Public- versus Private-led Industrialization in Meiji Japan, 1868-1912

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Current version: February 2011

Abstract

Weak institutions, capital scarcity, and risk aversion may motivate the state to lead industrialization in developing economies. Nevertheless, it is unclear whether public-led industries differ systematically from those led by private investors. Using a new dataset of firm establishment from pre-war Japan, I compare the development of industries pioneered by either the government or entrepreneurs. I find public investment was directed toward capital-intensive industries and in less populated regions, suggesting both capital market failure and market fragmentation. Private-led industries, despite modest capital requirements, had lower rates of entry among startup firms, which may indicate high risk aversion among entrepreneurs.

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Introduction

To the leaders of the Meiji Restoration, a modern Japan meant a centralized government, a strong military, railroads and telegraphs, a credible currency and banking system, and factories producing textiles and machinery. Less obvious were the means to achieve these ends, and over the next five decades, a group of industrialists, financiers, and intellectuals known as the genro\(^2\) embarked on an ambitious modernization program. The relative backwardness of the economy and paucity of private investment during the political transition meant the Meiji government bore the onus of creating a modern state. It purchased western technologies and equipment, employed skilled foreign labor, and founded schools, research institutes, and model factories throughout the country. On the eve of the first world war, Japan had won a colonial empire through military conquest, adopted the gold standard, and flooded world markets with merchandise carried by domestic-built steamships.\(^3\)

In particular, it has been argued that the government's seeding of particular industries like textiles and shipbuilding provided the catalyst for economic growth.\(^4\) Consistent with theories of late development, the turbulent political and economic climate that followed the Meiji Restoration meant that the Japanese state was arguably the sole actor able to amass sufficient capital to acquire foreign technology and invest in long-term industrial projects.\(^5\) Factors like the alignment of managerial and ownership interests and production coordination further highlight the suitability of public leadership in industrial ventures.

Nevertheless, while many attribute the country's economic success to public policies and investments, little research exists to substantiate claims of their efficacy, primarily due to a lack of

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\(^2\) These included Okubo Toshimichi, Saigo Takamori, Kido Takayoshi, Inoue Kaoru, Ito Hirobumi, Yamagata Aritomo, and Fukuzawa Yukichi.

\(^3\) Japan formally annexed the Ryukyu Islands (formerly a protectorate) in 1879. From its victories in the wars with China (1895) and Russia (1905), Japan acquired Taiwan and the southern half of the Sahkalin island, respectively. Japan later annexed Korea, previously a Chinese protectorate, in 1910.

\(^4\) Most scholars and historians agree that until the 1880s, the Japanese government was the most important contributor to industrial development. A financial breakdown from Rosovsky (1961) of public and private sector capital formation in the Meiji Period supports this conclusion; see Table 3.

\(^5\) See Rostow (1990) and Gerschenkron (1962). The breadth of its industrial activities meant that the government could better bear the risk of failed investments, much as zaibatsu conglomerates were thought to have done later in the period; see Tang (2011).
detailed historic data. Some scholarship even suggests a negative influence on industrialization from government involvement, arguing that the privatizations of public enterprises in the 1880s at fire-sale prices were indicative of mismanagement and inefficiency. Other factors that bely the government's beneficent role include its militarization policies, which may have distorted industrial development and ultimately led to economic and political crisis, and the contemporaneous activities of the private sector. In particular, many important industries were pioneered by zaibatsu conglomerates and much of the country's foreign exchange was earned through household production of raw silk.

Uncertainty about the government's leadership role as well as recognition of modest data availability that can provide answers motivate this research. Instead of attempting to generalize the public sector's contribution to economic growth as a whole, this paper presents some specific stylized observations at the industry level, comparing sectors that were either pioneered by the government to those by private entrepreneurs.

In particular, I look at three features: relative factor intensities, rates of entry, and the spatial distribution of firm startup activity during the Meiji Period. These three coincide with some of the goals articulated by the government at the start of the period, and thus provide a simple means to assess the efficacy of public investments in the decades that followed. If weak capital markets failed to provide funding to entrepreneurs, this should be reflected in the type of industries (ie, capital vs labor intensive) that the government and private sector entered. Similarly, besides financial constraints, if there were other barriers to entry like risk aversion or technology adoption that inhibited private investors, then sectors pioneered by the government would probably have greater rates of entry since the initial risks were borne by public enterprises. Finally, if the government placed market integration

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6 Rosovsky (1961) says that "although scholars generally share the view that government influence was widely felt throughout the economy...the opinions are not backed by macro-economic facts--one can believe almost what one chooses, tending toward either one extreme or the other." With regard to timing, Ohkawa and Rosovsky (1973) claim that the first "long swing" of modern industrial development occurred between 1888 and 1897.
7 Hirschmeier and Yui (1975). 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.
8 Tipton (1981).
at a higher priority than profit maximization, this may be revealed through the regions that were targeted for industrial investment (e.g., prefectures with lower population density or lacking coastlines).

