

Industrial Policy, Innovation Policy, and Japanese Competitiveness

Marcus Noland

Abstract

Japan faces significant challenges in encouraging innovation and entrepreneurship. Attempts to formally model past industrial policy interventions uniformly uncover little, if any, positive impact on productivity, growth, or welfare. The evidence indicates that most resource flows went to large, politically influential “backward” sectors, suggesting that political economy considerations may be central to the apparent ineffectiveness of Japanese industrial policy.

Rather than traditional industrial or science and technology policy, financial and labor market reforms appear more promising. As a group, Japan’s industrial firms are competitive relative to their foreign counterparts. Japan falls behind in the heavily regulated service sector. The problems are due less to a lack of industrial policy than to an excess of regulation. Japan may have more to gain through restructuring the lagging service sector than by expending resources in pursuit of marginal gains in the industrial sector.

JEL codes: O3, L52, F13

Keywords: Japan, industrial policy, innovation policy

Marcus Noland, senior fellow, has been associated with the Institute since 1985. He was a senior economist at the Council of Economic Advisers in the Executive Office of the President of the United States and has held research or teaching positions at Yale University, Johns Hopkins University, the University of Southern California, Tokyo University, Saitama University, the University of Ghana, the Korea Development Institute, and the East-West Center. He won the 2000–2001 Ohira Masayoshi Award for his book *Avoiding the Apocalypse: The Future of the Two Koreas*. He is also the author of *Korea after Kim Jong-Il* (2004) and coauthor of *The Arab Economies in a Changing World* (2007), *Industrial Policy in an Era of Globalization: Lessons from Asia* (2003), *No More Bashing: Building a New Japan–United States Economic Relationship* (2001), *Global Economic Effects of the Asian Currency Devaluations* (1998), *Reconcilable Differences? United States–Japan Economic Conflict* with C. Fred Bergsten (1993), and *Japan in the World Economy* with Bela Balassa (1988).

Author’s note: I would like to thank the participants at the Asia Economic Policy Review conference in Tokyo (April 21, 2007) for very useful comments on an earlier draft and Erik Weeks for his exemplary research assistance.

Copyright © 2007 by the Peterson Institute for International Economics. All rights reserved. No part of this working paper may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, or by information storage or retrieval system, without permission from the Institute.

INTRODUCTION

The performance of the Japanese economy over the past two generations is important for two distinct reasons. First and foremost, the economy's extraordinary performance, briefly documented in the next section of the paper, has underpinned a remarkable rise in living standards for the Japanese people. But the economy's performance has had broader relevance beyond Japan as well. Through its colonial history and subsequent contact, Japan deeply influenced the economic institutions and policies of Taiwan and South Korea, two other high-performing economies. Further afield, Japan is sometimes regarded as a model: an example of a country that has derived great benefits from increasing integration with the international economy, without surrendering national autonomy in the economic or cultural spheres, by pursuing industrial policy—defined as the implementation of sectorally non-neutral policies to promote specific industries, products, or activities—and thereby providing a concrete alternative to the “Washington Consensus.” At times, the government of Japan has actively encouraged such emulation, though the deterioration in Japanese economic performance since the 1990s has taken some of the bloom off the rose.

This paper begins with a short overview of Japanese trade and growth performance to establish the historical record. The overview is followed by a brief review of alternative explanations for these outcomes, distinguishing between those that are policy-based (and hence are arguably reproducible) and those that are historically specific to Japan and cannot be easily transferred beyond the Japanese milieu. The final section of the paper addresses the evolution of policy in Japan itself—from “industrial policy” to “innovation policy.”

JAPANESE ECONOMIC PERFORMANCE

Japan's economy grew strongly in the decades following the Second World War, reattaining peak output in most sectors by the early 1950s, partly on the back of the Korean War boom. Its share of world exports rose from roughly 1 percent in 1950, to a peak of nearly 11 percent in 1986, before subsequently declining to 6 percent in 2005 (figure 1). Evaluating Japan's share of world output or production is more problematic due to the difficulties of converting activity in the nontraded sector to common currency terms, but data from the World Bank suggests that Japan's weight in the world economy roughly doubled in the three decades following 1960, reaching 17.5 percent in 1991 then falling over the past 15 years.

Between 1952 and 1989, growth of per capita income, in purchasing power adjusted terms, averaged more than 5 percent a year, slowing to a bit more than 1 percent a year since. A strong rise in basic social indicators, such as life expectancy, accompanied an increase in per capita income. Relative to the United States, purchasing power adjusted per capita income rose from 22 percent in 1950 to around 85 percent in 1991, since receding to 68 percent in 2004.

