The Role of Financial Conglomerates in Industry Formation: Evidence from Early Modern Japan *

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Abstract

Large family-owned conglomerates known as *zaibatsu* have long been credited with leading Japanese industrialization during the Meiji Period (1868-1912). In particular, it is argued on the basis of little systematic evidence that the *zaibatsu* pioneered new industries and technologies in these formative years. I develop a game-theoretic model to predict firm entry behavior and then estimate likelihoods of entry with discrete choice econometric methods. The analysis uses a new dataset of firm entry dates that I collected from corporate genealogies. I find that *zaibatsu* are indeed more likely to be first entrants in new industries relative to independent firms. This effect is especially pronounced in capital-intensive sectors, and may be due to the *zaibatsu*'s ability to finance investments internally, autonomy to invest without shareholder interference, and lower risk-aversion from having diversified holdings. At the same time, *zaibatsu* lag independent firms in introducing more innovative technologies, possibly due to their preference for scale and monopolistic industries, growing conservatism among owners, and organizational complexity from over-diversification.

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1 Introduction

The Meiji Period (1868-1912) witnessed a remarkable transition for the Japanese economy, whose rapid development propelled the pre-modern agrarian nation to industrialized status. Under the banner of "rich country, strong military," the economy trebled in size between 1880 and 1913, and the navy won unexpected victories against China (1895) and Russia (1905). Investment in roads, railways, harbors, and the telegraph system grew at ten percent per year, and industrial output grew fivefold. Institutional development grew apace with the establishment of a central bank in 1882, promulgation of a constitution along western traditions in 1889, and adoption of the gold standard in 1897.

How did Japan overcome its late start? The agents of change were found in the private sector, with conventional wisdom crediting large conglomerates known as *zaibatsu* in "[providing] the impetus for the country's modern economic development."[1] In this view, the *zaibatsu*,[2] which emerged in the early part of the Meiji Period, had a number of advantages: size, which gave them sufficient scale to efficiently adopt foreign, capital-intensive technology; family ownership, which provided them with the flexibility to enter new sectors without interference from short-sighted shareholders; diversified holdings, which provided risk-sharing and internal financing among its businesses; employment of well-educated salaried managers; and access to natural resources like metals and coal.[3] These advantages are magnified in a developing economy with weak institutions, poor infrastructure, and immature capital markets. So powerful were these industrial cliques that they dominated the economy until the end of World War II.[4]

[1] Morikawa (1992). The government's industrial policies are widely cited as setting the pace of industrialization by seeding particular sectors, and later, after it privatized its ventures in the 1880s, through subsidies, education policy, and infrastructure. Less appreciated is the fact that many of the government's enterprises were unprofitable, which may have accounted for the rapidity of its privatizations. A prominent example is the first modern silk reeling facility, the Tomioka Filature, which the government built according to French design in 1872 and incurred significant losses before selling it to private investors. Moreover, since the government believed widespread industrialization could occur only through the development of private industry, maintaining even profitable industries in the public sector seemed inconsistent with this policy; see Hirschmeier and Yui (1975). Tipton (1981) is even more scathing, arguing that government policies hindered the development effort and ruined the country in its military pursuits.

[2] Various definitions exist for *zaibatsu*, including oligopolistic enterprises, multi-subsidiary organizations (similar to the German Konzerns), and groups of diverse firms. For the purpose of this discussion, *zaibatsu* is defined as a family-owned diversified conglomerate.

[3] *Ibid*; Fruin (1992).

[4] In the post-war era, after a brief interregnum when the American occupation authorities disbanded them, they were reincarnated to help Japan rapidly re-industrialize and attain its

Belying these apparent advantages are a number of uncomfortable observations. First, *zaibatsu* had few opportunities to capitalize on inter-industry scale economies since their enterprises were mostly unrelated, thus limiting their ability to share resources and technologies.[5] Moreover, these conglomerates had many interests in commerce (eg, transport, trade), which were not subject to significant scale economies.[6] Even if they were able to capitalize on scale, it was only on the eve of World War I and the corresponding disruption of European trade that *zaibatsu* had a large market to serve.[7] As for proof of their leadership in developing new industries, at a superficial level *zaibatsu* achievements are modest: data described below indicate that of the 144 new industries[8] in the Meiji Period, only 17 were started by the *zaibatsu*; see Table 1.[9]

Notwithstanding these problems, the visibility of the *zaibatsu* has generated a substantial body of research. Numerous scholars have asserted that the *zaibatsu* led the introduction and use of foreign technology in Japan during this early period of industrialization, although these claims are supported mainly by anecdote, studies of individual firms, or comparisons of international development.[10] The few papers that use quantitative data to compare *zaibatsu* behavior to other firms are limited to financial records dating from the interwar years, after the Meiji Period. This paucity of analysis, stemming from a lack of data, leaves as a mystery much of what helped the *zaibatsu* and Japan to succeed. Were *zaibatsu* responsible for introducing new technology to the country? Did *zaibatsu* target particular industries, and if so, why? What distinguished their business practices from other companies, and did they lead to better firm-level performance?

"miraculous" recovery. See Dodwell (1975) and Morikawa (1992).

[5]Fruin (1992). This is true for the Meiji Period; in the 1900s the *zaibatsu* engaged in more manufacturing activities, which allowed for scale economies.

[6]While commerce did allow for economies of scope, the attributes of size and wealth are less meaningful. Scope economies differ from scale economies in their reliance on the savings from fixed costs (eg, shared facilities, distribution channels) rather than variable costs (eg, shared inputs, learning curves). Another way of distinguishing the two is that scope economies typically involve production of multiple, unrelated goods while scale economies are usually from increased production of the same (or similar) goods. *Ibid.*

[7]Morikawa (1992).

[8]Industries are measured at the four-digit industry classification level; further discussion of the data is in later sections. See Appendix A for a complete list of new industries established in the Meiji Period.

[9]That is not to say the absolute number of first-entry firms adequately captures economic impact, as differences exist among industries (such as number of entrants), and later entrants in an industry can still lead in scale of operations. As I discuss later, a *zaibatsu* affiliate typically was much larger and produced more than a single independent firm.

[10]Fruin (1992); Morikawa (1992).

This paper attempts to fill in some of these gaps, in particular on the issue of technological leadership. It tests the hypothesis that *zaibatsu*-affiliated firms were more likely to be pioneers in new industries compared to their independently established rivals. I find that conglomerate affiliation does increase the likelihood that a firm will be a first entrant in a new industry. An interpretation of this result is that the affiliated firm has access to internal financing and/or lower cost capital compared to a standalone firm, which may also explain the *zaibatsu*'s relative leadership in entering capital-intensive industries. Nevertheless, *zaibatsu* appear to lag other firms in the introduction of highly innovative technology (ie, technology dissimilar from any existing in the economy), with the effect becoming more pronounced over time.[11] This may be due to growing conservatism among *zaibatsu* owners, with firm founders seeking to protect the family patrimony as well as later generations inheriting wealth but not entrepreneurial spirit. Increased organizational complexity arising from excessive diversification may have also weakened the desire for continued innovation (and offset any benefits from further diversification). Other analytical results indicate that both private ownership and urbanization increase the likelihood of first entry, regardless of a firm's membership in a conglomerate; these and other results are discussed in greater detail below.

At the heart of this analysis is the assumption that the first appearance of an industry using new technology is a reasonable approximation of when that technology was introduced to Japan.[12] As a late developing country, Japan was able to borrow existing technologies without needing to develop them itself, and thus the first appearance of an industry using new technology proxies the technology's introduction to the country. My analysis eschews the need for financial records, few of which existed before the twentieth century, developing instead a new dataset consisting of firm establishment dates from the Meiji Period, gathered from corporate genealogies. By studying the order of technology introduction via industry establishment, I can determine whether a firm's affiliation (*zaibatsu* or

[11] This behavioral change is much more pronounced in the decades following the Meiji Period; see Frankl (1999).

[12] Nevertheless, outside the late development context, there is an important difference between the development of new technology and its application, since developers may not have the resources to bring the technology into production (eg, modern-day research laboratories versus large pharmaceutical companies). This is not to say that the first firm to introduce new technology will necessarily succeed, as other firms may prefer to observe market reception before committing their resources or to learn from the experience of the first firm. Some of these issues will be explored in more detail in the later sections.

not) had an impact on the likelihood of it being the industry pioneer. This in turn should be indicative of the role of conglomerate membership in industrialization.

In addition to the new dataset, this study of the *zaibatsu* and Japanese industrialization improves on the existing literature in several ways. First, I motivate my analysis with a game-theoretic model of entry that incorporates credit constraints (via conglomerate membership) and industry risk. I test the predictions of the model using a broad sample of *zaibatsu* instead of individual ones, which is logical given that discussions about trends in Japanese industrial development generally refer to them as a group.[13] I examine *zaibatsu* influence across multiple industries and industry classes rather than in a specific industry (eg, the iron and steel industry) to assess the economy-wide impact of these corporate groups.[14] Finally, I focus on the Meiji Period, when Japan first began to industrialize, whereas other authors may have been forced to draw inappropriate conclusions about this crucial period from later periods due to their reliance on financial records.[15]

The remainder of the paper is as follows: Section 2 outlines the historical context and surveys earlier research relevant to the study of firm behavior and industry development in Meiji Japan. Section 3 presents a model of entry that includes firm and industry differences. Section 4 describes the data and empirical methodology, while Section 5 presents the analytical results. Section 6 checks for robustness, and Section 7 discusses the results and suggests extensions to this work. Section 8 concludes.

[13]The *zaibatsu* used for the analysis include Mitsui, Mitsubishi, Sumitomo, Yasuda, Furukawa, and Ōkura. These six are the biggest and oldest *zaibatsu* established in the pre- and early Meiji Period (with the first four referred to generally as 'The Big Four'), and their grouping together for analysis is consistent with Japanese practice in differentiating older from newer *zaibatsu* that emerged in the 1900s (Frankl 1999).

[14]Industry class refers to the classification of industries at varying degrees of specificity; ie, two- through four-digit industry classification codes. For example, a two-digit code of 05 refers to Metal Mining; a three-digit code of 053 refers to Iron Ore Mining; and a four-digit code of 0534 refers to Chromium (a type of iron ore) Mining. More discussion about the data and its coding is in the body text.

[15]This is important not only to better understand the genesis of modern Japanese industries, but also to circumvent the distortions associated with the global depression in the 1920s and militarization in the 1930s. Ohkawa and Rosovsky (1974) characterize Japanese modernization in terms of "recurrent waves" or "long swing expansions;" ie, Kuznets cycles of expansion and retrenchment. According to them, the first wave of Japanese industrialization began in 1901 and ended in 1917. The Commercial Code of 1893 established the modern Japanese corporate system based on ownership, eg, unlimited liability, joint-stock firm (Loenholm 1906).