To test these hypotheses, I employ cross-sectional and times series econometric techniques as well as non-parametric comparisons. My analysis uses a new dataset of firm establishments collected from corporate genealogies dating back to the nineteenth century.\(^{10}\) Encompassing the entire industrial spectrum, the data include firm entry dates, establishment location, and ownership type.

Intuitively, I find that the government were more likely to lead entry across all types of manufacturing industries, especially lighter ones like textiles and food processing, in the Meiji Period compared to private entrepreneurs. This finding is consistent with the hypothesis of financial market failure for capital-intensive investment. Furthermore, within the same broad class of industries, the average annual number of startups (i.e., entry rate) is higher in government-led sectors, which indicates that risk aversion may have had a greater influence on private investment flows. Finally, startups in public-led sectors, while fewer in number than those led by private entrepreneurs, are more typically found in prefectures with lower population densities as well as a smaller number of prefectures as a whole.

Together, these findings suggest that the government was able to achieve three of its main objectives: to substitute domestically produced capital goods for imports; to earn foreign exchange via light manufactures; and to consolidate its political and economic authority across the country.\(^{11}\) Despite the limitations to the data in terms of selection and detail, the peculiar alignment between the initial aims of government policy and the outcomes manifest a half century later imply that fortune notwithstanding, policymakers may deserve some credit for their prescience as well.

**Public Enterprise in the early Meiji Period**

Having been largely closed to international exchange until the arrival of a fleet of American battleships in 1853, Japan possessed virtually no modern industries, infrastructure, or institutions at


\(^{11}\) Smith (1974). Investing across multiple industries also provides supporting sectors and linkages along the production chain (i.e., intermediate goods) on which the targeted industries rely.
the beginning of the Meiji Period (1868-1912). To rapidly modernize its economy, the new Meiji government made substantial investments in some strategic industries: transport and communications; metal and coal mining; metal processing and manufacture; shipbuilding and machinery; armaments; chemicals; and textiles. These were chosen for a number of reasons, such as to encourage domestic production of capital goods; to earn foreign exchange; to ease commercial transactions and extend political control; and to increase military power.

Underlying these aims was the recognition of weak capital markets, the scale and skill required for industrial startup, and risk aversion to unfamiliar technology. In absolute terms, government expenditure to promote industry was modest, totaling 32 million yen between 1870 and 1885 (or less than 20 percent of the government budget). However, the government sought to encourage private enterprise by leading entry into targeted sectors with its pilot factories, acquiring and demonstrating new technologies, and supporting the opening of new markets.

To get a sense of the contribution of the government, I briefly describe some of key industries it helped to pioneer. These range from services (rail and shipping) to manufacturing (shipbuilding), from capital-intensive sectors (mining and metals processing) to lighter ones (textiles).

Transport and Communications

The first railroad in Japan was laid by the government in 1872, connecting Tokyo to Yokohama, while a second line followed two years later, connecting Kobe to Osaka. Until 1881, all railroads were

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12 Prior to this, Japan maintained limited trading relationships with the Dutch and Chinese in the port city of Nagasaki. On 31 March 1854, Japanese officials signed the country’s first foreign trade agreement, opening the two port cities of Shimoda and Hakodate to American commerce; U.S. Navy (2007). While a number of regional governments, and ultimately even the national government, invested in modern sectors toward the end of the Tokugawa Period (1617-1868), these were one-off projects and remained small-scale; Smith (1974).


14 Ibid.

15 Despite some wealth accumulation by merchants, private individuals remained largely in the fields of commerce and not manufacturing industries. Smith (1974) notes that the private sector was more effective in manufacturing industries, but even then they were "least active in heavier branches."

16 This figure excludes, however, the non-negligible expenses paid to foreign experts; see Hirschmeier and Yui (1975).

financed by the public sector, totaling 76 miles in length.\textsuperscript{18} Private sector activity took on a bigger role in the 1880s, with a group of aristocrats putting up 20 million yen to establish the Nippon Railway Company, which was the largest establishment at the time.\textsuperscript{19} Nevertheless, even after private investors began to build railways, they were offered subsidies and guaranteed returns for their undertaking. Notwithstanding its meager mileage, the railway system was intensively used, which in turn provided a source of technical and managerial knowledge for industrial development at large.\textsuperscript{20} The related telegraph industry was adopted more rapidly, extending throughout the main islands of Honshu, Shikoku, and Kyushu by the mid 1880s. The government also prohibited private ownership of the main telegraph lines and maintained a monopoly throughout the Meiji Period.