One can imagine two explanations for this pattern of strong relative performance, at least in the initial postwar period. The first is that the rapid growth of Japan (and its former colonies, South Korea and Taiwan) during the period under consideration reflects unique starting points or historically specific circumstances. The second explanation is that the rapid growth of Japan occurred because of a unique set of policies and practices that are transferable—i.e., “the Japan model.”¹ Before focusing on the role of transferable policies and practices, it is worth considering whether the experience of Japan over the past two generations can largely be explained by particular (and largely irreproducible) historical circumstances. It may be that Japan was “deceptively poor” and much of its outstanding growth performance reflected convergence from a perturbation back to a long-run steady-state growth path.

As seen in table 1, in the 1950s, among the limited number of countries that such data are extant, Japan had the world’s highest ratio of human capital embodied in the workforce to the contemporaneous level of per capita income, presumably because the Second World War destroyed most of the capital stock. The simple observation that Japan was the first country in the world to build a purpose-designed aircraft carrier, in 1922, and went on to develop a variety of effective, if not cutting edge, military aircraft is an indicator of preexisting technological prowess. Table 1 suggests that Japan had a capable population that simply lacked much physical capital with which to work.²

Human capital takes a long time to produce (roughly 12 years of schooling for a secondary school graduate), and once in the labor force, human capital of a particular vintage lasts a long time (perhaps 40 years or more). In contrast, physical capital is subject to relatively rapid accumulation—and scrapping, as newer vintage capital embodying technological progress becomes available. The Japanese invested roughly 30 percent of GDP for several decades. Moreover, if one believes that human and physical capital are complements, in that effective usage of recent vintage physical capital requires skill and/or that high levels of human capital are positively associated with the ability to absorb technological innovations from abroad, then economies with high levels of human capital relative to physical capital are likely to experience rapid rates of total factor productivity growth. In short, Japan was well-positioned for rapid economic growth. At least some of the growth that occurred there simply appears to be an example of neoclassical convergence from an unusual starting point.

1 Alternatively the explanation could be cultural: Something innate about the Japanese predisposes them toward rapid economic growth. Indeed, some commentators have ascribed Japanese performance to cultural markers ranging from Zen Buddhism to *bushido* (McClelland 1961; Morishima 1982). This perspective fails to explain why Japan grew relatively slowly for a long historical period, then grew fast, and now seems to be growing slowly again, unless one posits significant changes in culture—which calls into question the very notion of culture. A more sophisticated version of this argument would focus on institutions rather than culture per se. From this perspective, the strong performance of South Korea and Taiwan can be ascribed to their intimate historical connections to Japan.

2 Not only did the Japanese have a high level of human capital relative to income, abetted by favorable demographics, they accumulated it more rapidly than other similarly situated nations. Moreover, the share of students receiving training in engineering and science, presumably of relative value in the production of industrial traded goods, was high.

Paradoxically, Japan (along with several other high-performing Asian economies) also may have benefited from unusual endowments, specifically a relative lack of natural resources, in two ways. Figures 2 and 3 are projections of labor, physical capital, human capital, and arable land endowments onto a two-dimensional diagram. The average world endowment is represented by the intersection in the center of the triangle of the three rays emanating from its vertices. As one moves closer to the corner of the triangle, that factor's relative abundance increases. For example, in figure 2, it is clear that Japan is very land-scarce (i.e., it is far from the land vertex) and that Japan has a higher capital to labor ratio than South Korea, which, in turn, has a higher capital to labor ratio than Taiwan.

Given their factor endowments, we would expect extremely land-scarce economies, such as Japan, South Korea, Taiwan, Hong Kong, and Singapore, to begin manufacturing activities relatively early in their development (as measured by per capita income) and to specialize relatively intensely in these activities (Leamer 1987). As capital was accumulated, real wages increased monotonically reinforcing backward linkages and contributing to social peace. Under these conditions, industrial policies are effectively “leaning with the wind” and would be expected to be relatively noncontroversial politically.

This relates to the third, and probably irreproducible, initial condition, namely the comprehensive land reforms undertaken by the US military occupation authorities, which could have reinforced backward and forward linkages and encouraged productivity increases in the agricultural sector (Johnston and Kilby 1975). The result was “growth with equity,” and again, this development parallels the experiences of South Korea and Taiwan.

