

**PATH DEPENDENCE AND THE EMERGENCE AND EVOLUTION OF
THE ELECTRONICS SECTOR IN JAPAN**

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Abstract: This paper looks at the emergence of electronics-related industries in Japan in the postwar period and analyzes the extent to which path dependent factors were critical to their emergence. It finds that up until the 1990s, the electronics industries emerged largely out of path-dependent factors, such as policies of the state bureaucracy and its associated organizations, incumbent firms, national laboratories, and Japan's large industrial groups. Since the 1990s, there have been many more new and unpredictable factors leading to the emergence of new offshoots of the electronics industries, such as smart phones, broadband internet services, and online shopping. Entrepreneurs, many with unconventional backgrounds including extensive periods of study overseas, have increasingly taken on great risks in the 1990s and 2000s to create new firms and industries using novel business models. The weight of path dependence on the Japanese economy remains heavy and continues to hinder the process of creative destruction, vibrant competition, entrepreneurship, and the creation of new firms. Change has been slow and incremental, but the role of path dependent factors has declined significantly since the early 1990s.

I. Introduction

This paper looks at the emergence of several electronics-related industries and sub-industries in Japan in the postwar period, including computer mainframes and their software, semiconductors, video game software, color

televisions, smart mobile phones, internet services, and web-based shopping malls. The focus in each of these cases is to look at the early period of the industry's development and analyze the various conditions and factors that contributed to the emergence of these industries. More specifically, we look at the extent to which these industries in Japan have emerged from what might be called path-dependent factors, such as the existing innovation system, firms, and other actors, as opposed to the degree to which they have emerged due to factors that exhibit path plasticity. By the latter, we mean new factors untied to the past as well as a broader variety of configurations in Japan's innovation system than is generally assumed.¹ For example, we might find a new entrepreneur taking unusually heavy risks to enter a new industry in ways that do not build upon the existing innovation system or involve incumbent players.

By looking at industries that emerged over the postwar period from the 1950s through the 2000s, we focus first on a period up through the 1970s in which Japanese businesses were trying to catch up with the West in key electronics-related industries; then we look at the period starting in the 1980s when Japanese businesses were either first movers or major actors in industries that had recently emerged in foreign markets. Our analysis over 50-60 years involves looking at industries characterized by relatively stable, predictable technological change as well as industries characterized by radical and discontinuous technological change. By looking at various industries over a long period of time as Japan's innovation system, economy, and society have evolved, we can gain insight into whether some factors that were crucial in early periods

are less important or even harmful in later periods. We will also explore whether there have been distinct periods when entrepreneurial activity leading to new industries has been more vibrant than at other times, or periods when a certain actor or set of actors plays the role of entrepreneur as opposed to a different set of dominant players in other periods.

This paper draws in part on research I have previously done on various electronics-related industries, most comprehensively in *Reprogramming Japan: The High Tech Crisis under Communitarian Capitalism* (Cornell University Press, 2005). The focus in this earlier research was not on entrepreneurship and innovation at the time the industries emerged, and its analysis of the mainframe computer hardware and software, telecommunications equipment, and semiconductor industries concluded that path-dependent factors were very important in their emergence. These path-dependent institutional arrangements included a strong state bureaucracy; a very stable set of incumbent firms that operated in all of these related industries; a predictable set of major industrial groups (keiretsu) and banks; and a stable array of corporate practices such as lifetime employment, seniority-based wages, and risk-sharing corporate strategies that minimized cutthroat competition and bankruptcies and thereby protected weak firms at the expense of the strong. My study found that at least during the catch-up stage of development of these industries, various institutional, policy, and social elements of Japan's innovation system emphasized learning from and improving upon foreign technology and, if anything, hindered radical technological breakthroughs.

This paper uses the lens of path-dependence versus path plasticity to analyze entrepreneurial and innovative behavior in emerging industries in Japan. It looks at a broader range of industries and sub-industries than my previous research, and focuses particularly on the actors involved and decisions made around the time the industry emerged. It should be noted that in discussing emerging industries, I mean industries new to Japan, not necessarily new to the world.

This paper is divided into 4 sections. After this introduction, the case studies are presented in sections 2 and 3. These case studies are roughly presented in chronological order so that we can evaluate whether and how conditions and factors have changed over time. Section 2 focuses on the emergence of high-tech electronics industries up until the 1980s, most of which grew out of quite stable configurations of players, institutions, and policies. Section 3, which looks at industries over the last few decades up to the present, finds that there has been a much broader range of new and peripheral actors and forces involved in the emergence of more recent industries.

Each case in sections 2 and 3 explores various key questions including: Has the industry emerged through new firms or incumbents in related industries? Was the technology involved in the new industry indigenous or imported from abroad? How did entrepreneurs recognize the opportunities and mobilize the necessary financial and other resources necessary to make a start in the industry? What, if any, was the role of the government in the start of the industry? What were the key elements of the innovation system that were involved and

how did they help/hinder the emergence of the industry? Section 4, the concluding section, highlights insights drawn from the case studies and suggests areas where future research is necessary.

This study is largely qualitative. The hope is that through analysis and comparison of various cases, we can suggest some general propositions about the conditions under which new industries and sub-industries have emerged in Japan and how these conditions have changed over time as Japan moved from being a catch-up economy to a global economic power. Ultimately, this analysis will help provide insight not only into Japan's system, but also into broader patterns and factors that may be common to other late developers.