The other major, and arguably more important, form of transportation was shipping. The government, fearing foreign takeover of coastal routes and wanting to increase exports, sought to create a domestic shipping industry. However, after an early attempt at direct management of the Kaiso Shipping Company, which operated liner service between Osaka and Tokyo, the government recognized its inefficiency and began to indirectly support the sector's development.\textsuperscript{21} This included leasing ships to the Mitsubishi Trade Company, which transported government troops to Taiwan in 1874. Domestic ship operators received exclusive rights to certain routes and subsidies for postal and trade activities, like the 1896 Navigation Promotion Law. This act, amended in 1910, provided increasing subsidies for ships of large size and high speed.\textsuperscript{22}

\textit{Shipyards and Machinery}

Like the shipping industry, shipbuilding was underdeveloped in the early Meiji Period due to the isolationist policy of the previous shogunate government. The shipbuilding sector took longer to develop, however, due to its large financial and technological costs as well as the absence of supporting industries like metal processing and machinery.\textsuperscript{23} Of the three main shipyards (Yokosuka, Nagasaki, Hyogo) in the country, all were owned by the government at the start of the Meiji Period and

\textsuperscript{18} Smith (1974).
\textsuperscript{19} Hirschmeier and Yui (1975).
\textsuperscript{20} Ibid.
\textsuperscript{21} Chida and Davies (1990).
\textsuperscript{22} At least 1,000 gross tons and 10 knots per hour; see Travis (1945).
\textsuperscript{23} Chida and Davies (1990).
produced machinery like marine engines and boilers in addition to ships. By the 1880s, however, the government decided to privatize its enterprises due to the high cost of operation and inefficient production. After its withdrawal from direct operations, the government subsidized shipyards with the Shipbuilding Promotion Law in 1896, although private producers remained small in scale until the Russo-Japanese War a decade later, when demand for both repairs and construction due to military conflict aided the industry's growth.

**Mining and Metal Processing**

While there were numerous private coal and ore mines throughout the country, they were small and used traditional extraction techniques. Furthermore, none employed foreigners or could afford foreign equipment like mechanical drills or steam power. In contrast, the government owned nine mines that used modern machinery, of which six collectively produced approximately half of Japan's mining output by value in the 1880s. Domestic production as a whole, however, was insufficient to meet demand, where at least half the tonnage of iron and steel was imported throughout the period.

One of the largest investments the government made was the Kamaishi Iron Works, completed in 1878 at a cost of 2,376,625 yen. This facility was plagued with operational problems, including low quality ore and a lack of adequate fuel supplies, and was sold in 1882 to private investors for 57,000 yen. A commissioned report on Kamaishi’s failure revealed broader difficulties of managerial disorganization, low demand, and inadequate technological expertise. Nevertheless, the Kamaishi experience served the government's purposes by “[providing] a model of investment for the private sector to imitate,... absorbing unavailable initial costs and losses that private entrepreneurs could hardly be expected to bear,... [and] helping overcome certain technological difficulties that previously

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24 For example, the (private) Kawasaki shipyard also produced Japan's first locomotives and rail coaches in 1907; see Hirschmeier and Yui (1975).
25 Ibid. Thus, the first steel steamship was built in 1895 by the Mitsubishi zaibatsu, which had bought the Nagasaki shipyard from the government; Smith (1974).
27 This figure obscures the fact that government-owned mines were the primary producers of precious metals while private mines produced most of the country's copper and coal.
28 Yonekura (1994). The figures for domestic production may be underestimated because they exclude small indigenous producers using the Tatara method to produce pig iron.
had been considered insurmountable." Undeterred, the government invested in a larger, more advanced steel production facility, Yawata Works, which opened in 1901.

**Cotton and Silk Textiles**

It is hard to underestimate the contribution of textiles to early Japanese industrialization, not only because of the foreign exchange the industry earned, but also for its introduction of mechanized labor to an agrarian economy. While the country began exports of raw silk and silkworms a decade before the Meiji Period, it was not until the late 1800s, with technological advances as well as government-instituted quality measures and factory production, that the industry took off. The country's first modern manufacturing factory, the Tomioka Silk Filature, was built in 1872 by the government to promote mechanized reeling of silk (as opposed to hand-reeling). The Tomioka plant, with its French design and utilization of the latest equipment, operated at a loss for many years, until the government privatized it in 1893. Despite its inauspicious start, the success of the industry was clear by the end of the Meiji Period, when Japan had become the largest silk textile exporter in the world.

The cotton textile industry, on the other hand, was initially viewed with skepticism, given negligible domestic production of raw cotton and unfamiliarity with spinning technology. Although Japan's first cotton-spinning mill was built in 1867 by officials in Kagoshima prefecture, it was only after cotton textiles reached nearly a third of all imports during the 1870s did the government react with substantial investment. Two additional public mills were built in Hiroshima and Aichi prefectures, each equipped with 2,000 spindles, but were sold off in 1882 and 1886 due to their inefficiency and cost. The government also provided loans and spindles to entrepreneurs to encourage private factories. These independent firms had greater success, notably the Osaka Spinning Mill established by Shibusawa Eiichi in 1882 with 10,500 spindles. By the mid-1890s, Japan was exporting over four million pounds of cotton yarn.