In sum, one could characterize postwar Japan as an economy that had attained a high level of industrial sophistication, undergone a political upheaval, and initially reestablished production in sectors in which it had prior experience. In spite of these achievements and its foray into new industries and activities, Japan remained well behind the technological frontier defined by the United States and was essentially engaged in catch-up along a reasonably well-defined industrial path.

THE ROLE OF PUBLIC POLICY

For expository purposes, explanations of Japan's success in the early postwar period can be divided between those that focus on unique aspects of Japan's private sector organization and those that emphasize public policy.³ With respect to the former, characteristics of labor, product, and capital market organization at the firm and economy levels have been identified as specific institutional innovations that allegedly gave Japan a competitive edge. For example, in the labor market, a package of practices, such as

³ For a good introduction to the private sector bases of Japan's rise, see the volume edited by Yamamura and Yasuba (1987). On industrial policy, see Komiya, Okuno, and Suzumura (1988).

enterprise unions, seniority-based pay, lifetime employment, nonportable pensions, extensive on-the-job training, and continuing formal education provided through the firms, has been cited as contributing to a capable workforce, which was flexibly deployed, facilitating productivity growth. Counterpart arguments with respect to capital market organization emphasize the reputed benefit of the main bank and horizontal *keiretsu*, or enterprise group systems, which it was argued contributed to “patient” capital enabling a farsighted focus on strategic decision making.⁴ In the market for intermediate products and inputs, the vertical *keiretsu* system of affiliated firms has been characterized as a flexible and efficient halfway house between fully vertically integrated firms on the one hand and arm’s-length transactions on the other. Other uniquely Japanese practices have been cited as contributing to out-performance, such as the bonus payment system, which it was claimed contributed to saving and capital accumulation.

In the public policy sphere, beyond the orthodoxy of secure property rights and macroeconomic stability, Japan is sometimes regarded as the exemplar of the developmental state. One can point to a variety of economic justifications for activist industrial promotion policies, most of which have been invoked at one time or another with respect to Japan. Traditionally these rationales have included capturing externalities internal or external to the firm, often couched in terms of “infant industry” or dynamic comparative advantage arguments or compensation for informational, capital market, or coordination failures, that is, “big push” arguments (Okuno-Fujiwara 1988). The possibility of enhancing national welfare either through international rent-shifting (Helpman and Krugman 1989) or altering the terms of trade (Itoh and Kiyono 1987) arises as a distinct justification from strategic trade literature. Hausmann and Rodrik (2003) have argued that the revelation of comparative advantage is dependent on the initiation of actual production in new sectors. Such production involves sunk costs, which the pioneer may not completely recover. The market outcome may therefore embody an underinvestment in experimental forays, creating a justification for public intervention as a precommitment mechanism to achieve the optimal degree of experimentation.

Japan undertook a variety of policy interventions during its rapid growth period. Technological development was supported by direct and indirect production, research and development subsidies, the encouragement of multifirm research consortia, and the discouragement of foreign direct investment in sectors in which it was technologically feasible for Japan to enter (instead encouraging the development of indigenous competence, with the state at times acting as a monopsonist bargaining agent on behalf of local producers with respect to foreign technology licensing agreements, for example) (Borras, Tyson, and Zysman 1986; Goto and Wakasugi 1988).

Capital was channeled to preferred sectors through direct subsidies, indirect subsidies through

⁴ Of course these private sector institutions are not separable from public policy; in the case of the main bank system, policy encouraged financial repression by retarding the development of direct finance and insulating domestic finance from external influences through capital controls and other regulatory restrictions.

state-owned or dominated banks, and preferential tax breaks, such as accelerated depreciation on investments. Figure 4 reports on-budget subsidies from the early 1950s through the early 1980s. The lion's share went to agriculture, forestry, and fisheries (mostly rice farming, in fact). Agriculture and mining accounted for almost 90 percent of on-budget subsidies during this period. Minimal shares of on-budget subsidies went to high-technology development, and a Japanese government study finds that only one manufacturing sector, food processing, received direct subsidies exceeding 0.1 percent of GDP originating in that sector (Saxonhouse 1983).