2 The Significance of the *Zaibatsu*

2.1 Literature

Research on the *zaibatsu* has developed three major themes: their role in Japanese industrialization, their relationship with the government, and their performance relative to independent firms.[16] In their studies of Japan before the Pacific war, Hidemasa Morikawa and Mark Fruin argue that *zaibatsu* took the lead in introducing foreign technology by employing of students who either studied abroad or graduated from the newly established universities teaching occidental sciences; cultivating contracts with foreign manufacturers to import capital equipment and skills; and reengineering western technology to suit local resources and market conditions.[17] *Zaibatsu* achievements include a number of firsts in Japan, including the first modern steel ship, the first insurance company, and the first multidivisional (M-form) corporation.

Keiichiro Nakagawa suggests that government patronage accounted for the emergence of manufacturing firms by providing both the social and physical infrastructure needed by entrepreneurs and the initial investment in western technology and equipment.[18] The Meiji government, for its part, subsidized foreign education and employed foreign experts to work and teach, supplying administrators and engineers to the *zaibatsu*.[19] Moreover, the Sino-Japanese (1894-1895) and the Russo-Japanese (1904-1905) wars enabled well-connected businessmen to procure supply contracts in shipping, construction, armaments, and mining.[20]

Three recent papers compare the performance of *zaibatsu* to independent firms in the 1900s. Jennifer Frankl, using interwar (1915-1937) financial records for 100 firms, analyzes the effect *zaibatsu* affiliation had on equity returns and risk profiles. She finds that Meiji-era *zaibatsu* had less stability in their returns on equity than both independent firms and the newer *zaibatsu* of the Taisho (1912-1926)

[16] A comprehensive survey of Japanese business history that provides a context for *zaibatsu* development can be found in the fifteen-volume series of proceedings from the Fuji Conferences published by the University of Tokyo and edited by Keiichiro Nakagawa.

[17] Morikawa (1992); Fruin (1992).

[18] Nakagawa (1974). This view is controversial, with authors like Morikawa arguing that there are a number of *zaibatsu* that nearly collapsed due to the vagaries of political patronage as well as arose without recourse to political mercantilism.

[19] Morikawa (1992); Jones (1980). The French engineer Paul Brunat, who was responsible for managing the government-built Tomioka Silk Reeling factory, was paid $600 monthly in current prices, equivalent to that of government ministers, and foreign silk reelers were paid $80 per month, 50 times the wage of domestic reelers; see Kiyokawa (1987).

[20] Lockwood (1974); Yamamura (1977).

and Showa (1926-1989) Periods. In contrast, Tetsuo Okazaki, using financial data from 1922 to 1936 for 135 firms, finds that those affiliated with *zaibatsu* outperformed independent firms and attributes this to the holding company organization of the former.[21] These results are supported in a study by Hideaki Miyajima, Yusuke Omi, and Nao Saito, which concludes that concentrated ownership of a firm corresponded with better returns and that the *zaibatsu* had less volatile returns.[22] Nevertheless, because of the limitations of their data, all three papers are constrained to analyze the twentieth century, when Japanese industrialization was already underway. They also focus on the holding company characteristic of the *zaibatsu* without considering structural features of the industries and make only passing reference to technological introduction and leadership.

Example: Mitsubishi and Japan's Maritime Industries

It may come as a surprise that an island nation like Japan would not develop modern shipping and shipbuilding industries until the late 1800s. In fact, Japan had both, although its shipping industry was confined to domestic waters and its shipyards to construction of wooden ships no larger than 75 feet in length or 150 tons in weight.[23] Moreover, the development of these two industries and that of the Mitsubishi *zaibatsu* are closely intertwined.

The modern shipping industry began in 1870 with the establishment of Tsukumo Shōkai, later renamed Mitsubishi Shipping Company. This company was the first of many in the Mitsubishi *zaibatsu* led by founder Iwasaki Yatarō, and initially served to intermediate between foreign and native merchants as well as to procure foreign-built ships. Its 1875 inaugural overseas route was between Yokohama and Shanghai, expanding rapidly along the coast, then to Mumbai in 1894, and to London, San Francisco, and Australia in 1896.[24] While these early journeys were mainly for postal deliveries, the diversification of Mitsubishi meant that business increasingly was in the goods trade. However, strong competition with British and American ship-

[21] This is due to the efficiency of internal monitoring of firms by the holding company, as opposed to shareholder monitoring of publicly listed firms (Okazaki 2001).

[22] Miyajima et al (2003). Of the approximately 600 firms in Miyajima et al's sample, 50 have records between 1900 and 1912 (ie, the late Meiji Period).

[23] These limits were due to a series of isolation edicts at the beginning of the Tokugawa Period (1603-1868), where the ruling government under Shogun Tokugawa Iemitsu banned large ship construction in order to isolate the country from foreign influence and trade.

[24] An earlier, non-commercial international voyage was in 1874, when the Meiji government commissioned Mitsubishi to transport military troops to Taiwan for a punitive attack on that island's aborigines.

ping prevented Japan from developing large-scale international operations until WWI, which substantially decreased shipping capacity and left open market opportunities for Mitsubishi and its fellow Japanese shippers.[25]

The lack of technology and facilities to build modern steel ships meant that the shipyard industry developed after the shipping industry, since the latter could and did import foreign-built ships for their business in its early years. The advent of a modern shipyard industry came about in 1895, when the first steel steamship *Suma Maru*, at 1,522 tons, was built.[26] This accomplishment was also at the hands of the Mitsubishi *zaibatsu*, which owned the Nagasaki Shipyard that built the vessel.[27] Twenty-five years later, Japan had become the third largest shipbuilding nation, following the United Kingdom and the United States, with a fleet of 1,940 ships totaling almost 3 million gross tons in weight.[28] One constraint to the early development of the shipyard industry was a lack of domestic raw materials for construction. Fortunately, resources like iron ore and coal were available in Southeast Asia and northern China. The efficiency and advancement of this industry were such that by WWII, construction costs were a third less than its nearest rivals in Britain and Germany and half the cost of an equivalent American ship, savings which were driven primarily by low labor costs.[29]

2.2 Entry Timing and Innovation

Being an industry pioneer is significant for a number of reasons, including the ability to establish new markets, to garner market power and monopoly profits, and to set industry standards. Additionally, firms in capital-intensive or high minimum-efficient-scale industries benefit from lower average costs as they increase production, which is easier to do the fewer the number of competitors. First movers may gain a head start in the learning process as they acquire experience, which can also lower production costs, and develop linkages with suppliers and distributors to cement their market leadership. Understanding the importance of firm characteristics like conglomerate membership may thus help to clarify

[25] Mitsubishi monopolized the overseas shipping industry until 1891, when Osaka Shipping Company extended its domestic postal shipping service to Korea.

[26] However, the first modern ship of notable size was built in 1898, called the *Hitachi Maru* at 6,172 tons.

[27] The government first built this shipyard in 1871, but sold it to Mitsubishi in 1887.

[28] Even so, engines and turbines to power these ships continued to be imported until after WWI.

[29] Morikawa (1992); Travis (1945).

the roles of size, ownership, and organization in late development and economic catch-up.

In a widely-cited survey, Marvin Lieberman and David Montgomery discuss three factors favoring market pioneers: technological leadership, resource preemption, and switching costs.[30] Technological leadership can arise either through a head start in learning-by-doing or through research barriers such as patents.[31] Second, a first mover can dominate a market by being first to acquire scarce resources, be they physical, financial, human, or even geographic.[32] Finally, early entrants are likely to sustain market leadership if consumers face high transaction costs or have incompatible sunk investments when switching producers.[33]

Early entrants also face market and technological uncertainties and competition from followers who can free-ride on incumbent investments. In a study of the American animation industry, Alan Bryman finds that follower firms outperformed earlier movers due to the failure of the latter to adapt to changing tastes.[34] Jamal Shamsie, Corey Phelps, and Jerome Kuperman find that latecomer firms are more successful if they are large and draw on pre-existing resources, regardless of market conditions like industry competitiveness.[35]

An established firm's ability to reallocate resources away from unsuccessful new ventures can attenuate the risk of failure. Using a model of entrepreneurship, Denis Gromb and David Scharfstein suggest that skilled workers take into account the strength of the external labor market when choosing whether to be an entrepreneur or to work in an established firm.[36] If entrepreneurial activity is

[30]Lieberman and Montgomery (1987).

[31]See Lilien and Yoon (1990) on the importance of research investment for industry pioneers.

[32]For more recent studies on resource constraints, see Robinson et al (1994) on high initial costs and Fuentelsaz et al (2002) on geography.

[33]More recent work by Han et al (2001) has underscored the effectiveness of entry barriers, although there is substantial variation depending on the particular barrier. Consistent with earlier research by Will Mitchell, they find that incumbent firms can deter competitive entry most effectively through the use of proprietary assets and production cost advantages; see also Mitchell (1989). Schoenecker and Cooper (1998) find that sectors with more first entry advantages tend to be developed earlier. This occurs partly from widespread recognition of potential profits, encouraging a race for first entry. They also report earlier entry for larger firms, those with active marketing, and those with greater access to technology. There appears to be no timing advantage in having greater financial resources or diversity of operations. Incumbent firms are also more likely to expand into a new, related sector if they perceive potential competition, and not to diversify (for fear of cannibalizing existing sales) absent that threat. One significant limitation to this study, however, is the exclusion of startup firms that are established for a new sector since the authors wanted to compare existing features of potential entrants.

[34]Bryman (1997).

[35]Shamsie et al (2004).

[36]Gromb and Scharfstein (2002).

high and the pool of human capital is large, skilled labor do not need the safety net provided by working in an existing firm. However, if the entrepreneurial labor market is weak, then the high cost of a failed venture may deter startup activity.[37]

The decision to invest in a risky venture (for both entrepreneurs and established firms) also depends on the industry itself. Using U.S. manufacturing startup data from 1976 to 1986, David Audretsch provides evidence that entrepreneurs are more likely to start a company in industries that have greater knowledge asymmetries or exploit new technologies.[38] This is because entrepreneurs in these new industries are better able to appropriate the value of their innovation than entrepreneurs working within an existing firm.

These theories do not yield clear predictions of whether *zaibatsu* were more likely to be industry pioneers or laggards. Clearly, *zaibatsu* had both the financial means and ownership autonomy to invest in new sectors, and failures in the labor and capital markets enhance the advantages inherent in large, established companies. To clarify the extent that differences between *zaibatsu* and independent firms mattered for economic development, I propose a model and some tests of the hypothesis that *zaibatsu* were more likely to lead entry into innovative industries.