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29 Ibid.
30 See Nghiep and Hayami (1992) for discussion of the silk industry and the role of technology.
31 Fletcher (1996).
Research Design

Data

To analyze differences between public- and private-led industries throughout Japan's economic development in the Meiji Period, I use a new firm-level dataset collected from corporate genealogies. Of the 2,231 establishments with identifiable industries founded between 1868 and 1912, there are 66 in agricultural and other primary industries, 560 in manufacturing ranging from food processing to miscellaneous machinery, and the remaining 1,605 in service sectors like banking and retail sales. These startup firms represent 162 different industries at the 3-digit classification level, which I group together more broadly as modern, heavy, and light sectors, following Rosovsky's tripartite classification scheme.\(^{32}\) Besides a date of establishment and an industry code, each establishment may also provide the type of ownership (government versus private) and the location of establishment (prefecture).\(^{33}\) Because not all entries have this information, the respective numbers of establishments with ownership and location are 1,877 and 1,009. Table 1 presents some descriptive statistics.

Knowing the ownership and date of entry of a firm enables me to determine whether the government or an entrepreneur led entry into an industry (i.e., provided funding for the first identified establishment in a given sector). This, in turn, allows me to classify industries as being either public- or private-led.\(^{34}\)

Location identification makes it possible to control for differences in natural resource endowment, geographic features, and population density. I indicate the availability of four different

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\(^{32}\) Rosovsky (1961). The modern sector comprises chemicals, metal processing, machinery, utilities, textiles, and transportation and communication. Heavy industries include the first four groups in the modern group, while light industries include textiles, food processing, woodwork and papermaking, and miscellaneous manufacturing.

\(^{33}\) Private ownership can be further subdivided into unlisted firms (e.g., sole proprietorships, limited and unlimited liability partnerships and mutual associations) and listed firms (e.g., limited and unlimited liability joint stock firms).

\(^{34}\) More detail is in the following subsection. Given the typical fanfare accompanying public-sponsored first entrants, it is plausible that industries pioneered by the government are adequately identified. I further refine industry entry order with the genealogical records.
types of resources: timber, coal, petroleum, and metal ores.\textsuperscript{35} While no figures exist for the initial size of each resource deposit by prefecture, these categorical indicators may provide exogenous explanations for industrial development. Differences in prefecture geography are measured continuously, and include average annual temperature and rainfall, latitude and longitude coordinates, length of coastline, and area covered by water.\textsuperscript{36} These features may serve as proxies for agricultural production suitability (ie, climate, surface water), which may compete with manufacturing industries for both labor and capital; lower transportation and transaction costs; and availability of hydropower used in industries like millwork and paper production. Finally, population density may correspond to market demand and proximity, with urban areas also having better infrastructure and greater financial capital.

Hypotheses and Methodology

While this dataset provides sufficient information to test hypotheses on the role of industrial policy, there remain some conceptual and framing clarifications. A crucial question is whether the definition of government intervention is limited to enterprises it had set up (e.g., model factories) and financial assistance of any form or if it should also include the broader industrial impact issuing from its policies.\textsuperscript{37} While the former may be more easily measured, it seems the latter is a more realistic description of development, given the government's long-term social planning and the knock-on effects of initial investments.\textsuperscript{38}

Asserting the latter position leads to the difficulty of measurement, which this study addresses with the new dataset and the assumption that industries selected by the government differ in character and developmental paths from those pioneered by the private sector. This assumption is plausible because limited resources force public leaders to choose among many investment

\textsuperscript{35} Trewartha (1945).
\textsuperscript{36} Annual measures are approximated with modern figures; Weather Channel (2007). See Japan Statistical Association (1987) for physical geography measurements.
\textsuperscript{37} The definition of "assistance" remains controversial even today, such as in the debate on whether American government contracts awarded to the airplane manufacturer Boeing are implicit subsidies (compared to the explicit funding provided by European governments to Boeing's competitor Airbus).
\textsuperscript{38} Aubrey (1954) writes: "[t]he importance of government expenditures for economic development is inadequately expressed by investment figures, for they are the nucleus of further progress in which private investment can participate more prominently."
opportunities, and ostensibly the interest of the government is in long-term national welfare, not short-term profit maximization. With this in mind, I consider the any industry that the government was the first entrant to be "public-led" for the whole of the Meiji Period. This applies even if the government had exited prior to the period's conclusion, as was the case with its privatizations in the 1880s. Similarly, industries initiated by private entrepreneurs, even if subsidized, are designated as "private-led." This public-private delineation allows me to compare industrial development over time as well as examine industry-wide characteristics like capital intensity and firm entry.

