-tailed tests).

nificant and negative (as predicted by Hypothesis 1).<sup>4</sup> The magnitude of the coefficient indicates that on average, each interbuilder tie maintained by a shipbuilder reduced its annual risk of failure by 10 percent. Model 2 adds an interaction between the interbuilder ties variable and the corporation indicator variable, which shows a significant positive coefficient as predicted by Hypothesis 2. The coefficients in Model 2 indicate that the average effect of interbuilder ties calculated from Model 1 masks a marked difference between family firms and

corporations. Model 2 suggests that each interbuilder tie maintained by a family firm reduced its annual risk of failure by 34 percent, while interbuilder ties had no benefit at all for corporations—the positive interaction with the corporate form indicator completely offsets the main effect of the interbuilder ties variable ( $\chi^2_{1df} \approx 0.0$ ,  $p \approx .96$ ).

An alternative explanation for the effect of interbuilder ties is that the variable may be associated with endowments, or unobserved quality of the builders. If better builders had more apprentices that went into shipbuilding, interbuilder ties might reflect quality rather than the ongoing benefits of friendship ties. If builders with shipbuilding fathers got good advice when deciding where to locate, or learned the industry better because they were exposed to it as children, interbuilder ties might reflect these

<sup>4</sup> For a fuller version of Table 1, see Table S2 in the Online Supplement to this article on the *ASR* Web site (<http://www2.asanet.org/journals/asr/2006/toc050.html>). That table shows model 0, which includes only control variables.

**Table 2.** Influence of Interbuilder Ties on Shipbuilder Failure, 1711–1990

	Model 3 Year Fixed Effects	Model 4	Model 5	Model 6	Model 7
Interbuilder Ties	-.411** (.113)	-.407** (.109)	-.411** (.110)	-.418** (.110)	-.408** (.110)
Interbuilder Ties × Corporation	.397** (.124)	.406** (.121)	.429** (.123)	.411** (.122)	.311* (.136)
% Networked Family Firms	—	-2.818** (1.182)	-2.972** (1.198)	-2.783** (1.185)	-3.309** (1.259)
% Networked Corporations	—	-.803 (1.460)	-.994 (1.489)	-.655 (1.462)	-.941 (1.523)
Board Interlocks	—	—	-.082 (.066)	—	—
Antitrust Regime (post-1956)	—	—	—	—	.395 (.524)
Antitrust Regime × Interbuilder Ties	—	—	—	—	.149 (.092)
Repeat Customers × Corporation	—	—	—	-.129 (.116)	—
Log-likelihood	-257.31	-382.75	-381.25	-382.12	-379.73

Note: Standard errors are shown in parentheses. All models contain the control variables from Table 1. Coefficients for these variables appear in the Online Supplement to this article on the *ASR* Web site (<http://www2.asanet.org/journals/asr/2006/toc050.html>).

\*  $p < .05$ ; \*\*  $p < .01$  (one-tailed tests for hypotheses, otherwise two-tailed tests).

endowments rather than the ongoing benefits of family ties. To examine this possibility, we estimated a model that included *Ties to Failed Builders*, which is a count of interbuilder ties from the focal builder to other builders that have stopped operations (see Model 2a, Table S2, in the Online Supplement to this article on the *ASR* Web site). If, for example, a family tie was a proxy for the skill of a builder who learned the industry in the cradle, then it would still indicate skill if the father's company eventually stopped operating. The idea that ties represent endowments or unobserved quality is not supported, as ties to failed builders do not affect the failure rate. Consistent with our arguments, the benefits of interbuilder ties obtain only for ongoing relationships.<sup>5</sup>

<sup>5</sup> We agree with a reviewer that this test is evocative but not definitive, since failed firms may have had fewer resources, and may therefore be a weak proxy for their partners' unobserved quality. In this light, we caution that our estimate of the main effect of interbuilder ties might be inflated due to a correlation with unobserved dimensions of shipbuilder

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Table 2 presents additional investigations of the operation of interbuilder ties. Model 3 tests the robustness of our main results by including year fixed effects. This rigorous specification allows a different baseline hazard rate for every year of the analysis, and thereby controls for all historical influences on the failure rate. We included this model to rule out many macro-level factors that we cannot capture with our covariates, for example, changes in technology, transportation, labor relations, trade patterns, as well as international, British, Scottish, or Glasgow law, economics, demographics, and politics. Model 3 excludes industry-level covariates, and one of the age dummies to avoid linear dependence with the fixed effects. The coefficients that test our hypotheses remain significant in the predicted directions.