3 Theoretical Model

A number of models from the industrial organization literature analyze the determinants of entry. Timothy Bresnahan and Peter Reiss use market size to predict the number of firms that enter an industry.[39] Drawing inferences about production technology (ie, increasing returns to scale) and firm behavior (ie, creation of entry barriers) from market size, their model calculates entry threshold ratios for different industries. Steven Berry has a similar entry model, but allows for firm heterogeneity and uses computer simulation for his estimates.[40] Both investigations apply a two-stage game-theoretic framework and are discrete-choice models, with firms making the choice to enter or not.

Because they focus on the number of firms in an industry in equilibrium, compare industry incumbents with newcomers, or require a firm's existence prior to entry, these models are largely incompatible with the needs of this paper.

[37] Similar reasoning applies to the redeployment of financial capital; see Gertner et al (1994).
[38] Audretsch (1994).
[39] The original model is in Bresnahan and Reiss (1987), which the authors elaborate on in later papers on monopoly (1990) and concentrated (1991) markets.
[40] Berry (1992).

Given the scarcity of data, the question of first entry (as opposed to an industry's equilibrium number of firms), and the startup status of most firms in my sample, the typical entry model is inadequate for explaining basic questions about initial industry establishment.

3.1 Basic Structure

I propose instead a one-stage, simultaneous entry model with complete information and provision for firm and industry differences. This model borrows some features from the model of technology adoption by Drew Fudenberg and Jean Tirole.[41] For simplicity, I assume there are two investors with access to identical production technologies and cost structures, although the number of investors can be generalized without difficulty. I also assume that there are two industries available, whose expected payoffs are known prior to entry. Consistent with a discrete-choice model, both investors can choose to enter (via setting up a firm) one of the two industries.

One investor represents a conglomerate with operations in other industries, while the other investor is an independent entrepreneur without existing business interests. This is important in that the affiliated investor has the financial support of the conglomerate, which provides access to internal funds.[42] The independent investor, however, must seek funding from external sources in order to establish her firm, which may entail higher borrowing costs compared to that of the affiliated investor. These borrowing costs appear in their firms' respective profit functions as interest rates on capital, with the affiliated investor enjoying a lower interest rate. Thus, for the same level of investment in an industry, the independent entrepreneur has to produce more to get the same return as the affiliated investor, or equivalently, earn a lower rate of return with the same level of output.

To produce at minimum efficient scale, a firm must have sufficient market share; thus, in this two-agent model, profitable entry requires market monopolization while failure occurs when the two investors enter the same industry and split market demand and/or compete on price. In a single period game, industry monopoly corresponds to first entry with all its attendant advantages (eg, setting industry standards, cost reduction from learning). These two features, immature

[41] Fudenberg and Tirole (1985).

[42] Alternatively, an investor representing a conglomerate may also seek external funding, but have lower borrowing costs due to the size and reputation of the conglomerate.

markets and different borrowing costs, mean that the independent entrepreneur earns fewer profits from success (ie, single entry) as well as incurring heavier losses from failure (ie, shared entry) regardless of which industry she enters.[43]

Compared to the "safe" industry, the "risky" industry has higher initial fixed costs as well as higher profits (greater losses) with a successful (failed) venture. In either the "safer" or "riskier" industry, if both investors enter simultaneously and split the market, the independent entrepreneur receives greater losses due to higher borrowing costs/funding constraints (eg, less favorable repayment terms, loss of collateral). Success is also less rewarding to the independent entrepreneur for similar reasons (eg, higher interest payments, smaller scale from less capital).

The payoff matrix in normal form is:

		$Independent(I)$		
		$NoEntry(0)$	$Old(1)$	$New(2)$
$Affiliated(A)$	$NoEntry(0)$	$\pi^A_{0,0}, \pi^I_{0,0}$	$\pi^A_{0,1}, \pi^I_{1,0}$	$\pi^A_{0,2}, \pi^I_{2,0}$
	$Old(1)$	$\pi^A_{1,0}, \pi^I_{0,1}$	$\pi^A_{1,1}, \pi^I_{1,1}$	$\pi^A_{1,2}, \pi^I_{2,1}$
	$New(2)$	$\pi^A_{2,0}, \pi^I_{0,2}$	$\pi^A_{2,1}, \pi^I_{1,2}$	$\pi^A_{2,2}, \pi^I_{2,2}$

where $\pi^m_{i,j}$ represents a profit function of the form

$$\pi^m_{i,j} = p_i \cdot (q^m_i, q^n_i) \cdot q^m_i - c^i \cdot (q^m_i) - (1 + r^m_i) \cdot k_i, \qquad \text{for } m, n = \{A, I \mid m \neq n\}, \; i, j = \{0, 1, 2 \mid i \neq j\}.$$

Assume that:

a) $\pi^m_{0,0} = \pi^n_{0,0} = \pi^n_{0,1} = \pi^n_{0,2} = 0$ for $m, n = \{A, I \mid m \neq n\}$

b) $\pi^m_{2,0} = \pi^m_{2,1} > \pi^m_{1,0} = \pi^m_{1,2} > 0 > \pi^m_{1,1} > \pi^m_{2,2}$ for $m = \{A, I\}$

c) $\pi^A_{2,0} > \pi^I_{2,0} > \pi^A_{1,0} > \pi^I_{1,0} > 0 > \pi^A_{1,1} > \pi^I_{1,1} > \pi^A_{2,2} > \pi^I_{2,2}$

d) $r^I_i > r^A_i \geq 0$ for $i, j = \{0, 1, 2 \mid i \neq j\}$

e) $k_2 > k_1 \geq 0$ for $i, j = \{0, 1, 2 \mid i \neq j\}$

[43] Another interpretation of heavier losses for the independent investor is her inability to offset losses from the new venture with profits from pre-existing enterprises, which the affiliated investor can with those from his conglomerate.

These relationships follow from the earlier mentioned differences between the two investors and industries. They have the following interpretations: a) no entry into any industry results in a zero payoff for the investor regardless of the action of the other investor; b) payoffs in each industry are positive (negative) and equal for either firm if it leads (shares) entry into a given industry, and are strictly higher for being the only entrant in the "risky" industry than in the "safe" industry; c) the affiliated investor receives higher profits (smaller losses) from single (shared) entry compared to the independent entrepreneur; d) the independent entrepreneur investor has a higher interest rate for borrowing capital than the affiliated investor; and e) fixed costs for the "risky" industry are higher than the "safe" industry.

3.2 Equilibria

It is readily seen that there exist two pure strategy Nash equilibria, when both investors enter different industries, and a mixed strategy equilibrium when the two investors randomize entry between the two different industries. The pure strategy equilibria $\{(\pi^A_{1,2}, \pi^I_{2,1}), (\pi^A_{2,1}, \pi^I_{1,2})\}$ arise because the best response for either investor to a potential rival's entrance into an industry is to enter the other industry. This is true regardless of the relative profitability of one's industry compared to his rival's. To not enter any industry is to forgo a positive payoff, while entering the same industry as one's rival would lead to a negative payoff.

The mixed strategy equilibrium can be derived by calculating the probabilities of entry in either industry by a rival investor. Let $\{a, b\}$ be the respective probabilities that an affiliated investor and his independent counterpart will enter the "safe" industry. Then the affiliated investor's expected total payoff across industries is:

$$\Pi^A = a \cdot b \cdot \pi^A_{1,1} + a \cdot (1-b) \cdot \pi^A_{1,2} + (1-a) \cdot b \cdot \pi^A_{2,1} + (1-a) \cdot (1-b) \cdot \pi^A_{2,2}.$$

For the affiliated investor to be indifferent between choosing either the "safe" or the "risky" industry, the relative payoffs between the two choices must be:

$$\begin{aligned} b \cdot \pi^A_{1,1} + (1-b) \cdot \pi^A_{1,2} &= b \cdot \pi^A_{2,1} + (1-b) \cdot \pi^A_{2,2}, \text{ or} \\ b &= \frac{\pi^A_{2,2} - \pi^A_{1,2}}{\pi^A_{1,1} + \pi^A_{2,2} - \pi^A_{1,2} - \pi^A_{2,1}} \text{ and} \\ (1-b) &= \frac{\pi^A_{1,1} - \pi^A_{2,1}}{\pi^A_{1,1} + \pi^A_{2,2} - \pi^A_{1,2} - \pi^A_{2,1}}. \end{aligned}$$

Similarly, probabilities of entry $(a, 1-a)$ for the affiliated investor must exist for the independent firm to be indifferent between the two industry types.

The total expected payoff for the affiliated investor is increasing in a if:

$$b < \frac{\pi^A_{2,2} - \pi^A_{1,2}}{\pi^A_{1,1} + \pi^A_{2,2} - \pi^A_{1,2} - \pi^A_{2,1}}$$

and vice versa.[44] That is, the optimal response for the affiliated investor is to set $a = 1$ (ie, enter the "safe" industry) when the above inequality holds, and to set $a = 0$ (ie, enter the "risky" industry) when the inequality is reversed. When the above expression is an equality, then $a \in [0, 1]$ is an optimal response.

The main result from this model is that investors have asymmetric entry preferences due to differences in access to funding. Substituting in the profit functions shows that an increase in r leads to an increase of the right-hand side of the above inequality, which allows for a larger b, ceteris paribus. This effect increases when the difference between the fixed costs k_i for the "risky" and the "safe" industries is greater. In other words, a higher cost of borrowing increases the likelihood that the independent entrepreneur will choose to enter the "safe" industry with lower fixed costs. Because single entry is more rewarding and shared entry is less costly to the affiliated investor, his expected total payoff is higher than the independent entrepreneur's when both randomize with the same probabilities. In this mixed strategy equilibrium, this translates to a greater likelihood for the affiliated firm to enter the "risky" industry relative to the independent firm (ie, $a < b$). In the context of this paper, the model predicts that a *zaibatsu* firm is more likely to be a first entrant in a new industry relative to an independent firm.

4 Research Design

Having provided a theoretical model to characterize the relative likelihood of first entry for *zaibatsu* and independent firms, I now describe the data used to test the hypothesis that *zaibatsu*-affiliated firms are more likely to lead entry into new industries.

[44] This expression is true only if the expected value of entry across industries is greater than or equal to zero; if less than zero, then the investor does not enter and his rival will choose the risky industry with certainty. See Appendix B for the derivation of the equilibrium condition.

4.1 Data

The primary source used in this paper is the *Shuyo Kigyo no Keifuzu*, a compilation of corporate genealogies edited by the business historians Shintaro Yagura and Yoshiro Ikushima.[45] The *Shuyo* compilation includes genealogies for 1,089 firms, the majority of which were listed on the Tokyo Stock Exchange as of September 1984, and includes some 14,000 firms dating back to the early nineteenth century or prior. The genealogies provide company name, ownership type, entry date, location of establishment, and annotation of industrial activity, all of which they collected from company histories.[46]

The industry codes come from the *Standard Industrial Classification for Japan* (JSIC), 1984 edition, published by the Statistics Bureau of Japan.[47] The coding system is analogous to the North American Industrial Classification System (NAICS) used to identify industries.[48] I assigned codes on the basis of the firms' description in the corporate genealogies. Typically, company names in Japan comprise three parts: personal/geographic name + industrial activity + industrial operation/facility (eg, Ishitsuka + Bottle Manufacturing + Factory), with the most common company names using a combination of the first two identifiers.[49] The 1986 version of the JSIC system has three levels of industry classification, two-, three- and four-digit codes in increasing order of specificity; eg, JSIC 05: Mining, JSIC 052: Non-ferrous Metallic Ore Mining, JSIC 0521: Copper Ores.