Based on this distinction, I can test a number of hypotheses that compare industry characteristics. One hypothesis is that the government led entry in capital-intensive industries while the private sector led those that were labor-intensive. This may occur if private capital is weak and few financial intermediaries exist, suggesting difficulties in mobilizing funding for scale-oriented and high fixed-cost industries.39 I test this with a discrete choice probit model, using whether an establishment was public-led or not as the binary dependent variable.

The primary independent variable is relative factor intensity based on Rosovsky's tripartite division: heavy, light, and non-manufacturing. Setting this as a control variable assumes that the government had knowledge of an industry's capital intensity prior to entry, which is consistent with the theory of late development. In addition, I control for population density, indicators for natural resources, and geographic features, and interact industry type with population density to account for labor supply and market demand. I interpret positive coefficients on these variables as indicating an increased likelihood of public sector first entry.

Another hypothesis is that rates of entry into industries pioneered by the government are higher than those led by private entrepreneurs. It is likely that besides possible capital market failure, unfamiliarity with technology and risk aversion may inhibit industry formation and that government entry into an industry is an implicit vote of confidence in the industry's long term development.40 This

40 Of course, the government's presence may also deter private competitors because it may not behave like a rational agent and pursue profit maximization.
signal may arguably be more credible than that given by private individuals considering the relatively greater expertise and resources that the government possessed.\textsuperscript{41}

To see if different entry rates exist, I compare the means and standard deviations of the average number of establishment for the two series within the same broad industry type. These include both the heavy and light classes designated by Rosovsky as well as a set of modern industries similarly identified by him. By comparing entry rates for industries within the same broad class, I mitigate inter-industry heterogeneity in terms of production technology and initial investments. Consequently, if the average number of public-led industrial establishments is larger, ceteris paribus, I interpret this as suggesting possible entry barriers and risk aversion among investors toward sectors not endorsed by the government. Besides first moments, I can also assess second moment properties, ie, whether there are trends in either the public- or private-led industrial series and if they differ. For this, I use standard unit root tests for stationarity. The existence of a positive trend (ie, greater entry) over time may indicate imitative competition or lower risk aversion.\textsuperscript{42}

Finally, I look at the spatial dispersion of establishments by sector affiliation. The government may have a greater interest in spreading the effects of industrialization to less densely populated markets and over a greater geographic area, unlike a profit-maximizing private firm. Similar to the above approach with entry rates, I compare means and standard deviations to determine whether there were differences in population densities between affiliated sectors.

\textbf{Results}

The descriptive statistics in Table 1 indicate that establishments in public-led industries (224 out of 251) were over-represented in manufacturing compared to private-led industries (336 out of 1971); however, the proportions are nearly reversed for service industries.\textsuperscript{43} This corresponds to anecdotal

\textsuperscript{41} The government both sponsored foreign travel for students and officials as well as employed costly foreign workers to introduce new technology; see Hirshmeier and Yui (1975) and Jones (1980).

\textsuperscript{42} Negative trends could indicate anticompetitive behavior or market saturation, although this interpretation may be problematic since the current dataset contains only startup entry and not exit.

\textsuperscript{43} Note that the figures for service industries may be less reliable than those for manufacturing. This is because establishments providing services probably had fewer capital assets to pass on, and thus may be missing from the genealogies. Given the focus of this paper on industrial development, which was
evidence that private entrepreneurs were reluctant to engage in manufacturing due to the scale of investment, technical and organizational difficulty, and technological conservatism. Nevertheless, the number of private-sector startup establishments in heavy industries (234) exceeds that for light industries (186), which appears at odds with the previous result. An explanation for this may lie in the role of financial conglomerates in leading the development of scale-oriented and capital-intensive industries, as well as the dramatic growth of light sectors seeded by the government.

Correlations

Simple pairwise correlations, like summary statistics, provide a useful reference for more rigorous analysis. As shown in the top panel of Table 2, industries pioneered by the public sector are positively correlated with all three industrial series. In particular, between light and heavy industries, the public sector is five times more strongly correlated with the former, which is consistent with the descriptive statistics and suggests the success of government-seeded light industries like textiles that formed the foundation of the period's growth. However, like the descriptive statistics, these correlations lack a sense of temporal change. To see if different results obtain for smaller periods of time, I divide the dataset into pre- and post-1893 samples, with the year 1893 chosen because it both occurs near the midpoint of the Meiji Period and was the year when a commercial code for joint stock incorporation was promulgated. Since earlier Japanese governments typically had low regard for property rights and financial note legitimacy, this legal institution arguably eased private access to investment funding and signaled a milestone in financial system development.

[Table 2 here]

oriented toward manufacturing, possible sample bias does not invalidate the results (especially those using the light and heavy industry group series).