II. Emergence of High-Tech Electronics Industries in the Catch-up Stage

i. Computer Mainframe Hardware²

The bureaucracy, especially the Ministry of International Trade and Industry (MITI), was the primary entrepreneur that helped kick-start the emergence of the mainframe computer industry in Japan in the early 1960s through various targeting policies. Japanese scientists and businesspeople were, of course, also critical actors. A few Japanese firms worked along with government laboratories and universities in starting research on computers in the late 1950s. The key turning point in the industry's emergence was when IBM introduced a revolutionary computer series in 1959, making it clear that Japan's efforts lagged far behind. The question was whether to import foreign machines or try to nurture a domestic industry. In 1960 a group of people from both the

public and private sector got together to discuss this issue. The answer was not obvious. But the decision was quickly made that a domestic computer industry was critical to Japan's long-term economic interest.³

MITI and NTT (The Japan Telegraph and Telephone Company that was established as a national monopoly in 1952) decided to heavily support a domestic computer industry with a broad array of laws, cooperative R&D projects, subsidies and loan guarantees, government procurement plans, and a computer rental company called JECC. The major banks agreed to make huge loans to the industry over the long run to help it become competitive. The only major actor that was reluctant was the Ministry of Finance because they knew it would cost a lot of money, but they were talked into it.⁴

The government and the banks felt that only very large companies, and especially those who were major members of NTT's family of firms, could afford to enter and survive in this high barrier-to-entry industry, which required huge investment in R&D and was dominated by foreign companies such as IBM, UNIVAC, and Honeywell. Thus, all seven firms allowed to enter the industry were incumbents in related industries, had long histories, and were allied with at least one of Japan's major industrial groups. These included NEC, Hitachi, Fujitsu, Mitsubishi, Toshiba, Oki, and Matsushita. Oki was relatively small, but was favored because it was one of the "Big Four" producers of telecommunications equipment—that is, it was a key member of the "NTT family of firms". The government was reluctant to allow in consumer electronics firms, fearing that they did not have the research labs and long-time horizons needed to compete in

computers; however, in the end they allowed in Matsushita (now Panasonic), which was quite large and had deep pockets. However, Matsushita, giving priority to short-term profits, gave up after a couple of years, the only one of the seven firms to do so.

To help the industry take-off, MITI had very aggressive protectionist policies, including tariffs, quotas, and government procurement policies that required state agencies to use domestic computers, with very few exceptions. Also tight strings were placed on IBM's activities in Japan. In order to produce there, it had to give Japanese companies access to its patents at low royalty rates. And the government controlled what type and quantity of machines IBM was allowed to produce in Japan, how much IBM had to export (in the early years, IBM's exports from Japan made it the nation's greatest earner of foreign exchange), what parts IBM was allowed to import, and how much profit IBM could repatriate. MITI also helped create a national policy computer rental company that helped the firms rent their machines as IBM did. And numerous cooperative R&D projects promoted the industry; the first was the FONTAC project started in 1962, followed by a much larger project in 1966 which organized the firms to quickly counter IBM's 1964 introduction of a revolutionary new machine.⁵

The computer hardware industry thus emerged out of a very stable configuration of incumbent actors. The government selected existing firms that were already in related industries to be the main players because these companies already had strong roots and deep pockets to help them survive in

competition with IBM. Other major players were the key banks that went along with state policy, such as the Industrial Bank of Japan and the Long-Term Credit Bank of Japan, and NTT, the national telecommunications monopoly firm.

ii. Computer Mainframe Software Industry

The same firms, banks, and state actors involved in the emergence of the mainframe computer industry were involved in creating the software to run domestic mainframes. As in the hardware part of the business, the top three firms—Hitachi, Fujitsu, and NEC, which were key members of NTT's family—were the most heavily supported by the government in a broad array of software-related cooperative R&D projects and the like.

In 1966 the government created a national computer software company, the Japan Software Company, as part of a national cooperative R&D project, to try to nurture a domestic operating standard and vibrant software industry. This national policy company was funded by government subsidies but was a joint venture between NEC, Fujitsu, Hitachi, and the Industrial Bank of Japan. The Japan Software Company was to create a common operating standard that could run on any NEC, Fujitsu, or Hitachi mainframe. But Japanese firms at that stage did not have the human resources and accumulated experience to develop such a new standard. And the firms wanted to lock their keiretsu group firms into their own closed standards so were unwilling to commit to a common standard for software. In short, for a variety of reasons, the Japan Software Company failed and ultimately went bankrupt in the early 1970s.⁶

About this same time, the U.S. Justice Department forced IBM to unbundle its hardware and software. This allowed the Japanese hardware-software companies to pursue an IBM-compatible strategy—that is, make hardware like IBM's that could run on IBM's software. Fujitsu and Hitachi decided to go this route while NEC decided to base its machines on the standard of its technological partner, Honeywell. Unbundling assumed that firms could make hardware that would run on IBM software, which would be purchased from IBM. But since IBM was under strong antimonopoly suspicion, it did not complain about Japanese firms essentially copying its operating system and applications software, bugs and all. Indeed, a mainframe computer software industry in Japan did emerge, but it was primarily custom-made software that essentially copied IBM's operating system. The copied software was tweaked by the various firms in different ways and bundled with the firms' hardware. This strategy allowed the firms to lock in their users by making their machines incompatible with any others, but resulted in an industry with very fragmented and closed standards.⁷

Thus, in the software case as in hardware, its emergence was due largely to a very stable configuration of existing state and corporate actors and policies. The software industry grew out of the hardware makers; that is, the software makers were the hardware makers.⁸ This story of mainframe computer hardware and software also holds true for the emergence of the PC hardware and software industries in Japan.

iii. Semiconductor Memory Chips

The government was also the key entrepreneur in kick-starting the emergence of a domestic semiconductor industry. Just as in computer mainframe hardware and software, the barriers to entry were very high and the industry had first emerged abroad and thus was dominated by foreign companies, such as Texas Instruments (TI), Motorola, and Fairchild. MITI once again protected Japanese makers from foreign competition as much as possible and sponsored various cooperative R&D projects to help the firms catch up technologically.