In the context of a parliamentary system, the pattern of on-budget subsidies presumably reflected the preferences of Japan's elected politicians. However, Japan also had a system of off-budget expenditures with a subsidy element, the Fiscal Investment and Loan Program (FILP), under the control of the Ministry of Finance Trust Bureau, which might be thought of as being less susceptible to political capture by special interests than the elected politicians.⁵ Off-budget subsidies are reported in figure 5. While in comparison to the on-budget subsidies, the pattern of off-budget expenditures exhibits much more variation over time; the industry and technology category was not a major beneficiary, peaking at around 20 percent in 1958 and falling steadily thereafter, dropping below 5 percent in 1972 and never recovering.

One source of indirect subsidies is the public financial institutions that offer loans at rates below the prevailing market interest rate. A second source of implicit capital subsidy is the accelerated depreciation allowed under the tax system.⁶ An indication of the quantitative significance of the implicit capital subsidies is given in table 2, which reports the ratio of the implicit capital subsidy to investment for 14 industries in 1968, 1976, and 1984.⁷ In general, the low interest rate loans were of greater quantitative significance than the special depreciation provisions. With the exception of mining, where investment was weak and the involvement of public financial institutions high, the implicit capital subsidy to investment ratio was low, generally less than 5 percent.

This pattern of expenditure is important, because subsidies are financed by taxes that generate deadweight losses in the taxed sectors. Table 3 presents Japanese sectoral tax data that has been normalized so that a positive number represents a net inflow. For the most part, Japanese manufacturing was taxed

5 Funds for the FILP come mainly from the postal savings system. In addition to financing the activities of public corporations, private sector investments are financed through public financial institutions such as the Japan Development Bank, the Export-Import Bank, and the Housing Loan Corporation.

6 Although some countries allow instantaneous depreciation of new investment, the only method that does not distort profitability of new investment, most require depreciation to be taken over the life of the asset. Insofar as legal asset life and the structure of assets differ among sectors, there may be implicit differentiation among them in the present discounted value of depreciation allowances. In addition, an export-based special depreciation system existed from 1961 to 1972 (Ogura and Yoshino 1988).

7 The implicit subsidy provided through the provision of these low-interest loans has been calculated as the difference between interest rates charged by private and public sector financial institutions multiplied by the amount of government financial institution loans. In the case of the tax provisions, the special tax depreciation can be thought of as an interest-free loan, thus the subsidy value of the special depreciation provisions is the implicit interest burden reduction associated with the loan.

in order to provide subsidies for other sectors (such as agriculture and mining). Again, it is revealing that textiles was the one manufacturing sector that was a significant net beneficiary—a stereotypically large, established, and declining sector. The implicit message is that this pattern of resource transfers was determined by political, not analytical, considerations.

The government also has promoted high-technology sectors through direct subsidies to research and development (R&D) activity, special deductions for R&D costs, and reduced interest burdens through the provision of low-interest loans by public financial institutions.⁸ Tax preferences have been provided through a variety of schemes and were expanded in fiscal year 2003 (Yanase 2003). These programs include an exemption of 10 to 12 percent of expenses and 50 percent special depreciation for R&D facilities.⁹ In addition, there have been direct subsidies to R&D activity, with grant disbursements rising sharply since 2003 (Yanase 2003).¹⁰ Lastly, the provision of low-interest loans by public financial institutions for “financing development of new technology” subsidized private R&D. A number of government-supported institutions provide indirect support to R&D activities. These institutions include national and public research institutes, private nonprofit research organizations, special public corporations, and the mining and manufacturing technology research associations, such as the Very Large Scale Integration Research Association.

In quantitative terms, the direct subsidies are the most important component of government R&D support, about twice as large as the tax provisions in most years. Implicit subsidies through the provision of low-interest loans have been relatively unimportant; government support for research organizations is approximately as large as direct subsidies. Assessing the sectoral pattern of support is difficult. Some direct subsidies from the government, public corporations, and special R&D tax deductions are reported only at the aggregate level. Sector-specific indirect support through the research associations is difficult to ascertain, partly because individual associations frequently encompass more than one sector and partly because the budgets of these organizations include private, as well as government, funding.

Table 4 reports data on the government subsidy share of total R&D expenditures. These figures show government support of R&D activities is low, with total government support, allowing for nonsubsidy financing, certainly less than 5 percent of private R&D expenditures for the economy as a whole and far less than the comparable figure for the United States. If one looks at individual sectors, government

8 See Harayama (2001) for a history of Japanese technology policy.

9 There are special depreciation provisions for the purchase of specified high-technology products. Additional tax incentives exist for the use of these products by small businesses. High-technology capital goods' producers have been further assisted by the Japan Development Bank and Small Business Finance Corporation funding, including the establishment of special leasing corporations to encourage the leasing of these products, especially by small firms.