Model 4 examines the possibility that the broader structure of interbuilder ties produced a diffuse benefit in the industry. For example, if the network supported collusion or other

quality, although it should be kept in mind that our controls for shipbuilder characteristics are extensive.

forms of collective action, then all shipbuilders might have benefited, even if they themselves were not part of the network. We test this idea by considering the relative size of the largest cluster in the network, the largest set of builders that were somehow interconnected. We divide the size of this cluster by the number of shipbuilders in the industry in every year, resulting in a percentage of builders that were “networked.” We decomposed this percentage into two components, one that represents the family firms in the dominant cluster and the other the corporations. The coefficients indicate that failure rate for all builders was lower to the extent that a greater portion of the builders were networked family firms. The magnitude of this benefit was large: for example, the average failure rate in 1861 (networked family firms = 46.3 percent) was 27 percent that of 1964 (networked family firms = 0 percent). Consistent with our theme that the efficacy of the interbuilder network was undermined by the corporate form, there was no significant influence of networked corporations.

Model 5 examines the influence of a form of interorganizational ties enabled by the rise of corporate capitalism, namely interlocks between boards of directors. Did Clyde shipbuilders simply shift from the friendship and family network to the interlock network as corporations replaced family firms? We examined the position of Clyde shipbuilders in the network of interlocks of the largest Scottish corporations by using data from Scott and Hughes (1980) for the years 1904, 1921, 1937, 1955, and 1973. A shipbuilder could enter this network by being one of the (roughly 100) largest Scottish corporations in those years, or if its managers or founders served on the boards of those corporations. Only 17 of the 118 yards that operated on the Clyde from 1904 onward were ever part of the interlock network, probably because the industry was already in decline by the time board interlocks became prevalent. The variable *Board Interlocks* in Model 5 is a count of the number of first- or second-step interlocks between a given shipyard and the other corporations in Scott and Hughes’s data. The coefficient is negative, but not statistically significant. In other analyses we differentiated between first- and second-step interlocks, and between interlocks to industrial and financial companies; these distinctions yielded no significant

coefficients. Whatever the effect of board interlocks on the broader Scottish economy, they do not appear to have reduced the failure rate of Clyde shipbuilders.

Model 6 examines whether vertical builder-customer ties were less beneficial for corporations than for family firms. The interaction of the repeat-customer variable with the corporate form indicator is insignificant, suggesting that close vertical ties worked the same way for family firms and corporations, a finding we take up in the discussion. We also broke the interbuilder ties variable into two components—family/friendship ties and business ties—to test our treatment of these types as equivalent (see Model 6a, Table S3 in the Online Supplement to this article on the *ASR* Web site). The raw magnitude of the family/friendship ties variable is larger than its business equivalent, but the difference is not significant ( $\chi^2_{1df} \approx 0.35, p \approx .55$ ). This supports our belief that these connections played similar roles as sources of interpersonal closeness between shipbuilders. Finally, Model 7 introduces an indicator variable, *Antitrust Regime*, and an interaction between it and the interbuilder ties variable. We do this to examine whether the efficacy of interbuilder ties was lessened by the introduction of antitrust law, which we date to the 1956 passage of the Restrictive Trade Practices Act. The coefficient on the interaction is positive, and with a one-tailed test, has a *p* value of 0.05. Since interbuilder ties facilitated collusion, it makes sense that they would be less beneficial in the presence of antitrust law.