When TI applied for patent recognition in 1960 and for a wholly-owned subsidiary in 1964, MITI initially refused to acknowledge both of the applications.⁹ In the early 1960s Japanese companies were starting to produce semiconductors but were charging three times the price of imported chips because their yields were much lower—less than 10% compared to 25% for US makers.¹⁰ In addition to protecting the domestic companies by keeping TI at bay, MITI also started several R&D initiatives to help the firms with integrated circuits, for example, a project supported by 29 million yen (\$80,000) in state funds. Tarui Yasuo, a member of the MITI lab involved in this project, admitted that its goal was to decrease duplication of effort through specialization and “frankly [much of the project’s aim is] to avoid patents that cover procedures developed in the US.”¹¹ Other government support included 6 billion yen (\$16.67 million) in low interest loans over a ten year period from the government’s Japan Development Bank and a ban on imports of advanced chips starting in 1966.¹²

When TI threatened to sue Japanese firms that tried to export products using chips that infringed on TI's patents, MITI was forced to come to a compromise with the U.S. giant. A MITI official acknowledged that "MITI had to agree with TI's request for a subsidiary because it needed TI's patents."¹³

The result was that TI was pressured to make a fake joint venture with Sony for a three year period, starting in 1968.¹⁴ Forcing TI into a joint venture allowed MITI to tell other American competitors, such as Motorola and Fairchild, that they had to join with Japanese partners. In fact, MITI arranged for these two U.S. companies to tie up with minor domestic firms rather than Japanese companies that were major sophisticated players. Tying up these major U.S. giants had the desired effect of delaying their serious entry into Japan.¹⁵ In fact the Motorola-Alps joint venture collapsed in 1975 and the Fairchild-TDK joint venture in 1977.

In short, a very stable set of predictable actors—MITI and the same firms that were in the computer and software industries—were the primary impetus behind the emergence of a semiconductor industry in Japan. However, the fortuitous timing of the emergence of the pocket calculator industry in Japan in the early 1970s just at the time that Japanese semiconductor firms needed heavy demand to become competitive, also helped the chip makers get the confidence, economies of scale, and experience necessary to make a big jump into advanced IC memory chips.

iv. The Color Television Industry

The case of the emergence of the color television industry in Japan also highlights the role of major path-dependent factors: a very stable set of incumbent consumer electronics firms, a predictable pattern of government policies aimed at promoting exports and encouraging technological advancement, and weak antimonopoly laws that allowed firms to collude in various ways to gain global market share.¹⁶

The Japanese government passed several laws to promote the industry in the late 1950s and 1960s, and foreign imports were essentially blocked by two laws passed during the Allied Occupation: The Foreign Investment Law of 1949 and the Foreign Exchange and Foreign Trade Control Law of 1950. The industry's emergence was also strongly encouraged by MITI policies that promoted exports and allowed and indeed encouraged cooperative arrangements whereby Japanese firms set color television prices very high at home and below-cost abroad in ways that dramatically increased their share of the U.S. market.¹⁷

Collusion through close trade association ties and each company's control over their final retail prices due to strong distribution keiretsu was critical to this industry's growth. Producers of Japanese television sets held regular monthly meetings from 1964 through at least September 1974, at which they exchanged information and coordinated color television strategy and prices.¹⁸ The companies set domestic and international prices and fixed distributors margins and rebates at these meetings.¹⁹ The prices of exported televisions were set at less than half the price of domestic ones; when caught, the firms argued that the

price gap was due to differences in the quality of the cabinets and various other things such as different commodity taxes, distribution costs, and advertising.²⁰

Ensuring that market share abroad was gained at the expense of foreign firms rather than at each other's expense was a strategy key to the industry's emergence. To assure this, minimum export prices were managed by the Council for the Export of Televisions, and agreements about which producers would supply which dealers, including formal registration of such buyer-supplier relationships, was managed by the Japan Machinery Exporters Association (JMEA).²¹ These two associations also created the 'five company rule', which required that each exporter specify 5 U.S. dealers as its only and exclusive customers. Any changes in the buyer-supplier relationships required approval by the TV Export Examination Committee of JMEA. Member firms were required to notify the JMEA about each specific television shipment, providing information on the buyers and suppliers involved, the type and quantity of televisions, and both the domestic and export price agreed upon.²² These arrangements involved existing actors, but relationships and policies were configured creatively so as to maximize domestic gains at the expense of foreign makers.