Secondary sources include the manufacturing productivity database from the National Bureau of Economic Research (NBER); firm financial reports from the

[45] Yagura and Ikushima (1986).

[46] Besides tracking changes to a given firm's name or company type, the genealogies also show asset investment/divestment, franchising, and closure; this information, however, is not included in the current dataset since the hypothesis to be tested concerns only firm entry in the years between 1868 and 1912.

[47] The classification of Japanese industrial sectors did not begin until 1930 and has been revised a number of times since. To address this issue, I retroactively apply industrial codes from the 1984 edition, which coincides with the publication date for the corporate genealogies. My rationale for retroactive classification include: a lack of a system in the Meiji Period means retroactively applied codes do not alter the historical record; industrial sector distinctions that were made in later years do not preclude the existence of those distinctions during the Meiji Period; codes for industries that did not exist in the Meiji Period do not have to be used; industries that existed in the past that do not appear in the 1984 system can be additively included without needing to change existing codes.

[48] U.S. Census (2006). The NAICS recently replaced the United States Standard Industrial Classification (SIC) system to facilitate standardization among the three countries in the North American Free Trade Area, ie, the U.S., Canada, and Mexico.

[49] Yagura and Ikushima (1986). The move toward abbreviation, multiple personal names, and deletion of industrial activity has largely occurred in the post-WWII period.

Eigyo Hokokusho Shusei collection; and various Japanese industry indices and firm case studies. The NBER database provides four-digit industry-level input costs such as labor expenditures and capital outlays, which I use to calculate factor intensity ratios for industries.[50] While the NBER dataset uses cost figures from post-war American manufacturing industries, it is the only database that provides factor cost breakdowns with the necessary level of industry specificity; this seems preferable to arbitrary designation of factor intensity. Moreover, these figures are used in one set of specifications and are not crucial to the main findings of this paper. The *Eigyo* financial reports give typical balance sheet data for a publicly listed firm, including capitalization value, revenues, profits, assets, and liabilities.[51] However, given the scarcity of reports from the Meiji Period, most of the firms in the collection postdate those in the current dataset.

4.2 Methodology

The premise of this paper is that firms affiliated with *zaibatsu* and firms established independently differ in fundamental ways, with implications for the development of industries and the introduction of technology. Differences include access to natural resources (eg, coal, iron); managerial autonomy; the ability to finance investments internally; risk-sharing from diversification; the employment of highly skilled labor; and relationships with the central government. These characteristics are assumed to influence if and when firms enter and help to establish new sectors. Other characteristics such as regulatory environment and market demand are taken as common to both types of firms.[52]

I use a discrete-choice probit regression model to estimate relative likelihoods of entry. Under the hypothesis that *zaibatsu*-affiliated firms are more likely to be first entrants in new industries, I use the entry outcome (first entry or not) as my dichotomous dependent variable (FIRST). I include the following independent variables to determine the relative influence each plays in the choice to be a first entrant: conglomerate affiliation (ZAIB), firm ownership type (PRIV), the

[50] Bartelsman et al (2000). The NBER database provides data between the years 1958 and 1996. For the current dataset, I use the earliest available figures (year 1958).

[51] Yushodo (1966).

[52] Nevertheless, considering the lack of specific firm data like revenues and market share from this period, estimation of this reduced set of variables is problematic. Fortunately, the theoretical model as formulated above needs only a firm's affiliation and an indication of an industry's relative risk to predict likelihood of first entry. Other variables help to clarify what features are not captured by conglomerate affiliation and contribute to the explanatory power, but by themselves are not essential to the model.

number of industries a firm is operating in at the time of entry (DIV), industry innovativeness (INNOV), the type of industry the firm is entering (PRIM, MFG, UTIL, FINAN, SERV), the ratio of labor expenditures to capital outlays (L/K), and the urbanization of the prefecture that the firm is establishing in (URBAN).

The key independent variable is firm affiliation (ZAIB), which takes the values of zero for independent establishment (ie, startup) or one for membership in a *zaibatsu*. I include affiliates of all the major *zaibatsu* established in the first half of the Meiji Period or earlier: Mitsui, Mitsubishi, Sumitomo, Yasuda, Furukawa, and Okura.[53] This variable captures unobserved differences between a *zaibatsu* firm and an independent one, such as lower capital costs, internal financing, information spillovers, etc. Under different specifications of the regression model (ie, the inclusion of different independent and control variables), I can compare observable characteristics of conglomerate membership (eg, ownership, diversification) to unobservable ones (eg, internal financing, network externalities) and determine their contributions to first entry. I hypothesize that *zaibatsu* affiliation has a significant positive correlation with first entry.

The variable for firm ownership type (PRIV) takes the value of zero for publicly listed joint-stock firms or one for privately held firms.[54] Given that private ownership was one of the defining characteristics of the *zaibatsu*, this variable may indicate the importance of investment autonomy and external monitoring.[55] An immature financial system may favor private firms, which can finance investments using internal funds and retained profits. Anecdotal evidence suggests that equity-financed firms were constrained by their need to pay dividends, resulting in firms that remained small and undercapitalized.[56] Furthermore, private ownership may allow a firm to make longer-term investments since financing was neither subject to business cycle volatility nor reliant on investors unwilling to tolerate

[53] Cumulatively, there are 58 *zaibatsu* affiliates in the dataset.

[54] There may be some confusion as to terminology: "privately held" means firm equity that is not available to the public as shares (ie, unlisted), and differs from "private sector" firms, which are those not owned by the government. In this paper, "private" refers to the former definition. While the analysis distinguishes only two types of ownership, there are a number of variations: private ownership includes individual proprietorship or partnership (unlimited and limited liability) as well as mutual associations, and public firms came in both limited and unlimited liability flavors (Yagura and Ikushima 1986).

[55] While there may be some overlap between private ownership and conglomerate affiliation (since conglomerates were largely private), the two variables are different in that there were a number of non-zaibatsu investors who owned private firms while some *zaibatsu* held equity in publicly listed firms.

[56] Morikawa (1992); Teranishi (1999). Many publicly listed firms were run for short-term profit and were incorporated for a predetermined time period, between three to ten years (Fruin 1992).

long gestations until the enterprise makes a profit.

The issue of corporate monitoring, prominent in discussions of post-war Japanese conglomerates, was important in the pre-war era as well. Prior to the adoption of the 1893 Commercial Code, which standardized incorporation procedures and defined fiduciary responsibilities, insecurity about financial system stability and regulatory oversight may have impeded the public listing of firms (and thus created a market failure for investment).[57] This is because while incorporation occurred as early as 1868, the lack of institutions governing business practice or protection of property rights remained until the 1890s.[58] Together these observations suggest a positive correlation between private ownership and first entry.

The variable for industry diversification (DIV) is the number of industries in which a firm is operating in at the time it establishes an enterprise in a new sector. By definition, a conglomerate is a firm that operates in multiple industries. In the dataset, there are also independent firms that operate in multiple industries, but this occurs usually at the time of entry (ie, simultaneous entry into two related industries). Arguably, diversifying across industries reduces volatility in revenues and spreads industry-specific risk across all industry holdings. On the other hand, having many different industry holdings increases administrative complexity and the potential for inter-divisional conflicts in management and strategy.[59] Nevertheless, it is reasonable to expect that a diversified firm is more likely to invest in a risky industry relative to an independent firm, which is supported by the prediction from the theoretic model.

Industry innovativeness (INNOV) indicates the relative innovativeness of an industry relative to pre-existing technology in the market. The variable takes a value of one for an industry that is the first to be established out of its broader industry grouping, and zero for industries that are not. An example of this is the three-digit industry grouping "251: Glass Manufacturing," which includes specific industries at the four-digit level like "2511: Plate Glass," "2514: Glass Container," and "2515: Scientific Glassware." If there were no glass manufacturing industries prior to 1871, when the Ishitsuka Glass Container Company was founded, then the four-digit industry "2514" would be coded as innovative, and the other four-digit glass industries would be coded as not. The rationale for

[57] Loenholm (1906). There is an interesting literature on the effect of owner-managed firms on performance; see Denis et al (1999).

[58] Rosovsky (1961).

[59] There were many disputes within the Mitsui *zaibatsu* between the directors of the trading company and the bank over investment strategy in the late 1800s; see Morikawa (1992).

this coding is that technologies with precedents in the market are less likely to be rejected by the public (since the first technology of its kind was already introduced and thus familiar) or are more transparent in their operational difficulty and expense, thus representing a lower investment risk.

I control for industry-level differences with dummy variables for five general industry categories: primary/construction (PRIM), manufacturing (MFG), utilities (UTIL), financial services (FIN), and retail/transport services (SERV).[60] I cluster the standard errors in regressions using the four-digit JSIC industry codes. This is to account for random industry-specific shocks that are shared within narrower industry groupings (eg, drought for agricultural industries).

The factor intensity of a manufacturing industry (L/K) is included to gauge the effect it had on firm entry, and comes from the NBER collection of industry productivity as described earlier. This variable is the ratio of total annual employment wages for an industry to total annual expenditures on capital maintenance and energy minus new investments. Ratios approaching zero are relatively capital intensive, while values greater than or equal to one signify labor-intensive manufacturing. I also include a dummy variable for urban areas (URBAN), which is based on the population density of a Japanese prefecture (ie, county) for the year a firm was established.[61] This variable is used to control for market demand and access to infrastructure and institutions, which are greater in areas of higher population density.[62]

To identify shared influences, I interact *zaibatsu* affiliation and private ownership with each other and with industry innovativeness, industry type, factor intensity, and population density. *Zaibatsu* affiliation and private ownership, although generally identified with each other, are not identical. A number of *zaibatsu* held substantial shares in some publicly listed firms, such as Sanyo Railway and Japan Postal Shipping Company, but did not exercise control, and other privately owned firms were not affiliated with *zaibatsu*. The interaction between the two variables may show differences in the behavior of *zaibatsu*-controlled firms versus those that simply had a *zaibatsu* connection (and possibly access to *zaibatsu* capital). I anticipate a positive correlation between privately owned *zaibatsu* firms and

[60] Separating industries by type is important due to differences in capital requirements, scale, and other characteristics shared within industry families but not across all industries.