44 Smith (1974).
46 Loenholm (1906).
47 According to Confucian tradition, which the Japanese drew heavily on to justify their class system, merchants were the lowest of the four occupational groups (aristocracy, warriors, craftsmen, merchants) and loan obligations were routinely annulled by government decree; see Hirschmeier and Yui (1975).
The results for the first half of the Meiji Period (Table 2, middle panel) show that sectors pioneered by the government remain positively associated with heavier industries, but this relationship is no longer significant for the second half of the period (Table 2, bottom panel). These findings correspond to the earlier summary statistics that show significant contrasts between startup activity in industries led by either the public or private sectors.

**Differences in Industry Type**

A major shortcoming of correlation analysis is that it does not include other explanatory influences. Results from the probit analysis, given in Table 3, show positive coefficients for both light and heavy sectors relative to the omitted group of non-manufacturing industries. I interpret this as indicating that higher capital intensity increases the likelihood of being a public-led industry. This makes sense given the relative immaturity of the financial system and risk aversion of private capital for a large part of the period.

[Table 3 here]

To account for variation in labor supply and market demand across prefectures, I include population density and its interaction with industry type as additional control variables. Interestingly, higher population density lowers the relative probability of a generic light or heavy industry being pioneered by the government (specification 3), shown by the negative coefficient on the variable. When limited to the subset of industries considered modern, however, the cumulative probability of government-led entry into heavy industries becomes negative (specification 4). This may imply the government's interest in developing regions that had less access to investment capital or infrastructure, but with an emphasis on lighter sectors.

In addition to including fixed effects for year and prefecture in all four specifications and both natural resource and geography indicator variables in the last three, I cluster the standard errors by 3-

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48 That is, the numerator in the capital-labor ratio increases.
digit industry to allow for correlation in errors within industries, and report Eicker-White standard error estimates that are robust to data heteroskedasticity.

Differences in Entry

To better understand the relationship between public sector leadership and an industry's revealed ease of entry, I test the hypothesis that industries pioneered by the government see greater entry than those led by the private sector. If public-led industries have greater startup activity, this is consistent with the premise of capital market failure and the need for public intervention to overcome initial investment costs and technological risks. In addition, greater entry in public-led sectors also suggests profit potential and the implicit long-term support of the government in its viability.

I also examine whether the difference between the average number of startup establishments for both public-led versus private-led industries is stable over time. If a difference exists, it may indicate technological entry barriers.\textsuperscript{49} That is, when two series begin with different rates of entry that converge over time, there may be decreasing costs to entry. On the other hand, divergent entry rates may indicate monopolistic or predatory behavior on the part of incumbents or other persistent entry barriers. Stable rates suggest the absence of differential technological impediments between the two sectors.

To test these hypotheses, I first compare the means and trends between public-led and private-led industry startups using a two-sample t-test of significance. If one series has a larger mean for the average number of startups per industry in a given year compared to the other, then the former is revealed to have fewer barriers to entry. I then use standard unit root tests to determine if either series has a dynamic trend, and if so, test for cointegration to see if the two series share a long-term relationship.

Table 4 has the overall means and standard deviations, which indicate statistically significant differences in mean entry rates across different industry groups. For both modern and light industries, the positive difference means indicate greater entry rates in public-led sectors, which may reflect

\textsuperscript{49} I use the average number of startup establishments per 3-digit industry instead of total number of startups to reduce distortions from industry outliers.
lower risk aversion. Surprisingly, the opposite result obtains among heavy sectors, despite these having a greater probability of being pioneered by the government.

[Table 4 here]

**Geographic Differences**

The final area this study examines is differences in geographic establishment, with spatial distribution serving as a gauge of industry promotion and market integration. On this premise, it appears that public-led industries were less widespread than private-led ones, the former being found in 35 of the 47 prefectures compared to the private sector in 45. In particular, for both the modern and heavy industry series, startups in government-led sectors were on average in ten or eleven fewer prefectures compared to private-led sectors, as shown in the top panel of Table 5. On the other hand, they were slightly better represented in light sectors by an average of three prefectures.

[Table 5 here]

Alternatively, one can use population density to assess economic integration of underserved areas. Earlier correlations already indicated that population density decreases the likelihood for public sector entry, which suggests that the government may have wanted to encourage development in the periphery. Based on average population density of prefectures, government-led industries indeed tended to be in less densely populated areas for both modern and heavy sectors. Thus, although government-led industries may have tended to locate in fewer areas, these locations were less urban and presumably in greater need of industrial development.