This strategic dumping was critical to the emergence of the color television industry in Japan. Over time, it knocked out foreign competitors such as Zenith, General Electric, and RCA.²³ Research suggests that this dumping, though crucial, was only part of the story of the successful emergence of this industry. Technological advances made by Japanese companies, such as using integrated circuits and single circuit boards in their televisions much earlier than American

makers, gave them some key cost advantages above and beyond the benefits accrued by strategic dumping.²⁴ These advances were completed in a MITI-organized and supervised cooperative R&D project on solid state technology for televisions, starting in 1966.²⁵

This quick sketch shows that this industry too emerged out of a relatively stable, predictable configuration of existing public and private sector players, policies, and laws. Research shows that these actors could also rely on a predictable partner—the U.S. government, which up until the 1980s consistently gave higher priority to the U.S.-Japan military alliance than defending American manufacturers that were injured by violations of U.S. trade laws. That is, the U.S. government looked the other way despite clear evidence that Japanese companies were dumping color televisions at below-cost prices; this U.S. policy helped the Japanese industry get enough global market share to survive and ultimately thrive.²⁶

There was some variation in how these actors molded the policies and laws to their advantage, and new organizations to manage dumping were created. However, the emergence of this industry largely follows the pattern in other electronics-related industries in the 1960s and 1970s, such as mainframe computers, software, and semiconductors. Path-dependent factors dominated. The government was heavily involved, the firms were all incumbents in related industries, and they had quite stable relationships with key banks and keiretsu industrial groups.

III. Emergence of High-Tech Electronics Industries since the 1980s: Firms as First Movers or Early Followers

i. Computer Game Software

From the 1980s on, we get many more examples of industries in this high-tech electronics area in which a much greater variety of actors and behavior stimulate the emergence of new industries. One example is the computer game software industry.

The video game business was first launched in the U.S. by two Americans in the 1970s using a Japanese name “Atari”. There was a period of intense battles among the main players that led to a collapse of the industry in the U.S. in 1984, when many Americans ditched their video consoles in favor of cheap home computers. All of the key American players in this industry in the early 1980s—Atari, Mattel, and Coleco—either gave up selling video games, were sold off to another firm, or went bankrupt. This provided Nintendo, a Japanese maker of playing cards and other games, with the opportunity to move into the U.S. market in 1985 with a version of its so-called family computer or “famicom”—the first cartridge-based video game console.²⁷

Nintendo’s actions did not grow directly out of Japan’s existing innovation system. Nintendo had roots as a hanafuda playing card company started in 1887, but its owner, Yamauchi Hiroshi, a descendent of the founder, was very entrepreneurial in taking risks to reinvent the firm and develop core competencies around the emerging video game market. He was a first mover responding quickly to market forces. Nintendo had to get funding through unconventional means because the government and main banks highly favored

loans going to larger firms in strategic industries deemed critical to Japan's long-term economic development. Entry into this business did not require huge up-front investment, government contacts, or keiretsu group support. Characterized by relatively low barriers to entry and relatively short product life cycles, firms had a chance to succeed as long as they could get financing.

In the mid-1970s Yamauchi obtained the right to distribute in Japan the Magnavox Odyssey, an early version of a home video game console, and success with this precursor to video consoles led Nintendo to develop its own video games for use in game arcades. While Sega and NEC tried to get into the market in the late 1980s, and Sega was quite successful in the 1990s along with Sony and its Playstation machine, it was Nintendo that nurtured the emergence of the industry and gained the first mover advantage. It created an open, proprietary standard, which encouraged independent software makers to develop software packages to run on its machines. It reaped the network externalities of the software business, made huge profits, and plowed those back into making more advanced machines and games.²⁸

Cornelia Storz, in her excellent study of this industry, argues that some dominant institutions in Japan's innovation system played a central role in the emergence of this industry, but that elements of the system were configured in novel ways. She points out that game software firms, such as Nintendo, practice lifetime employment, and that the creative combination of dominant institutions as well as peripheral ones were key to the rise of this industry.²⁹

My research on this industry also emphasizes the roles of peripheral institutions and new configurations.³⁰ It also shows that for various reasons, this industry and the firms in it were much less tied to Japan's traditional capitalist system, or what I call communitarian capitalism. This system is characterized by a relatively strong state, lifetime-employment, seniority-based wages, vertical and horizontal industrial groups (keiretsu), and risk-sharing behavior by banks, the government, and firms in ways that intentionally minimize cutthroat competition and thereby support the weak at the expense of the strong. This set of communitarian capitalist arrangements gives high priority to social stability and national autonomy rather than profit. The national innovation system at the core of this business system is dominated by very large firms tied in predictable ways to keiretsu industrial groups, the large banks, and MITI and NTT and their laboratories and related public policy companies.

The game software industry emerged in ways quite detached from this mainstream communitarian capitalist system. This separation is due to various factors that distinguish this industry from computer mainframe hardware and software, telecommunications equipment, memory chips, and the like. These characteristics include the fact that game software companies were generally young firms run by their founders or their descendants, or, as in Nintendo's case, an old company with a completely new product. Firms with tight family control and ownership are much more interested in earning profits than promoting social stability and national technological autonomy, the core objectives of the communitarian capitalist system. Another difference is that the game software

industry was not dominated by foreign firms. Barriers to entry were thus quite low compared to industries such as computer mainframes, semiconductors, and telecommunications equipment, so state assistance was not necessary. Moreover, MITI viewed game software as a luxury, consumption-oriented industry, completely unrelated to the nation's techno-nationalist agenda so would not support it. Thus, firms in this industry were exposed to international competition from the beginning. They were not sheltered by the government and had to win market share abroad to survive. Because this industry was fully exposed to market forces, the firms have been practical in relying on key foreign components, when necessary. Nintendo, for example, used Silicon Graphics of the U.S. to make the central microprocessor in its early consoles, and turned to IBM for the central chip in its Game Cube machine. Sony also turned to IBM for help with the chip for its Playstation.³¹ This acceptance of long-term dependence on foreign suppliers for key components was deemed unacceptable in strategic industries such as computer mainframes and semiconductors.