### CONTROL VARIABLES

Beyond the contingent influence of interbuilder ties, our models paint a picture of Clyde shipbuilding consistent with relevant historical and sociological arguments. Consistent with histories of Clyde shipbuilding, builders did suffer from foreign competition and were more robust during the world wars, when the Clyde teemed with industrial activity (Peebles 1987). Consistent with historical accounts that attach economic gains to the rise of corporate capitalism, the *main effects* of the proliferation of corporations in Scotland and the adoption of the corporate form were to make shipbuilders more robust (Erlbaum and Lazonick 1984; Hannah 1976). Consistent with arguments from histo-

rians (e.g., Robertson 1974) and economic sociologists (e.g., Uzzi 1996), close relations to customers helped Clyde shipbuilders. Also, consistent with organizational ecology, competition increased as a function of the number of shipbuilders (Baum and Mezias 1992; Carroll and Hannan 1995), while shipbuilders with more current output had lower rates of failure (Barron et al. 1994). Finally, it makes sense in this capital-intensive industry that builders with higher levels of costly capacity had higher failure rates.

## DISCUSSION

The contingent influence of interbuilder ties, which was unanticipated by the extant theory and history, is even more notable because the pattern of organizational failure on the Clyde was in so many other ways as expected. This was not otherwise an odd industry, yet it was an industry where a social tie between two shipbuilders reduced their annual risk of failure by about 34 percent if they were family firms, and where all shipbuilders were substantially more robust to the degree that networked family firms made up a greater percentage of the active builders. While this point-estimate may seem large, it is worth remembering that the success of the most prominent family firms in the heyday of the Clyde was spectacular. They stood out in a globally competitive industry, and *something* has to explain their remarkable achievements. Even so, and even though our analyses contain extensive controls for other shipbuilder resources and capabilities, our intention is not to dwell on a coefficient. Even if part of the benefit that our models attribute to the interbuilder ties of family firms is due to some unobserved correlate, the quantitative and historical evidence indicates that Clyde shipbuilders benefited considerably from interbuilder ties in the era of the family firm, and they benefited less from those ties in the era of the corporation. This conclusion has important implications for two areas of research: on industry structure and competition, and on the influence of social relations on economic behavior.

On the issue of industry structure and competition, our results suggest that increased emphasis should be paid to the horizontal orientation of producers (White 1981). Attention to social ties within an industry presents a par-

ticular opportunity for sociologists, as it juxtaposes the economic realm with that of social forms such as kinship and friendship. The most obvious target for such efforts would be economic models of perfect competition, duopoly, oligopoly, and even collusion, which assume structural independence between competitors. The assumption of competitor independence also exists in sociological models from organizational ecology, and our results could be usefully applied in that field. For example, geographic proximity produces more potential for competition (Baum and Mezias 1992), but it also produces opportunity for social interaction between competitors (Sorenson and Audia 2000). More generally, density-based models of competition could be refined by recognizing the implications of demographic characteristics of organizations and organizational participants for cohesion and collective action (Ingram and Rao 2004).

On the question of social relations and economic behavior, our identification of the “corporate contingency” of interbuilder ties should alert researchers to the significance of organizational governance for the analysis of interorganizational ties. We do not claim that corporations never benefit from interorganizational ties; clearly there is evidence from other studies that they do. Rather, the contingency on the Clyde indicates that when the mechanisms behind the operation of ties are interpersonal, organizational structure and corporate character may matter, as they affect the likelihood that personal sentiments influence organizational action. Of course, the effect of the corporation on individual autonomy was an early topic in organizational sociology (e.g., Merton 1957). This topic has faded as the corporation has become a taken-for-granted part of social life, but the findings here suggest that it may be time to resurrect it. After all, what sense does it make to develop economic sociology on the foundation of social embeddedness without considering the extent to which the most economically powerful individuals are free to interact as social persons and not merely as corporate functionaries?