[61] Urban areas are defined as those with a population density of at least 400 people per square kilometer (ie, the equivalent of 1000 people per square mile); see U.S. Census (2005).

[62] Since both factor ratios and population density are not available for all the firms in the dataset, the increased specificity comes at the cost of some predictive power.

first entry into new industries, consistent with earlier mentioned benefits of both conglomerate membership (eg, risk-sharing, credit access) and private ownership (investment autonomy, long-term planning).

Given high capital requirements for primary industries like mining and construction as well as for heavy manufacturing and utilities, it is reasonable to expect a positive association of conglomerate affiliation with first entry into these industry groups. Similar reasoning applies to *zaibatsu* affiliation and a low factor intensity ratio (ie, capital-intensive). Conversely, it is unlikely that non-*zaibatsu* private investors could afford the costs of capital and technology for heavy industries, much less take the lead in entering them. Finally, I interact population density with conglomerate affiliation to test whether *zaibatsu*, with their distribution channels and scale, would have needed the market proximity, infrastructure, and wealth concentration of densely populated areas. Private firms may prefer urban areas to lead industry entry for the same reasons.

I remove government firms from the sample on the grounds that the behavior of such firms is not obviously driven by market factors. I also remove all industries in which the government had been the first mover during the early part of the Meiji or prior. This is to minimize distortions from possible favoritism the government may have shown to well-connected companies (including many *zaibatsu*) in the period of privatization in the first two decades of the Meiji Period. Additionally, I include only industries that were established in the Meiji Period since pre-Meiji industries are less likely to use technology borrowed from abroad.[63]

5 Results

5.1 A First Look at the Data

In the period from 1868 to 1912, 1,881 entrants could be identified by a four-digit JSIC code.[64] After imposing the restrictions mentioned above, the dataset has 1,645 entrants, of which 1,593 were independent firms and 52 were affiliated with *zaibatsu*. The sample covers 144 industries at the four-digit industry level, of which 30 are *zaibatsu*-affiliated. Additional summary statistics are in Table 2.[65]

[63] A further exclusion involves duplicate appearances in the dataset due to changes in name or ownership. Unless the industry in which the firm was operating in changed as well, only the first appearance is included in the analysis.

[64] Entrants include both individual firms as well as industry divisions within multi-industry companies (eg, conglomerates).

[65] While the relative numbers of *zaibatsu* to independent firms suggest an imbalance in the sample, the absolute number of firms belies substantial organizational and productive differences.

There are some interesting differences between *zaibatsu* and independent firms. *Zaibatsu* are three times more likely to be established in innovative new industries by percentage representation, which is expected from wealthy family-owned conglomerates with investment autonomy.[66] Among broad industry groups, *zaibatsu* are proportionately more likely to be in primary, manufacturing, and retail/transport industries, while independent firms favor entry in the financial service sector. This contrast can be explained by operational scale, with heavy industries like mining and metals processing requiring significant initial investment, and trade and rail services needing large organizations to handle complex logistics. This may also explain why *zaibatsu* members are more often located in urban areas than independent firms, with proximity to greater demand lowering average production costs. Nevertheless, this urban preference does not extend to the proportion of first entries in industries, of which independent and *zaibatsu* firms is similar.

5.2 Correlations

Results from pairwise correlation analysis in Table 3 are consistent with the summary statistics. As hypothesized, first entry is positively correlated with *zaibatsu* affiliation, private ownership, industry diversification, manufacturing, and urban areas. It is negatively correlated with financial services.

Zaibatsu affiliation has strong positive correlations with first entry, private ownership, industry innovativeness, industry diversification, and the primary/ construction and retail/transport industries, and is negatively correlated with financial services.[67] These results correspond with the historical development of *zaibatsu*, with two having substantial mining interests (Sumitomo, Furukawa) and two in shipping and trade (Mitsui, Mitsubishi). The negative relationship with financial services buttresses the earlier claim that *zaibatsu* had access to internal financing and lower borrowing costs. This suggests that these conglomerates did not need to establish financial service firms to acquire cheap capital for investment during the Meiji Period.

Nevertheless, to avoid possible over-representation bias, I perform separate regressions on a subset of industries contested by both *zaibatsu* and independent firms. The results are reported in the section on robustness checks.

[66] Note, however, that the difference is much less when comparing the percentages of *zaibatsu* (70 percent) and independent (68 percent) first entrants in innovative industries out of all their respective first entries.

[67] By construction of the firm affiliation variable, independent firms have correlations with opposite signs at the same level of statistical significance.

Private ownership is positively correlated with industry innovativeness, manufacturing, and urbanization, while being negatively correlated with financial services. An explanation may be the over-representation of *zaibatsu* among privately owned firms (which will be explored further when the two variables are interacted together in regression analysis). Industry innovativeness is positively correlated with industry diversification, which is consistent with the premise that diversified firms are more likely to make risky investments. It is also positively correlated with most industry types and urbanization, which is reasonable over a period of technology introduction and economic growth.

5.3 Regression Results

The results from the probit regressions in Table 4 confirm the model's prediction that *zaibatsu* affiliation increases the likelihood of first entry into a new industry.[68] This is indicated by the positive coefficient on *zaibatsu* affiliation in Column 1. Including control variables at the firm level (Column 2) and industry level (Columns 3 and 4) reinforces this positive relationship between *zaibatsu* and the probability of first entry. In addition, private ownership and industry diversification also increase the likelihood of first entry, confirming earlier correlation analysis.[69]

Industries are more likely to be started in urban areas, as shown by the positive coefficient on the urban variable in Column 5. This is consistent with new firms preferring to be located in densely populated areas that afford greater access to funds and the consumer market. Factor intensity (Column 6) also appears to affect the probability of first entry, with *zaibatsu* more likely to lead entry into capital-intensive industries. This is evident from the negative coefficient on the interaction between *zaibatsu* affiliation and the labor-capital ratio, where increasing values of the latter means greater labor usage relative to capital and vice versa. This result corroborates the notion that *zaibatsu* supported early industrialization by focusing on industries with high fixed costs that independent investors were averse or unable to finance.

One major qualification to *zaibatsu* leadership in establishing new industries

[68] An alternative to the probit model, which uses a standard normal distribution to estimate probabilities, is the logit model, which uses a logistic distribution. The results from logit regressions are qualitatively similar to those of the reported probit results, which suggests that results are robust across functional specifications.

[69] One should note that the effect of diversification in some specifications may not be identified as it is indistinguishable from its interaction with *zaibatsu* affiliation. This is indicated by the similar valued but opposite-signed coefficients for the two respective variables, which cancel each other out.

is the coefficient on the interaction between *zaibatsu* affiliation and industry innovativeness, which is significant and negative. This suggests that *zaibatsu* lagged behind independent firms in establishing industries that used truly new technology. One interpretation of this result is that *zaibatsu* were more likely to pioneer new industries only when they use technology that has already demonstrated market viability.[70] This result is not as contradictory as it may appear, as there were relatively few capital-intensive industries in this period (ie, sectors better able to exploit advantages of *zaibatsu* affiliation). Similarly, *zaibatsu* preferred to enter industries with scale economies or monopolistic production, which are numerically few and decreasing over time. Other explanations include increased reluctance to make risky investments as the first generation of *zaibatsu* owners pass on their wealth but not their entrepreneurial drive; or administrative complexity outweighing the benefits from further diversification.[71]

All these effects, however, are less influential than *zaibatsu* affiliation, indicated by the probabilities of each variable's effect given in Table 5.[72] *Zaibatsu* affiliation increases the probability of entry between 24 and 68 percent depending on the specification.[73] When interacted with industry innovativeness, the likelihood of first entry falls on average by 6 percent.[74] Private ownership increases the probability of first entry on average by 14 percent, while being diversified increases the probability by 5 percent.

Overall, these results suggest that in the early stage of Japanese industrialization, conglomerate membership offered a substantial advantage in pioneering new sectors, even apart from that associated with private ownership. This advantage, however, may be specific to capital-intensive or large scale industries, ie, sectors that can fully exploit the benefits of *zaibatsu* affiliation. Furthermore, *zaibatsu* leadership may be short-lived as opportunities to innovate decrease over time and become less attractive from an organizational perspective.

[70] The discrepancy with the summary statistics can be explained by comparing the number of first entries (instead of all entries) in innovative new industries between *zaibatsu* and independent firms.

[71] While not discussed in this paper, government policies to subsidize particular industries may have induced preferential entry into certain types of industries.

[72] These are typically calculated from marginal changes in the explanatory variable, but for dummy variables, probabilities are calculated from discrete changes in the variable (ie, zero to one).

[73] Reported percentages are taken only from statistically significant coefficients.

[74] Combined with the coefficient on *zaibatsu*, the net effect is still positive.

6 Robustness

6.1 Specification

I perform joint tests of significance to check whether the coefficients on the independent variables are significantly different from zero. All specifications pass at the 1 percent level of significance. I also test for functional form and omitted variable bias with a specification link test. This test takes the fitted values of the residual from the original regression and squares them, then reinserts them into the model as an additional variable. The modified model is regressed to check for significance in the new variable. The null is that the model has no omitted variables, and if correctly specified, the squares of the residuals should not be significant (since they would not show a pattern that could be explained with additional control variables). A significance level above 5 percent is generally interpreted as failure to reject the hypothesis (ie, model is not incorrectly specified). Aside from specifications 1 and 3, all other specifications are above this threshold, which means that the null hypothesis of no omitted variables cannot be rejected. Finally, I control for data heteroskedasticity by estimating and reporting Eicker-White standard errors. As mentioned earlier, I cluster the standard errors of all the specifications by four-digit industry codes to allow for correlation in errors within industries.

6.2 Restricted Datasets

I restrict the dataset two ways, first by including only industries that were contested by both *zaibatsu* and independent firms, and second by running separate regressions for firm entry before and after the year 1893, when joint-stock firms became legal commercial entities.[75] Both sets of results are shown in Table 6.

By limiting analysis to industries in which both independent firms and *zaibatsu* enter, I can check whether earlier results are due to different industry preferences (eg, *zaibatsu* preferring monopolies or large-scale industries), possible entry deterrence, and the inclusion of monopolies. There are some differences in significant coefficients between the full and restricted datasets. Using shared entry with the

[75] Notwithstanding the many joint-stock companies that existed before the 1890s, prior to the implementation of this code they had no legal basis. A legal commercial code based on German practices was officially adopted in 1891, although only implemented in July 1893. The code established three types of commercial entities, unlimited partnerships, limited partnerships, and joint-stock companies. This paper makes a distinction between private firms (partnerships) and public firms (joint-stock).

specification from Column 4 in Table 5, I find that there is a significant positive correlation between diversified *zaibatsu* and first entry. This differs from the earlier result where affiliation on its own has a positive effect while diversification itself has no effect on first entry. Also, the interaction between affiliation and industry innovativeness is dropped from the regression due to multi-collinearity with *zaibatsu* affiliation. In any case, these results indicate that a *zaibatsu* effect remains even in industries with both *zaibatsu* and independent firms.