In short, the emergence of this industry was due to a wide range and varied pattern of factors and players not predicted by a model of path-dependence. Key components of Japan's traditional innovation system, such as government subsidies, government labs, and experienced and diversified firms with deep pockets were not a part of the story of this industry's emergence. There was continuity in terms of reliance on lifetime employment practices, but the firms also actively hired people mid-career. And they drew upon the talents of

a wide range of existing and new peripheral actors in the fields of animation and other visual arts.

ii. Smart Phones

Smart phones—mobile phones that allow e-mail and internet access—first appeared in Japan. This industry emerged from the telecom giant, NTT, the national telephone monopoly, when it was partially privatized and new entrants were gradually allowed into various telecommunications market segments. Despite this dominant role of NTT, the smart phone industry's emergence involved many new domestic and foreign players and various factors outside the mainstream of Japan's innovation system.³²

In the early 1990s NTT was still focused on its monopoly over landlines and various other aspects of the nation's communications infrastructure and did not have high expectations for the mobile phone or smart phone industry. However, due to heavy pressure from Motorola and the U.S. government, the Ministry of Post and Telecommunications (MPT) started to slowly deregulate and allow for the emergence of the mobile phone industry in the late 1980s and early 1990s. MPT allowed in two entrants to compete with NTT. One new entrant was DDI, which used Motorola technology and was backed by Sony and Kyocera; and one was Nippon Idou Tsushin, which was backed by Toyota.

Meanwhile, NTT DoCoMo was started as a division of NTT in 1992 and spun off into a separate company in October 1998 through an IPO. NTT DoCoMo's first president, Oboshi Koji, had the reputation of being very outspoken and individualistic and was appointed president as a type of exile from

the main company to what was considered a less-than-promising division.³³ In 1994, when MPT further deregulated the industry and mobile phones started to take off, President Oboshi turned to young outsiders for help. To develop the i-mode service--e-mail and internet access on a cell phone -- he hired a female editor of the Recruit Corporation's magazine and a Japanese entrepreneur who had received his MBA from Wharton's School of Business.³⁴ Hiring outsiders mid-career and giving a woman major responsibility for the concept of this new industry was virtually unheard of in Japanese industry at the time. The "i" in "i-mode" actually refers to the word "ai" or "love" in Japanese. Oboshi saw this new product as having a huge market among Japanese teenage girls, who felt they had to keep in touch with each other or risk being isolated from their group.³⁵ He thought that a young female leader could best guide the company's efforts to develop contents and functions that would appeal to female teenagers.

I-mode was not a major technological breakthrough; rather its success was due to excellent miniaturization and high quality manufacturing, combined with an innovative marketing strategy and a unique business model that met customers' needs. The strong emergence of this industry was also due to NTT's very high prices for landlines (NTT then charged 72,000 yen or about \$720 US dollars to install a landline), which made it economically rational for young people to have only a mobile phone rather than a landline. The industry's emergence was also spurred by the fact that most Japanese did not have internet access at their homes at the time. Indeed, due in part to the difficulty of typing Japanese characters on a keyboard, Japanese people and firms were slow to buy personal

computers for home and for individual use at the office. Thus, they were very attracted to a service giving them access to e-mail and the internet over the phone, especially in highly dense urban areas where people had long commutes to work and school. Parents' willingness to pay \$100-\$200 in monthly phone bills for their children in the 1990s also was critical in kick-starting demand for this quite expensive service. Initially, it was primarily teenage girls who had smart phones, but by the 2000s they were increasingly used by the entire population.³⁶

In short, the emergence of the smart phone industry in Japan in the 1990s before the rest of the world would not have been predicted by path-dependence theory. While the first mover in this area was an offshoot of NTT, the giant national telecommunications company that became partially privatized starting in 1986, this offshoot was run by an unusual entrepreneur. He hired "outsiders" not part of the NTT group to create a very innovative business model, which led to an explosion of domestic demand for smart phones.

iii. Internet-related Industries

A. Broadband Internet Services: The Softbank Company

NTT was also the first internet service provider in Japan due to its monopoly position over much of the nation's communications market. But it was the Softbank Company that took advantage of a wave of deregulation in the late 1990s and early 2000s to offer low cost broadband internet services.

Softbank is an unusual company owned and run by a maverick entrepreneur, Son Masayoshi. The firm was founded in 1981, when Son, who was born in Japan but is of Korean descent, returned from studying in Berkeley,

California for 6 years. He went overseas in part due to the discrimination he and his family felt in Japan.³⁷ There he started several businesses and patented a few technologies, including one patent that he sold to the Sharp Corporation for \$1 million. This connection with Sharp was indispensable to Son's ability to get a loan to start Softbank when he returned to Japan. He remembers that the staff of Daiichi Kangyo Bank laughed when he applied for a loan without any collateral. But they ultimately gave him a loan based on the recommendation of Sharp's top scientist.³⁸

Softbank originally was in the PC software business but when the internet took off in the 1990s, it was the primary company behind the emergence of the broadband internet service industry. Deregulations starting in the late 1990s and early 2000s that allowed new entrants to freely enter and exit the market and set their own pricing set the stage for the emergence of this industry.³⁹ Son seized on the opportunity to be a first mover in DSL by launching an aggressive price war on broadband services in 2001, cutting monthly fees to half of what they had been and forced NTT to offer its own broadband service.⁴⁰ Softbank's low prices triggered explosive growth in the use of the internet in Japan.