To identify the scope conditions of our theoretical claims it is useful to compare our study to others that examined the impact of social ties on organizational behavior and performance. The most obvious comparisons are to

analyses of horizontal relations. One prominent study in this realm is Baker and Faulkner's (1993) analysis of networks that supported collusion among large U.S. corporate electrical-equipment manufacturers. The companies in that case were subject to the largest fines ever levied under the Sherman Anti-Trust Act, and many of the managers involved were imprisoned. This outcome seems consistent with our Model 7, which indicates that corporations subject to effective antitrust law are better off without horizontal ties. A counter-case is Ingram and Roberts (2000), who identified substantial financial gains to intercompetitor friendships in the Sydney hotel industry, partly due to tacit collusion. Australian antitrust enforcement was weak at that time, but a more significant difference seems to be in the nature of the hotels, which, while branches of corporations, were relatively small and allowed substantial autonomy to local managers. This reminds us that corporate constraints are not uniform, and they may be weaker when the managers are remote from headquarters and when they manage smaller and less structured operations. Another difference between the Sydney study and the current one is the historic periods that are examined. The corporation was a novel institution in the United Kingdom when Clyde shipbuilders began adopting it in the latter half of the nineteenth century, and corporate design has advanced substantially in the past one-hundred plus years. Control systems that orient managers to the long-term interests of the company, and grant them more operational autonomy, have developed greatly. So, it may be that (some) contemporary corporations can accommodate the competitor ties of their managers where the corporations on the Clyde could not.

A comparison to the more numerous analyses of the benefits of vertical ties (e.g., Perrone et al. 2003; Uzzi 1996, 1999) is also informative, especially since vertical ties were advantageous to Clyde shipbuilders whether they were corporations or family firms. Why might a corporation benefit from its managers' ties to customers or suppliers but not to competitors? The difference, we believe, is that close vertical relations are often recognized by the designers of corporations as desirable as a source of control over vertical transactions and are therefore incorporated into the design of managerial roles (Perrone et al. 2003). That corporate

shipbuilders saw the importance of close vertical connections is evidenced by the frequency of stock cross-holdings between shipbuilders and shipping companies (Slaven and Checkland 1986). It is only logical, therefore, that they would encourage (or allow) their managers to pursue close relationships with the executives of shipping companies. In contrast, corporate designers typically ignore the significance of close ties to competitors for the same reason it has been ignored by economic theorists and historians—influential models of the economy celebrate vertical connectedness but assume horizontal independence.

The question of what Clyde shipbuilders lost in the transition to corporate governance brings us back to the substantive phenomenon we began with, the decline of the industry. Consider shifts in shipbuilder failure between 1860, when there were no corporations on the Clyde, and 1960 when corporations dominated and the industry's crisis became obvious to all (using coefficients from Model 4). Over that time foreign competition grew, resulting in an increase in the annual risk of failure of 68 percent. Shipbuilders were made more robust due to more of them becoming corporations, and due to the increase in the number of corporations in Scotland overall—on average, the failure rate decreased by 73 percent because of these benefits of the corporate economy. The effect of each repeat customer was the same in 1860 and 1960, but there were more of them on average by the later date—the result was a decrease in the failure rate of 15 percent. Finally, compare the benefit of the horizontal network. In 1960 there were actually more interbuilder ties on average because of rationalization in the industry. Yet, the benefits of more ties were more than offset by the erosion in tie-benefit due to the shift from family firms to corporations. The total effect of changes in the horizontal network meant an increase of 503 percent in the average risk of failure. Overall, a shipbuilder in 1960 had a risk of failure 132 percent greater than one in 1860 ( $1.68 \times 0.27 \times 0.85 \times 6.03 - 1$ ), and the greatest factor was the degeneration in the efficacy of interbuilder ties.

That the shift to the corporate form simultaneously produced its own benefits while undermining the interbuilder network points to the crux of this article, for economic sociology and economic history. We seek to illuminate the

tension between two approaches to capitalism, the one that rests on social relations among competitors, and the one that rests on corporate governance. Sociologists recognize both, but they have attended more to the latter than the former, and have underplayed the tension between the two. Historians of British industry also see elements of both, but they treat the residue of family capitalism as an unfortunate anachronism, a social indulgence that acted as a brake on the progress to corporate capitalism. We show that kinship and friendship links between industrialists were not an indulgence but instead stood as the foundation for a great industry. In Clyde shipbuilding, interbuilder ties represented their own effective economic logic, a logic that was an alternative to, but not subordinate to, corporate capitalism as it was subsequently practiced. The evidence here should encourage wider recognition that horizontal ties within industries may be a basis of organizational viability, as well as prompting a closer examination of the interdependence between such ties and alternative forms of governance.

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