The comparison of results from before and after July 1893 is to check whether behavior changed after the Japanese government implemented a commercial code that gave legal standing to publicly listed firms. With more robust institutions delineating fiduciary responsibilities, firms may find it easier to finance investments externally (eg, equities, loans) and blunt the advantage of internal financing in *zaibatsu*. Also, with a number of *zaibatsu* investing in publicly listed firms or changing their own ownership structure, sample separation may clarify what effect affiliation may have had on entry that is unrelated to ownership. The probit results for the pre-July 1893 sample show a positive correlation between *zaibatsu* affiliation and first entry overall, and a negative correlation between affiliation and first entry into innovative new industries, similar to results from the full dataset. However, the results from the post-1893 sample show that affiliation is no longer significantly correlated with first entry (although the coefficient remains positive). The negative coefficient on the interaction between *zaibatsu* affiliation and first entry into innovative sectors remains and is stronger than before. This foreshadows the technological conservatism of *zaibatsu* found by some studies in the post-Meiji decades.[76] Private ownership continues to positively influence on first entry, suggesting the importance of investment autonomy in financing risky ventures even with stronger institutions for equity finance.

The results from all three restricted samples are also tested for functional form and omitted variable bias, and are above the relevant thresholds for significance. Like the probits for the original sample, standard errors are adjusted for heteroskedasticity and clustered by industry.

6.3 Second Entry

As earlier results have shown, *zaibatsu* appear to lag their independent competitors in leading entry into innovative new industries. This suggests that perhaps

[76] Frankl (1999).

zaibatsu prefer letting independent firms take risks by entering first and wait until the new industry shows market acceptance. That is, *zaibatsu* may show preference for second entry into a new industry compared to independent firms. To test this possibility, I rerun all the earlier probit specifications with second entry as the dichotomous dependent variable; the results are shown in Table 7. Results from some specifications show a significant positive correlation between *zaibatsu* and second entry, but others indicate no significant relationship (or a negative one) even when interacted with other variables. The coefficients on *zaibatsu* are also smaller in magnitude than those from specifications for first entry, underscoring *zaibatsu*'s relative preference for first entry.

6.4 Other Considerations

Small firms may be under-represented in the corporate genealogies, which may bias the results especially if they were early entrants in industries but had failed to survive, grow, or be acquired. While this possibility of small firm censorship may exist, in general, I believe that such objections to the present findings are not persuasive. The corporate genealogies include not only direct ancestors of successful contemporary firms, but also unrelated firms whose assets were purchased or absorbed by direct ancestors. That is, the genealogies include asset activity, such as those transferred when a small, possibly innovative firm disbands or becomes bankrupt. This argument is bolstered by the observation that many new industries of the Meiji Period were manufacturing oriented, which typically requires fixed capital.

Another concern is that while *zaibatsu* may have been more likely to lead entry, their absolute number of first entrants is small, bringing into question their overall impact. This observation assumes erroneously that *zaibatsu* and independent firms were similar, when in reality a single *zaibatsu* affiliate was usually much larger and more productive than an independent firm. As shown in Table 1, many industries that *zaibatsu* pioneered were capital-intensive or large scale, and thus out of reach for most independent investors. These industries were also important for production in other sectors (eg, metal mining for machine manufacture), suggesting an alternative means for *zaibatsu* to lead industrialization.

Finally, there may be reason to worry that firms are misclassified, given that some may have had operations in multiple industries but are for the most part classified in only one.[77] However, the authors of the corporate genealogies note

[77]There are a few exceptions to a single-industry-per-firm identification, excluding the con-

that Japanese companies typically included their industry and function in their corporate name and that the practice of name abbreviation was largely absent in the pre-war era. The authors have also annotated firms with their respective industries if they are not obvious, and listed internal divisions of a single firm, which suggests that multidivisional firms are adequately identified. Other researchers state that most Japanese firms up to WWII were largely single-product companies, and that this specialization contributed to their success.[78]

Additional performance measures at the firm level, such as numbers for capitalization, workers, and revenues, would improve this paper's findings, but lack of documentation prevents their inclusion. That said, given the relatively meager number of firms and industries used in earlier studies for this time period, one of the strengths of the current dataset is its size, reducing small sample bias. Moreover, the object of this paper is to compare corporate behavior via qualitative measures (ie, entry timing, industry establishment), which is adequately addressed by the data.

7 Discussion and Extensions

While the main finding of this paper supports the view that *zaibatsu* assisted the development of industry, it also disputes the notion that they were vanguards of innovation. What accounts for this seemingly important omission in earlier research? One possible explanation is the emphasis on firm characteristics as opposed to industry-level determinants of performance, and the ease in drawing contrasts between specific conglomerates and independent firms.[79] This paper itself leads with stylized facts about the *zaibatsu*'s preponderant size and better access to resources that were deemed critical to pushing forward innovation and expansion. But even these identifying features are misleading. For example, as mentioned in the introduction, *zaibatsu* were less able to attain economies of scope since their holdings were so diverse, this applying especially to the original trading and shipping companies that specialized in services as opposed to manufacturing.

glomerates. For example, Uemo Coach and Rail is classified as both in the Local Railway (JSIC three-digit code 402) and Light Passenger Vehicle Transport (JSIC 414) industries.

[78] Fruin (1992).

[79] The idiosyncrasies of individual *zaibatsu*, with their different diversification strategies and founders' colorful personalities, may also have defied collective comparison. There was swashbuckling Iwasaki Yataro transporting government soldiers on their punitive expedition to Taiwan; financial wunderkind Zenjiro Yasuda transforming a small money-changing shop into a banking empire; mulishly-focused Ichibei Furukawa, the mining magnate who excused the purchase of an unprofitable mine as "throwing away 300,000 yen on [his] hobby" (Morikawa 1992).

Thus, a useful extension to this research would be to compare the role of firm networks and upstream-downstream linkages in the process of Japanese industrialization. The inability of independent firms to internalize transaction costs with suppliers through acquisition because of an immature investment environment motivated them to be efficient. This could be done through coordination with other independent companies to provide goods and services, creating interfirm dependencies and alliances that together reduced any inherent size disadvantages.[80] In a sense, this type of firm coordination would be akin to the strategy behind public-private partnerships in late development theory, writ small instead of at the macro-level.

Research about active industrial policy, economic benefits of authoritarian governments, institutional requisites to development, etc are legion in both earlier and modern work. Less fashionable is a market-centered approach to studying development, applying theories about firm fundamentals and industrial organization to macroeconomic growth. These extremes leave a large middle ground in which to explore Japan's economic history and development, employing tools from strategy management, agency theory, and other firm- and industry-centered schools of thought. One specific extension would involve reassessing the government's creative responsibility in industrialization, since the above analysis has intentionally excluded the public sector. As shown with the results from restricting data analysis to after the 1893 Commercial Code, institutional development substantially influenced firm behavior and the absence of quantitative investigations leaves many political economy issues to be considered.

With the considerable amount of attention paid to Chinese modernization, an understanding of the Japanese precedent is especially valuable. The Meiji Period saw the unbridled proliferation of a free market system and massive transfer of modern technology, both situations in present day China. How the Japanese government successfully freed itself of an antiquated economic system and ill-functioning public enterprises and spread its growing wealth throughout the interior of the country are lessons that can be well learned by any developing country, but more exigently by its lumbering East Asian neighbor. Moreover, while it may seem that discussions of industry pioneering are quaint to a global economy where multinationals leave intercontinental imprints, it is reasonable to expect new industries to emerge ex novo, as information technology continues to mature and applications in genetics, proteomics, and nanotechnology appear.

[80] Morikawa (1992).

8 Conclusion

It has long been accepted that industrialization in late nineteenth century Japan owed much to the leadership of the *zaibatsu*. Using a new dataset of firm establishment dates taken from corporate genealogies, I find evidence that *zaibatsu* are indeed more likely to pioneer new industries, particularly capital-intensive ones. This advantage was likely due to their size and diversified nature, which allow internal financing for investments and a greater appetite for risk. I also find that private ownership increases the probability of first entry, regardless of conglomerate membership. This result is consistent with private firms' greater autonomy in making investment decisions. Nevertheless, even with these characteristics, *zaibatsu* exhibit risk-aversion in that they were less likely to lead entry into innovative (as opposed to imitative) new industries.

These results highlight an important limitation of earlier analyses of Japanese development. Previous studies tend to focus on the development of individual sectors without comparing differences among them (eg, relative risk) or on characteristics of individual firms. I assert that a better understanding of industry formation in emerging markets like early modern Japan requires analysis that synthesizes both industry and firm features; as my results indicate, both matter.

Finally, my findings raise a number of questions about the process by which Japan industrialized, such as why *zaibatsu* were less likely to pioneer innovative industries and when did *zaibatsu* become industrially conservative? With the current dataset, it may be possible to clarify the effects of certain organizational forms and of industry diversification. Results from the robustness section indicate the turning point from pioneer to laggard occurred sometime in the second half of the Meiji Period. Further scrutiny of technological and temporal differences among firms and industries may provide lessons to countries seeking to emulate successful development models.

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Table 1: List of New Industries Started by *Zaibatsu*

Industry Name	JSIC Code	Year	*Zaibatsu*
Coastwise freight transport	4323[a]	1871	Mitsubishi
Agents, brokers	5211[ab]	1873	Ōkura
Ordinary banks	6121	1873	Mitsui
Technical college	9143[ab]	1876	Mitsubishi
Joint-stock fire and marine insurance	6721[a]	1879	Mitsubishi
Water supply	3911[ab]	1880	Mitsubishi
General merchandise, 100+ employees	4911[ab]	1880	Mitsui
Coal mining	611[a]	1881	Mitsubishi
Primary smelting/refining of copper	2711[a]	1881	Furukawa
Lead, zinc mining	522[a]	1887	Mitsui
Construction, mining machinery repair	8213[ab]	1889	Sumitomo
Mutual life insurance companies	6712	1894	Yasuda
Coke	2131[ab]	1898	Mitsubishi
Compound chemical fertilizers	2012[b]	1905	Yasuda
Secondary smelting/refining misc metals	2729[b]	1906	Furukawa
Business consultants	8691[ab]	1906	Ōkura
Aircraft	3151[ab]	1910	Mitsubishi

[a]Innovative Industry (ie, first 4-digit industry established in 3-digit industry group)
[b]Monopoly until at least the end of the Meiji Period

Table 2: Summary Statistics

	All	Independent	*Zaibatsu*
Total Observations	1881	1823	58
New Industries	1645	1593	52
First Entrants	144	127	17
Innovative Industries	499	455	44
First Entrants	98	86	12
Ownership			
Publicly Listed Firms	1483	1445	38
Privately Owned Firms	162	148	14
Industry Groups			
Primary/Construction	83	73	10
First Entrants	15	13	2
Manufacturing	268	255	13
First Entrants	68	63	5
Utilities	43	41	2
First Entrants	5	4	1
Financial Services	1071	1060	11
First Entrants	18	15	3
Retail/Transport	180	164	16
First Entrants	38	32	6
Location			
Rural Areas[a]	483	475	8
First Entrants	42	37	5
Urban Areas	253	235	18
First Entrants	66	59	7
Number of New 4-digit Industries[b]	144	133	30
Number of New Innovative Industries	98	90	25

[a]: The sum of rural and urban industries is less than the full dataset due to some entries lacking geographic indicators.