B. Web Portal Business: The Livedoor Company

Another internet-related company, one that contributed to the emergence of a domestic web portal industry, was the Livedoor Company. Horie Takafumi founded a web consulting company called "Livin' on the Edge" in 1996; he grew up in Kyushu and went to the same high school as Son of Softbank. He went to the top university in Japan--Tokyo University. But in a very unconventional move,

he dropped out after a few years to start a company with some friends. This small web consulting company acquired a U.S. internet portal company called Livedoor in 2004, and took its name.⁴¹ Horie listed it on the Mothers market (Tokyo's stock market for start-ups) just after the acquisition in 2004 and entered the portal industry in Japan.

Livedoor was fairly late to enter this business; foreign companies such as Yahoo Japan, MSN, Infoseek and other firms had already gained significant market presence and first mover advantages. To overcome these disadvantages, Horie tried to enlarge his firm quickly through mergers and acquisitions and by boosting its share price by splitting each into 30,000 shares in a three-year period.⁴² He exhibited a wide variety of unconventional behavior, including attempting a hostile takeover of a major television company, suddenly becoming a Liberal Democratic Party candidate for a seat in Japan's Diet or Congress in 2005 (he was unsuccessful), driving around Tokyo in a Ferrari with flashy fashion model girlfriends in tow, and writing a book called "Money is Everything: From Zero to 10 Billion Yen, My Way," a very unusual topic in a society that views excessive money-making as greedy and taboo.

He was arrested in 2006 on accusations of security fraud, found guilty of falsifying the company's accounts and misleading investors, and sentenced to jail.⁴³ While the Livedoor Company and Horie did not survive in the internet industry, his company shows how new actors with unconventional corporate strategies contributed to the emergence of the web portal industry. Horie founded a new company that took over a U.S. start-up and aggressively entered this

relatively new industry. Livedoor did not grow out of Japan's existing innovation system, nor did Horie use traditional ties to enter the industry or nurture his firm. Rather he maneuvered quickly, breaking many taboos, to take advantage of new deregulations in the internet service business as well as in the areas of finance and mergers and acquisitions.⁴⁴

The actions of both Horie of Livedoor and Son of Softbank are examples of how widespread deregulation and the breakdown of many traditional norms in the 1990s and 2000s led to the blossoming of new entrepreneurs, firms, and alliances, leading to the emergence of new industries.

iv. Online Shopping Industry

The online shopping industry in Japan was kick-started by an American firm, Amazon.com, but it was greatly accelerated by a domestic company called Rakuten, which, like Softbank and Livedoor, was founded by an entrepreneur with an unusual background. Rakuten's founder, Mikitani Hiroshi, graduated from a major national university and worked at a mainstream conservative bank. But he had lived in the U.S. for several years as a child and returned there to get his MBA at the Harvard Business School in 1993. While at Harvard he made a lot of contacts in Silicon Valley and started to think about a different future.⁴⁵

He founded what became Rakuten in 1997, using money he raised by calling contacts in the United States.⁴⁶ He studied Amazon and EBay as business models. In the end he created a unique one: Rakuten provides a website where retailers sell their wares; they pay Rakuten for using space on the website. Thus Rakuten, unlike Amazon.com, does not have any inventory.

The online shopping industry was also able to emerge due to various deregulatory changes in telecommunications policies in the 1990s and 2000s, including those that led to a rapid decline in computer prices and internet service fees. These changes helped induce consumers to purchase goods online rather than solely at bricks-and-mortar stores. The success of Mikitani's company was largely because it was one of the first movers domestically, and thus became a recognized brand right away. Mikitani has also led the way in his country toward creating a more globalized firm. Indeed, in 2010 he announced that English would become the company's official language in 2012.⁴⁷

In short, the emergence of the online shopping industry in Japan exhibits a very different set of actors, policies, sources of financial backing, and business models than the industries that emerged during the catch-up stage up until the 1980s. This was a new industry and it required a quite unusual Japanese businessperson, with a strong elite background but also significant overseas experience and contacts, to nurture its development.

IV. Conclusion

While more research on other firms and industries is necessary, this quick overview of the factors involved in the emergence of several electronics-related industries in Japan over the last 50-60 years suggests a few broad conclusions.

First, it appears that at least in high barrier-to-entry strategic industries dominated by foreign firms in which Japan was quite behind, the state and the communitarian capitalist system that heavily shaped the flow of money from banks to firms, hindered the inflow of foreign goods and capital, and encouraged

heavy investment was necessary for their emergence. Indeed, path-dependent factors and institutions such as MITI, NTT, incumbent firms, national labs, main banks, and industrial groups, were critical to the emergence of the mainframe computer hardware, software, and semiconductor industries. There was more variation in how the firms collaborated and strategized in the color television case, but in that industry too path-dependent factors outweighed those elements exhibiting path plasticity. It is very possible that analysis of the emergence of non-strategic industries, especially what the government saw as luxury consumer products during this period—such as cosmetics, fashion, toys, and the like--involved a much greater variation of factors, although this needs to be explored in further studies.

Second, while the government played a critical entrepreneurial role in the catch-up stage of these high tech electronics industries, it hindered the development of new offshoots from these industries from the 1980s on. Once Japan had caught up with the west in these industries, to move ahead and nurture new related industries, it needed more flexible labor and capital markets and more willingness to take risks and accept failure. State targeting no longer worked when the targets were unclear. With a strong wave of deregulation starting in the 1990s, combined with a very stagnant economy and sluggish job market, we started to see more young people with diverse backgrounds such as Son, Horie, and Mikitani take on the heavy risks necessary to create new firms and industries in the electronics sector. Many of these entrepreneurs were backed by foreign investors and had spent significant time abroad where they

were exposed to different norms toward risk-taking and new business models. The government's role receded in many industries it had traditionally managed as it started to realize that it was part of the problem not the solution.