**Discussion and Conclusion**

How well did the government succeed in its modernization program? The above results showed that the government was more likely to invest in more capital-intensive industries than the private sector, which may indicate capital market failure for manufacturing investments early in the Meiji Period. Within major industry type, the government-led sectors also retained an advantage in
the entry rates of startups. Since these entry rates are compared within broad industry groups, this suggests that as opposed to financial entry barriers, risk aversion among private entrepreneurs may have delayed adoption of new technologies not endorsed by the government. Finally, the government also succeeded in spreading the effects of industrialization across the country to more sparsely populated areas. Whatever the metric, its broad-based policies paid off with per capita GDP increasing 5.1 percent annually between 1875 and 1912, over twice the rate of the United States in the same period.\(^{50}\)

The government's industrial policies did much to improve its international position as well. Japan repeatedly demonstrated its martial prowess over its neighbors, thereby convincing western powers to relinquish extraterritorial rights and to return tariff autonomy by 1911. As mentioned earlier, the country's adoption of technology and heavy industrial growth benefited considerably from military demand. Thus, it may be of interest to study to what extent investment (public or private) in military goods stimulated the domestic economy. Notwithstanding the availability of public expenditure data on military budgets, the current dataset of firm establishment may provide an alternative perspective by tracing the expansion of commerce and manufacturing in Japanese colonies.

The government also actively encouraged international trade to acquire technology and capital. As shown in Table 6, exports increased more rapidly than imports, easing the burden of capital goods imports and underwriting the development of domestic industries to substitute for foreign production. Less clear is how trade impacted small independent firms and domestic market integration. One may be able to assess how non-tradable goods and services were affected by foreign technology and infrastructural improvements induced by foreign commerce by comparing industrial growth between regions. It may be possible as well to examine the extent to which Japan transferred technology (as embodied in firm activity within more advanced industries) to surrounding nations that were even less developed (eg, those in the Greater East Asia Co-Prosperity Sphere).

\(^{50}\) Japan Statistical Association (1987).
That said, it would be misleading to consider trade as the primary engine of Japanese development. While exports helped to finance Japan's industrialization, the ports, ships, and merchandise themselves were the issue of careful policymaking and well-functioning institutions, both domestic phenomena. The success of the government's modernization program lay in the mutual reinforcement of its various efforts to substitute imports, earn foreign exchange, consolidate political authority, and increase military strength. Within this broader framework, even the privatizations of its failed public enterprises in the 1880s can be viewed as a sign of progress that the private sector was ready to take the reins of economic growth.

References


Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Public-Led</th>
<th>Private-Led</th>
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</thead>
<tbody>
<tr>
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**By sector**

<table>
<thead>
<tr>
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<tr>
<td>Primary</td>
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**By product class**

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<thead>
<tr>
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<tbody>
<tr>
<td>Modern</td>
<td>632</td>
<td>209</td>
<td>423</td>
</tr>
<tr>
<td>Light</td>
<td>352</td>
<td>166</td>
<td>186</td>
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<tr>
<td>Heavy</td>
<td>298</td>
<td>58</td>
<td>234</td>
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**By ownership**

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<td>Government</td>
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</tr>
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<td>44</td>
<td>264</td>
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**By population density**

<table>
<thead>
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<th></th>
<th>Total</th>
<th>Public-Led</th>
<th>Private-Led</th>
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<tr>
<td>Urban</td>
<td>392</td>
<td>77</td>
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</tr>
<tr>
<td>Rural</td>
<td>617</td>
<td>112</td>
<td>505</td>
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</table>

*Based on 3-digit JSIC code

*Includes textiles, chemicals, metals, machinery, utilities, and transport; cf. Rosovsky (1961)

*Includes processed food, textiles, wood products, glass/ceramics, and unclassified manufacturing; ibid.

*Includes chemicals, metal processing, machinery, and utilities; ibid.

*Urban is defined as over 386 people per square kilometer.

Source: see text
<table>
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<tr>
<th></th>
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<th>Modern</th>
<th>Light</th>
<th>Heavy</th>
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<tbody>
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<td><strong>Meiji Period (1868-1912)</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Public-led sector</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern industry</td>
<td>0.419*</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light industry</td>
<td>0.493*</td>
<td>0.203*</td>
<td>1.000</td>
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<tr>
<td>Heavy industry</td>
<td>0.100*</td>
<td>0.617*</td>
<td>-0.165*</td>
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<td>0.161*</td>
<td>0.021</td>
<td>0.219*</td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Modern industry</td>
<td>0.496*</td>
<td>1.000</td>
<td></td>
<td></td>
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<tr>
<td>Light industry</td>
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<td>0.100</td>
<td>0.163*</td>
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<td><strong>Post-Commercial Code (1893-1912)</strong></td>
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<tr>
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<td></td>
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<tr>
<td>Modern industry</td>
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<tr>
<td>Light industry</td>
<td>0.531*</td>
<td>0.179*</td>
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</tr>
<tr>
<td>Heavy industry</td>
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<td>0.644*</td>
<td>-0.155*</td>
<td>1.000</td>
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<td>Population density</td>
<td>-0.010</td>
<td>0.163*</td>
<td>0.004</td>
<td>0.232*</td>
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Significance level: *5 percent
Source: see text
Table 3: Probit Results