[b]: The sum of independent and *zaibatsu* industries exceeds the total number of industries because of overlap (ie, industries with shared entry).

Table 3: Correlations

	FIRST	ZAIB	PRIV	INNOV	DIV	PRIM	MFG	UTIL	FIN	SERV	URBAN	L/K
First Entry	1											
Zaibatsu	0.153*	1										
Private	0.201*	0.104*	1									
Innovative	0.254*	0.213*	0.110*	1								
Diversification	0.153*	0.778*	0.058*	0.245*	1							
Primary	0.076*	0.117*	0.054*	0.265*	0.137*	1						
Manufacturing	0.259*	0.043	0.191*	0.457*	0.073*	-0.102*	1					
Utilities	0.017	0.014	-0.029	0.058*	0.034	-0.038	-0.072*	1				
Finance	-0.342*	-0.167*	-0.156*	-0.835*	-0.236*	-0.315*	-0.603*	-0.224*	1			
Retail	0.153*	0.115*	-0.011	0.519*	0.160*	-0.081*	-0.155*	-0.057*	-0.479*	1		
Urban	0.233*	0.140*	0.164*	0.225*	0.108*	0.004	0.274*	0.032	-0.285*	0.029	1	
Labor/Capital	0.138*	0.046	-0.032	0.086	-0.040	-0.273*	0.273*				0.068	1

*: *significant to 5% level*

Table 4: Probit Results

Dependent Variable : First Entry						
	(1)	(2)	(3)	(4)	(5)	(6)
Zaibatsu	0.959***	1.307**	2.242***	2.074***	1.795	1.405**
	(0.345)	(0.513)	(0.478)	(0.502)	(1.190)	(0.634)
Private Ownership		0.895***	0.763***	0.473**	0.628**	0.529
		(0.164)	(0.199)	(0.221)	(0.306)	(0.797)
Diversification		0.374***	0.252***	0.126	0.272*	0.220*
		(0.119)	(0.096)	(0.100)	(0.150)	(0.130)
Innovativeness			0.831**	-0.129	-0.238	-0.844***
			(0.380)	(0.277)	(0.285)	(0.273)
Industry Groups				included	included	
Labor/Capital Ratio						0.725**
						(0.304)
Urban					0.423***	
					(0.156)	
Zaibatsu · Private		-0.180	-0.375	-0.167	1.749*	dropped
		(0.694)	(0.766)	(0.826)	(1.010)	
Zaibatsu · Diversification		-0.362***	-0.230**	-0.120	-0.285*	-0.110
		(0.119)	(0.099)	(0.105)	(0.168)	(0.131)
Zaibatsu · Innovativeness			-1.764***	-1.577***	-0.062	dropped
			(0.430)	(0.408)	(0.682)	
Zaibatsu · L/K Ratio						-2.845**
						(1.114)
Zaibatsu · Urban					-1.066	
					(0.801)	
Observations	1645	1645	1645	1645	736	311
R-squared	0.025	0.090	0.166	0.243	0.225	0.141

Robust Standard Errors in Parentheses

: significant to 10% level* *: significant to 5%* ****: significant to 1%*

Table 5: Probit Probabilities

Dependent Variable : First Entry						
	(1)	(2)	(3)	(4)	(5)	(6)
Zaibatsu	0.247***	0.361**	0.679***	0.582***	0.575	0.511**
	(0.079)	(0.158)	(0.175)	(0.213)	(0.429)	(0.213)
Private Ownership		0.199***	0.142***	0.061**	0.136**	0.167
		(0.065)	(0.066)	(0.038)	(0.083)	(0.276)
Diversification		0.053***	0.030***	0.012	0.045*	0.062*
		(0.015)	(0.013)	(0.010)	(0.024)	(0.037)
Innovativeness			0.129**	-0.012	-0.039	-0.277***
			(0.048)	(0.025)	(0.045)	(0.083)
Industry Groups				included	included	
Labor/Capital Ratio						0.206**
						(0.076)
Urban					0.077***	
					(0.033)	
Zaibatsu · Private		-0.022	-0.033	-0.014	0.567*	dropped
		(0.077)	(0.053)	(0.060)	(0.358)	
Zaibatsu · Diversification		-0.051***	-0.027**	-0.011	-0.047*	-0.031
		(0.015)	(0.013)	(0.010)	(0.026)	(0.037)
Zaibatsu · Innovativeness			-0.065***	-0.048***	-0.010	dropped
			(0.033)	(0.024)	(0.105)	
Zaibatsu · L/K Ratio						-0.810**
						(0.310)
Zaibatsu · Urban					-0.088	
					(0.032)	
Observations	1645	1645	1645	1645	736	311
R-squared	0.025	0.090	0.166	0.243	0.225	0.141

Robust Standard Errors in Parentheses

: significant to 10% level* *: significant to 5%* ****: significant to 1%*

Table 6: Restricted Sample Probit Results

Dependent Variable : First Entry			
	Shared	*< 1893*	*> 1893*
Zaibatsu	-0.721	1.953***	1.341
	(0.794)	(0.299)	(0.886)
Private Ownership	-0.252	-0.223	0.573*
	(0.732)	(0.495)	(0.336)
Diversification	-0.560**	0.017	0.134
	(0.238)	(0.136)	(0.141)
Innovativeness	2.609***	0.201	-0.594*
	(0.375)	(0.434)	(0.343)
Industry Groups	included	included	included
Zaibatsu · Private	2.801	dropped	dropped
	(1.764)		
Zaibatsu · Diversification	0.479**	-0.044	0.074
	(0.243)	(0.148)	(0.165)
Zaibatsu · Innovativeness	dropped	-1.681***	-3.676***
		(0.417)	(0.850)
Observations	1038	500	1145
R-squared	0.441	0.265	0.293

Robust Standard Errors in Parentheses
: significant to 10% level **: significant to 5% *: significant to 1%*

Table 7: Second Entry Probit Results

Dependent Variable : Second Entry						
	(1)	(2)	(3)	(4)	(5)	(6)
Zaibatsu	0.667**	1.364***	0.962**	1.151**	0.598	-0.279
	(0.294)	(0.489)	(0.454)	(0.553)	(0.789)	(0.819)
Private Ownership		0.749***	0.886***	0.701**	1.035**	0.055
		(0.223)	(0.244)	(0.278)	(0.474)	(0.879)
Diversification		0.269**	0.163*	0.118	0.092	-0.002
		(0.107)	(0.094)	(0.098)	(0.187)	(0.124)
Innovativeness			0.645*	-0.067	0.079	-0.557**
			(0.346)	(0.259)	(0.261)	(0.283)
Industry Groups					included	included
Labor/Capital Ratio						0.256
						(0.213)
Urban					0.427***	
					(0.159)	
Zaibatsu · Private		0.232	0.391	0.576	dropped	dropped
		(0.854)	(0.838)	(0.851)		
Zaibatsu · Diversification		0.269**	-0.209**	-0.189*	-0.107	0.039
		(0.107)	(0.101)	(0.110)	(0.206)	(0.137)
Zaibatsu · Innovativeness			dropped	dropped	dropped	dropped
Zaibatsu · L/K Ratio						0.191
						(0.898)
Zaibatsu · Urban					dropped	
Observations	1645	1645	1645	1645	727	311
R-squared	0.013	0.042	0.083	0.136	0.108	0.055

Robust Standard Errors in Parentheses

: significant to 10% level* *: significant to 5%* ****: significant to 1%*

A List of New Industries in Meiji Period

Industry Name	JSIC4 Code	Year	*Zaibatsu*
Electric wire and cable	2751[a]	1868	
Other fabricated wire products	2879[a]	1868	
Fiber materials wholesale, not silk	5012[a]	1868	
Beer	1322[a]	1869	
Foreign exchange banks	6124[a]	1869	
Joint-stock life insurance companies	6711[a]	1869	
Cotton spinning mills	1421[a]	1870	
Glass containers	2514[a]	1871	
Coastwise freight transport	4323[a]	1871	Mitsubishi
Postal services	4711[a]	1872	
Drug stores	5811[ab]	1872	
Credit vouchers	6323	1872	
Water supply installation, draining work	1133[ab]	1873	
Ocean transport	4311[a]	1873	
Agents, brokers	5211[a]	1873	Ōkura
Ordinary banks	6121	1873	Mitsui
Misc gas establishments	3719[ab]	1874	
Generators/motors/rotating electrical machinery	3011[a]	1875	
Technical college	9143[ab]	1876	Mitsubishi
General civil engineering, building works	911[a]	1877	
Rice cleaning	1261[a]	1879	
Wheat flour manufacture	1263	1879	
Other industrial inorganic chemicals	2029[a]	1879	
Credit cooperative associations	6313[a]	1879	
Joint-stock fire and marine insurance	6721[a]	1879	Mitsubishi
Flat glass	2511	1880	
Wooden ship building and repair	3143	1880	
Small watercraft building and repair	3144	1880	
Water supply	3911[ab]	1880	Mitsubishi
General merchandise, 100+ employees	4911[ab]	1880	Mitsui
Underwear wholesale	5133[ab]	1880	
Central banks	6111[a]	1880	
Coal mining	611[a]	1881	Mitsubishi
Primary smelting/refining of copper	2711[a]	1881	Furukawa
Primary smelting/refining of precious metals	2714[b]	1881	