Third, while much more comprehensive research is necessary, it appears that there may be distinct eras of entrepreneurship in Japanese history. Some studies suggest that there was a wave of entrepreneurship in the early Meiji period (1868-1912) and again right after World War II—both times of turbulent political, economic, and technological change. This study has suggested that entrepreneurship and the creation of new firms seem to have stalled during this catch-up stage in the 1960s through the 1980s; and then a more entrepreneur-friendly era once again emerged in the 1990s. Indeed, data shows that in the 1990s and 2000s there has been a clear increase in the creation of new corporations after a quite dramatic decline since the 1950s and early 1960s.⁴⁸ Ulrike Schaeede goes so far as to suggest that the dramatic overhaul of regulations, laws, and corporate strategies between 1998 through 2006 has led to a “New Japan.”⁴⁹

Clearly, Japan has changed significantly in the last two decades, and the emergence of new industries since the 1990s has involved new domestic and foreign actors, reconfigurations of old dominant and peripheral players, as well as a wide range of new and unpredictable forces such as rapid and discontinuous technological change, a dramatic shift toward global outsourcing, the sudden slowdown of Japan's economy, and the rise of China. Still strong continuities in state and corporate institutions and policies work in ways that hinder the

emergence of new industries in Japan today.⁵⁰ While I expect the broader trend toward more path plasticity that is identified in this paper to continue, we may very well find eras of more risk-taking and creative reconfiguration of dominant and peripheral players, as well as eras of less risk-taking and stable players and policies. And a “New Japan” may very well exist alongside an “Old Japan”.

Indeed, according to surveys, the current global great recession appears to be stifling Japanese youth’s ambitions to start new businesses. In a 2000 poll by the Japan Productivity Center of 1,200 new employees, 31% of respondents agreed that “Instead of rising within the company, I would like to start up a business and become independent.” But by 2009, this had plummeted to only 14% of respondents. In 2006, 188 companies offered IPOs, but only 19 went public in 2009. In this same 2000 survey, only 20% of the respondents agreed that “I would like lifetime employment at my current company,” which was sharply lower than in earlier decades. However, in 2009, 55% agreed with that statement. During the early 2000s women started to want to work more, but in a 2009 survey by the Cabinet Office, more women say they want a husband who works while the wife stays at home. Japanese students studying abroad have also plummeted as they have turned inward. In 2009, India and China both sent about 100,000 students each to study in the U.S.; Korea sent 70,000 and Japan under 30,000, a 14% drop from the earlier year. The number of student-aged people in Japan has of course dropped too as the overall population has declined and aged.⁵¹ In short, it is not clear whether the trend toward more new companies,

industries, and mindsets in the 1990s and 2000s will continue to be as significant in the coming decade.

This brief overview of the emergence of several industries in Japan suggests that forces of both path-dependency and path-plasticity play key roles, with the former having greater weight, at least in the high tech electronics-related industries, up until the 1980s and the latter more critical since the 1990s. Further research on a wide range of industries from the Meiji period starting in 1868 up until the present would provide much greater insight into more specific conditions under which these different factors dominate and how they interact to create new industries. A detailed historical study would also help us gain a better understanding of why there appears to be more risk-taking and innovative combinations of actors in some historical periods than in others. It would also be useful to explore whether the broad trends we identify in Japan during and after its catch-up stage are representative of patterns in other late developers, such as South Korea, Taiwan, and more recently India and China.

¹ Cornelia Storz, “The Emergence of New Industries between Path Dependency and Path Plasticity: The Case of Japan’s Software and Biotechnology Industry,” Frankfurt Working Papers on East Asia (October 2009); and Storz, “Dynamics in innovation systems: Evidence from Japan’s game software industry,” *Research Policy*, 37 (2008), p.1480-1491.

² For a detailed analysis of this industry, see Marie Anchooguy, *Computers, Inc.: Japan’s Challenge to IBM*, Cambridge, Ma. Harvard University Press, 1989.

³ Ibid. p.19-20

⁴ Ibid, p.20.

⁵ Half of the cost of the FONTAC project was funded by government subsidies of 350 million yen (\$972,000). The 1966 project, the “Super High-Performance

Computer Project”, was fully government-funded with 12 billion yen (\$33.33 million). Ibid, p.43-53.

⁶ Marie Anchooguy, *Reprogramming Japan: The High Tech Crisis under Communitarian Capitalism* (Ithaca, New York: Cornell University Press, 2005), p.153-54; Anchooguy, “Japan’s software industry: a failure of institutions?” *Research Policy*, v.29, no.3, 2000, p.391-408.

⁷ Anchooguy, *Reprogramming Japan*, chapter 6 on the software industry, p.147-176.

⁸ No clear independent software industry emerged until much later in the 1990s, when Japan’s hardware-software makers, lagging further and further behind the west, decided to unbundle their hardware and software products and adopt international standards such as Windows, while still exploring Linux and other free standards.

⁹ Anchooguy, *Reprogramming Japan*, p.179.

¹⁰ Ibid.

¹¹ Ibid.

¹² Ibid. p.180.

¹³ Ibid.

¹⁴ Marie Anchooguy, “U.S.-Japan Relations and Japan’s Industrial Policy toward its Electronics Sector,” in *Japan and the United States Reconsidered: Evolution of Security and Economic Choices since 1960*, (Washington, D.C.: Economic Strategy Institute, 2002), p.97-98.

¹⁵ Anchooguy, *Reprogramming Japan*, p.180.