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<thead>
<tr>
<th>DV: Government-led sector</th>
<th>[1-All]</th>
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<th>[4-Modern]</th>
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<tbody>
<tr>
<td>Light</td>
<td>1.998***</td>
<td>2.537***</td>
<td>2.998***</td>
<td>4.380***</td>
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<tr>
<td></td>
<td>(0.593)</td>
<td>(0.583)</td>
<td>(0.650)</td>
<td>(0.873)</td>
</tr>
<tr>
<td>Heavy</td>
<td>1.235***</td>
<td>1.468***</td>
<td>2.397***</td>
<td>1.377**</td>
</tr>
<tr>
<td></td>
<td>(0.449)</td>
<td>(0.449)</td>
<td>(0.529)</td>
<td>(0.617)</td>
</tr>
<tr>
<td>Pop den</td>
<td>-0.366*</td>
<td>-0.457</td>
<td>0.760</td>
<td>2.109***</td>
</tr>
<tr>
<td></td>
<td>(0.204)</td>
<td>(0.467)</td>
<td>(0.522)</td>
<td>(0.784)</td>
</tr>
<tr>
<td>Popden*Light</td>
<td></td>
<td>-1.041**</td>
<td>-1.791***</td>
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</tr>
<tr>
<td></td>
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<td>(0.475)</td>
<td>(0.691)</td>
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<tr>
<td>Popden*Heavy</td>
<td>-1.934***</td>
<td>-1.497***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.589)</td>
<td>(0.421)</td>
<td></td>
</tr>
<tr>
<td>Resource and geography fixed effects(^a)</td>
<td>included</td>
<td>included</td>
<td>included</td>
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<tr>
<td>Observations</td>
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<td>829</td>
<td>829</td>
<td>341</td>
</tr>
<tr>
<td>Pseudo R-squared</td>
<td>0.281</td>
<td>0.441</td>
<td>0.451</td>
<td>0.596</td>
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</tbody>
</table>

Significance levels: *10% **5% ***1%; robust standard errors in parentheses, clustered by JSIC 3-digit industries.
\(^a\)See text for complete variable list. All specifications include year and prefecture fixed effects.
Source: see text

Table 4: Average Annual Startups per Industry

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern industries</td>
<td>2.111</td>
<td>1.627</td>
<td>0.484***</td>
</tr>
<tr>
<td></td>
<td>(1.604)</td>
<td>(0.713)</td>
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<tr>
<td>Light industries</td>
<td>2.554</td>
<td>1.358</td>
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</tr>
<tr>
<td></td>
<td>(1.986)</td>
<td>(0.468)</td>
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<tr>
<td>Heavy industries</td>
<td>1.349</td>
<td>1.519</td>
<td>-0.171*</td>
</tr>
<tr>
<td></td>
<td>(0.432)</td>
<td>(0.557)</td>
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Significance levels: *10% **5% ***1% for null hypothesis that mean difference does not equal zero. Standard error in parentheses.
Source: see text
Table 5: Geographic Representation

<table>
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<tr>
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<tbody>
<tr>
<td>Average number of prefectures</td>
<td></td>
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<tr>
<td>Modern industries</td>
<td>9.373</td>
<td>20.995</td>
<td>-11.622***</td>
</tr>
<tr>
<td></td>
<td>(7.114)</td>
<td>(14.497)</td>
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<td>Light industries</td>
<td>10.337</td>
<td>7.441</td>
<td>2.896***</td>
</tr>
<tr>
<td></td>
<td>(8.865)</td>
<td>(4.904)</td>
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<tr>
<td>Heavy industries</td>
<td>3.828</td>
<td>14.504</td>
<td>-10.677***</td>
</tr>
<tr>
<td></td>
<td>(2.637)</td>
<td>(10.279)</td>
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</tr>
</tbody>
</table>

Average population density

|                        |               |                |                  |
| Modern industries      | 403.195       | 528.224        | -125.029***      |
|                        | (317.147)     | (408.828)      |                  |
| Light industries       | 418.298       | 426.037        | -7.738           |
|                        | (330.405)     | (362.947)      |                  |
| Heavy industries       | 367.670       | 627.643        | -259.973***      |
|                        | (242.517)     | (418.828)      |                  |

Significance levels: *10% **5% ***1% for null hypothesis that mean difference does not equal zero. Standard error in parentheses.
Source: see text

Table 6: Annual Trade Growth

<table>
<thead>
<tr>
<th>Period</th>
<th>Exports (%Δ)</th>
<th>Imports (%Δ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1868-1912</td>
<td>9.9</td>
<td>12.3</td>
</tr>
<tr>
<td>(a) 1868-1880</td>
<td>6.7</td>
<td>15.4</td>
</tr>
<tr>
<td>(b) 1881-1895</td>
<td>10.5</td>
<td>11.8</td>
</tr>
<tr>
<td>(c) 1896-1912</td>
<td>11.7</td>
<td>10.3</td>
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Source: see text