Industry Name	JSIC4 Code	Year	*Zaibatsu*
Air transport, scheduled	4411[ab]	1881	
Forwarding	4621[a]	1881	
Banks for cooperative associations	6314	1881	
Paper and stationary stores	5843[a]	1882	
Watches, glasses, optical goods stores	5871[ab]	1882	
Small business finance corporations	6315	1882	
Securities exchanges	6631[a]	1882	
Medical product preparations	2062[a]	1883	
Misc electricity establishments	3619[a]	1883	
Ordinary warehousing	4511[a]	1883	
Canned seafood, seaweed	1221[ab]	1884	
Manufactured ice	1341	1884	
Hemp spinning mills	1425	1884	
National railways	4011[a]	1884	
Piers and docks	4674[a]	1884	
Unrefined sugar processing	1251[a]	1885	
Cotton, spun rayon fabric weaving	1441[a]	1885	
Soda manufacture	2021	1885	
Fired bricks	2551[a]	1885	
Power stations	3611	1885	
Dairy products	1212[a]	1886	
Paperboard	1822[ab]	1886	
Misc paper products	1849[ab]	1886	
Lead, zinc mining	522[b]	1887	Mitsui
Wool spinning mills	1423	1887	
Lead pencils	3443[a]	1887	
Beverage and seasoning stores	5521[ab]	1887	
Credit associations and related federations	6312	1887	
Crude petrol	711[a]	1888	
Twisting yarns	1431[ab]	1888	
Paints	2054	1888	
Watches, clocks and parts	3271[ab]	1888	
Other musical instruments, parts	3429[a]	1888	
Local railways	4021[a]	1888	
Light vehicle passenger transport	4141[a]	1888	
Misc business services	8599[ab]	1888	
Silk spinning mills	1424	1889	
Fatty acids, hydrogenated oils, glycerin	2051	1889	
Construction and mining machinery repair	8213[ab]	1889	Sumitomo
Soft drinks, carbonated water	1311[a]	1890	

Industry Name	JSIC4 Code	Year	*Zaibatsu*
Transport agencies	4631[ab]	1890	
Paints et al wholesale	5021[a]	1890	
Textile sanitary fabric	1498[ab]	1892	
Machine dyed/finished silk, rayon fabrics	1462[ab]	1893	
Yarn wholesale	5013[b]	1893	
Petroleum wholesale	5032[a]	1893	
Mutual life insurance companies	6712	1894	Yasuda
Canvas products	1593[a]	1895	
Plastics	2037[a]	1895	
Asbestos mining	892[ab]	1896	
Refined sugar processing	1252	1896	
Wool fabric weaving	1443	1896	
Printing ink	2055	1896	
Motor vehicle bodies and trailers	3112	1896	
Development financial institutions	6143	1896	
Agricultural cooperatives	6231[a]	1896	
Synthetic dyes, organic pigments	2036	1897	
Petrol refining	2111[a]	1897	
Steel pipes, tubing	2644[a]	1897	
Wire drawing	2648[b]	1897	
Long term credit banks	6123	1897	
Coke	2131[ab]	1898	Mitsubishi
Steel castings	2663[a]	1899	
Primary smelting/refining of aluminum	2716	1899	
Coal wholesale	5031	1899	
Overseas loans and investment institutions	6142	1899	
Basic petrol chemicals	2031[b]	1900	
Taxicab operators	4112[b]	1900	
Rubber hoses	2332[ab]	1901	
Secondary smelting/refining of aluminum	2723[ab]	1901	
Rolling of aluminum and allows, with drawing	2731[ab]	1901	
Telephone and telegraph	4721[ab]	1901	
Advertising agencies	8441[ab]	1901	
Other industrial organic chemicals	2039	1902	
Bicycles and parts	3131[ab]	1903	
Metallic springs	2892[ab]	1904	
Power and distribution transformers	3012[b]	1904	
Real estate agents and brokers	6921[ab]	1904	
Misc stone, sand, gravel quarrying	819[ab]	1905	
Nitric, phosporitic fertilizers	2011[ab]	1905	

Industry Name	JSIC4 Code	Year	*Zaibatsu*
Compound chemical fertilizers	2012[b]	1905	Yasuda
Nails	2871	1905	
Secondary smelting/refining misc metals	2729[b]	1906	Furukawa
Electric bulbs	3031[a]	1906	
Lumber and bamboo wholesale	5051[a]	1906	
Motion picture theaters	7721[ab]	1906	
Business consultants	8691[ab]	1906	Ōkura
Sulphur mining	831[ab]	1907	
Basic livestock feed	1352[ab]	1907	
Leather tanning, finishing	2411[a]	1907	
Looms, knitting machinery	2952[a]	1907	
Dyeing and finishing machinery	2953[b]	1907	
Refrigerated warehousing	4521[a]	1907	
Fire and marine reinsurance companies	6724	1907	
Hotels	7311[ab]	1907	
Legitimate theaters	7811[ab]	1907	
Veterinary services	8641[ab]	1907	
Rayon, acetate fiber	2041[ab]	1908	
Secondary smelting/refining of lead and alloys	2721[b]	1908	
Trust banks	6122	1908	
Pastries, cakes manufacture	1272[ab]	1910	
Misc fabric weaving	1449[b]	1910	
Compressed, liquefied gases	2024	1910	
Medical material preparations	2061[b]	1910	
Aircraft	3151[ab]	1910	Mitsubishi
Gasworks	3711[ab]	1910	
Misc chemical fertilizer mining	839[b]	1911	
Tableware pottery	2542[ab]	1911	
Pottery ornaments	2543[b]	1911	
Land lessors	7012[ab]	1911	

[a]: Innovative Industry (ie, first 4-digit industry established in 3-digit industry group)

[b]: Monopoly Industry at least until end of Meiji Period

B Derivation of Entry Model Mixed Equilibrium

The affiliated investor's expected total profit across both "safe" and "risky" industries is:

$$\Pi^A = a \cdot b \cdot \pi^A_{1,1} + a \cdot (1-b) \cdot \pi^A_{1,2} + (1-a) \cdot b \cdot \pi^A_{2,1} + (1-a) \cdot (1-b) \cdot \pi^A_{2,2}$$

where $(a, 1-a)$ are his probabilities of entry into those industries, respectively. In addition, there are the following assumptions (with explanations in the text):

a) $\pi^m_{0,0} = \pi^n_{0,0} = \pi^n_{0,1} = \pi^n_{0,2} = 0$ for $m, n = \{A, I \mid m \neq n\}$

b) $\pi^m_{2,0} = \pi^m_{2,1} > \pi^m_{1,0} = \pi^m_{1,2} > 0 > \pi^m_{1,1} > \pi^m_{2,2}$ for $m = \{A, I\}$

c) $\pi^A_{2,0} > \pi^I_{2,0} > \pi^A_{1,0} > \pi^I_{1,0} > 0 > \pi^A_{1,1} > \pi^I_{1,1} > \pi^A_{2,2} > \pi^I_{2,2}$

d) $r^I_i > r^A_i \geq 0$ for $i, j = \{0, 1, 2 \mid i \neq j\}$

e) $k_2 > k_1 \geq 0$ for $i, j = \{0, 1, 2 \mid i \neq j\}$.

To be indifferent between the two industries, the affiliated investor's relative payoffs between both industries must be:

$$b \cdot \pi^A_{1,1} + (1-b) \cdot \pi^A_{1,2} = b \cdot \pi^A_{2,1} + (1-b) \cdot \pi^A_{2,2}.$$

That is, the expected payoff for choosing the "safe" industry must equal the expected payoff for choosing the "risky" industry, conditional on the probabilities of entry for the independent investor. The above equation can be rewritten as the independent investor's relative probabilities:

$$\text{"safe" industry:} \qquad b = \frac{\pi^A_{2,2} - \pi^A_{1,2}}{\pi^A_{1,1} + \pi^A_{2,2} - \pi^A_{1,2} - \pi^A_{2,1}}$$

$$\text{"risky" industry :} \qquad (1-b) = \frac{\pi^A_{1,1} - \pi^A_{2,1}}{\pi^A_{1,1} + \pi^A_{2,2} - \pi^A_{1,2} - \pi^A_{2,1}}.$$

For the affiliated investor to prefer the "safe" industry, the independent investor's probability of entry into the "safe" industry must satisfy:

$$\text{"safe" industry:} \qquad b < \frac{\pi^A_{2,2} - \pi^A_{1,2}}{\pi^A_{1,1} + \pi^A_{2,2} - \pi^A_{1,2} - \pi^A_{2,1}}.$$

It can be shown that both the numerator and denominator are negative, which means the fraction overall is a positive value less than one. If the inequality holds, then the affiliated investor's payoff to enter the "safe" industry is increasing with a (and vice versa if the inequality is reversed). If both investors randomize

entry with equal probabilities by industry (ie, $a = b$), then the affiliated investor earns a higher total expected payoff; equivalently, if both investors have the same expected payoff (eg, zero-profit condition), then the affiliated investor enters the "risky" industry with a greater probability than the independent investor (ie, $a < b$).

If we substitute the profit functions in for the payoff terms, the inequality becomes:

$$b < \frac{[p_2(q_2^A, q_2^I)\cdot q_2^A - c_2(q_2^A) - (1+ r_2^A)\cdot k_2] - [p_1(q_1^A, 0)\cdot q_1^A - c_1(q_1^A) - (1+ r_1^A)\cdot k_1]}{[p_1(q_1^A,q_1^I)\cdot q_1^A - c_1(q_1^A) - (1+r_1^A)\cdot k_1] + \pi_{2,2}^A - \pi_{1,2}^A - [p_2(q_2^A,0)\cdot q_2^A - c_2(q_2^A) - (1+r_2^A)\cdot k_2]}$$

which means the inequality can be rewritten as:

$$b < \frac{[p_2(q_2^A, q_2^I)\cdot q_2^A - c_2(q_2^A) - (1 + r_2^A)\cdot k_2] - [p_1(q_1^A, 0)\cdot q_1^A - c_1(q_1^A) - (1 + r_1^A)\cdot k_1]}{p_1(q_1^A, q_1^I)\cdot q_1^A + p_2(q_2^A, q_2^I)\cdot q_2^A - p_2(q_2^A, 0)\cdot q_2^A - p_1(q_1^A, 0)\cdot q_1^A}.$$

Assuming that the demand for goods is normal, we have the following relationship:

$$p_i(q_i^m, 0) \geq p_i(q_i^m, q_i^n)$$

which means both the numerator and the denominator are each negative and thus the entire fraction is positive, as asserted earlier. The interest rate r appears only in the numerator, and is inversely proportional to the value of the entire fraction (ie, a higher interest rate makes the numerator more negative). Therefore, at a higher interest rate, the affiliated investor's payoff to enter the "safe" industry also increases with a, ceteris paribus.

Notice also that interest rates do not need to differ even with different fixed costs. If there were a uniform interest rate r, then the above expression can be further simplified as:

$$b < \frac{[p_2(q_2^A, q_2^I)\cdot q_2^A - c_2(q_2^A)] - [p_1(q_1^A, 0)\cdot q_1^A - c_1(q_1^A)] + (1 + r)\cdot(k_1 - k_2)}{p_1(q_1^A, q_1^I)\cdot q_1^A + p_2(q_2^A, q_2^I)\cdot q_2^A - p_2(q_2^A, 0)\cdot q_2^A - p_1(q_1^A, 0)\cdot q_1^A}.$$

This inequality indicates that even if borrowing costs do not differ, different fixed investment costs are sufficient to change entry proabilities.