¹⁶ Kozo Yamamura and Jan Vandenberg, "Japan's Rapid-Growth Policy on Trial: The Television Case," in *Law and Trade Issues of the Japanese Economy: American and Japanese Perspectives*, Gary Saxonhouse and Kozo Yamamura, eds. (Seattle, Wa., University of Washington Press, 1986), p.238-283.

¹⁷ Ibid.

¹⁸ Anchoroguy, "U.S.-Japan Relations and Japan's Industrial Policy toward its Electronics Sector," p.85-89; Komiya Ryutaro, Takeuchi Hiroshi, and Kitahara Masao, "Katei Denki," in Kumagai Hisao, ed. *Nihon no Sangyo Soshiki*, volume 1 (Tokyo: Chuo Koron Sha, 1978), third edition, p.28; Yamamura and Vandenberg, p.254-5.

¹⁹ Komiya, Takeuchi, and Kitahara, "Katei Denki," p.28.

²⁰ Anchoroguy, "U.S.-Japan Relations and Japan's Industrial Policy toward its Electronics Sector," p.86; *Chogin Chosa Geppo*, April-May 1967, p.101.

²¹ *Denshi Kogyo Nenkan*, 1973, p.752; *Japan Economic Journal*, August 27, 1963, p.10.

²² Yamamura and Vandenberg, p.259; David Schwartzman, *The Japanese Television Cartel, A Study Based on Matsushita and Zenith* (Ann Arbor, Michigan: University of Michigan Press, 1993).

²³ Yamamura and Vandenberg; Schwartzman; and David Yoffie, "Zenith and the Color Television Fight," Harvard Business School case no. 383-070 (Harvard University, 1982).

²⁴ James E. Millstein, "Decline in an Expanding Industry: Japanese Competition in Color Television," in John Zysman and Laura Tyson, eds., *American Industry in International Competition* (Ithaca: Cornell University Press, 1983), p.106-141

²⁵ "Integrated Circuits for Television Receivers," *I.E.E.E. Spectrum*, May 1969.

²⁶ See Anchordoguy, "U.S.-Japan Relations and Japan's Industrial Policy toward its Electronics Sector," p.87-89 for documentation of how the U.S. government worked with the Japanese government to find a political rather than legal or economic solution to the dumping problem in order to minimize a clash with its major defense ally in the Pacific.

²⁷ Anchordoguy, *Reprogramming Japan*, p.163-164.

²⁸ Ibid. p.163-166.

²⁹ Storz, "Dynamics in innovation systems: Evidence from Japan's game software industry," p.1480-1491.

³⁰ Anchordoguy, *Reprogramming Japan*, p.163-166.

³¹ Ibid. p.166.

³² For a detailed history of the emergence and development of Japan's telecommunications industry, see my two chapters on this topic in Anchordoguy, *Reprogramming Japan*, p.66-124.

³³ John M. Ratliff, "NTT DoCoMo and its i-mode Success: Origins and Implications," *California Management Review*, vol.44, no.3 (2002), p.58.

³⁴ Anchordoguy, *Reprogramming Japan*, p.112-115.

³⁵ Ibid, p.115.

³⁶ Ibid.

³⁷ Alan M. Webber, "Japanese-Style Entrepreneurship: An Interview with Softbank's CEO, Masayoshi Son," *Harvard Business Review*, January-February 1992, p. 98.

³⁸ Ibid, p.99.

³⁹ Ulrike Schaeede, *Choose and Focus, Japanese Business Strategies for the 21st Century*, (Ithaca, New York: Cornell University Press, 2008), p.226-230, and Kenji E. Kushida, "Entrepreneurship in Japan's ICT Sector," a working paper presented at a conference for Stanford University's Project on Japanese Entrepreneurship (STAJE), February 26-27, 2010.

⁴⁰ Ibid.

⁴¹ "Capitalism with Japanese Characteristics," *The Economist*, October 8, 2005; "Foreigners blazing trails in IT industry," *The Nikkei Weekly*, August 1, 2005.

⁴² "A New Empire is shaken," *The Japan Times*, January 21, 2006. James Brooke, "Investigation of Livedoor leads to arrest of its founder," *The New York Times*, January 24, 2006, p.C5.

⁴³ Livedoor's value plummeted and it was de-listed from the Tokyo Stock Exchange in April 2006; its remnants were purchased in April 2010 by NHN Corporation, the owner of South Korea's biggest Web search engine. "NHN Said to Acquire Japan Internet Portal Livedoor (update 2)", *Bloomberg Businessweek*, April 2, 2010.

⁴⁴ "A New Empire is shaken," *The Japan Times*, January 21, 2006.

⁴⁵ Stephanie Strom, "Online Overseas; Taking a warlord's advice to shake up the marketplace," *The New York Times*, June 7, 2000, p.H32

⁴⁶ The company was founded in 1997 as MDM Incorporated and changed its name to Rakuten in 1999. Sheryl WuDunn, "The Emperor has no e-mail," *National Post* (Canada), August 31, 1999, p.C15

⁴⁷ "Japan firms demand English proficiency," *The China Post*, July 13, 2010.

⁴⁸ "Trend in number of incorporation registration and company entry and exit rates," chart from *Chusho Kigyo Hakusho*, (Tokyo, Okurasho Insatsu Kyoku, 2008).

⁴⁹ Schaede, *Choose and Focus, Japanese Business Strategies for the 21st Century*, p.1-18.

⁵⁰ Anchoroguy, *Reprogramming Japan*, p.206-234.

⁵¹ "Oh so practical: economic malaise has reversed youthful ambition," *Oriental Economist*, August 2010, p.13-14.