10 The most important channel in quantitative terms has been the system of research contracts on large-scale industrial technology R&D established in 1966. Of particular significance were subsidies to promote the development of computers in the 1970s and research contracts on next generation industrial technology, including new materials, biotechnology, and new electronic devices, in the 1980s.

R&D, as a share of total R&D, is by far the highest in the declining mining industry. After mining, support has been highest in the energy-related sector of petroleum and coal products and, as in the case of the capital subsidies, the transportation equipment industry, which includes aerospace. But outside these sectors, the value of public support has been 2 percent or less of overall R&D expenditures in recent years.

Government procurement is another channel through which the government of Japan could seek to tilt the playing field. Bergsten and Noland (1994), for example, calculated that if in 1990 Japanese public entities exhibited the same purchasing patterns with respect to supercomputers produced by Japanese and US firms (the only non-Japanese producers) as did purchasers in the EU market (the only third market), US producers would have increased their sales by \$30 million annually, supporting nearly \$5 million in additional R&D.¹¹ Similar, and quantitatively larger, results were obtained for public procurement of nonsupercomputers.

In addition to direct and indirect subsidies, preferential access to capital, and preferences in public procurement, promoted sectors were at times sheltered from internal competition by lax competition policies and from external competition by restrictions on international trade and investment, in effect creating “bastion markets” in which protected incumbent producers extracted rents from domestic consumers (Porter and Sakakibara 2004).¹² Informal administrative guidance augmented these formal policies.

Taken together one can interpret these policies as comprising a coherent package of targeted industrial upgrading in which the government established priorities, encouraged the accumulation of technical capacity in targeted sectors, pushed resources into private firms operating in those sectors, and encouraged the accumulation of additional rents by local incumbents to provide them with a financial cushion to support entering new product and geographical markets. The question is whether this strategy delivered more rapid growth or improved welfare in reality than what would have been observed counterfactually under a more orthodox policy mix.

Numerous case studies of various industries, projects, and initiatives exist, reaching a predictably indeterminate and contradictory set of conclusions. The case studies have the advantage of unearthing considerable institutional detail of interest (for example, how Japanese firms behaved strategically in their participation in government-led consortia, which counted actual or potential rivals among the participants), but by their very nature, the case studies are limited in their ability to pose counterfactuals (cf.

11 The same calculation found that the US government appeared to discriminate reciprocally against Japanese supercomputer producers in its procurement decisions.

12 Despite the long-running controversies about the nature of Japanese trade policy the empirical record is remarkably weak. The most commonly cited data on effective rates of protection (ERPs), Shouda (1982), were computed exclusively on the basis of tariff data and do not take into account Japan's explicit quantitative restrictions in agriculture, much less other nontariff barriers, and ignored explicit subsidies as well. (See Noland [1997] and Fukao, Kataoka, and Kuno [2004] for more complete discussions of nontariff barriers.) With these caveats, Shouda's results portray a general fall in rates of protection over a 20-year period. Barring a dramatic increase in nontraditional protection, a distinct impression of a gradual liberalization in most manufacturing sectors emerges.

Baldwin and Krugman 1988; Flamm 1996).

Counterfactuals are more easily posed in the context of formal models, and a number of researchers have attempted to model the impact of industrial policy on output, trade, and welfare in a cross-industry framework.¹³ A number of studies use regression models to examine the impact of industrial policy interventions either on total factor productivity (TFP) growth at the sectoral level (Beason and Weinstein 1996; Lawrence and Weinstein 2001) or on the international terms of trade (Noland 1993).¹⁴ These studies do not uncover any consistent evidence that industrial policy interventions raised TFP or captured strategic sectors—indeed, their results could be read to suggest that industrial policy interventions actually slowed productivity growth. Studies that focus on public support for basic R&D have tended to reach more benign conclusions (Noland 1996; Branstetter and Sakakibara 2002).

It is more difficult to assess the impact of informal policies, if for no other reason than that they are less amenable to formal modeling. For this reason, better descriptions of the workings of the industry councils and the process of setting targets should be developed. Better accounts of the penalties and rewards used to encourage adherence to informal guidance also should be developed. The one study that attempted to model the impact of administrative guidance, Weinstein (1995), finds that administrative encouragement of cartels had only a minor impact on prices, margins, and sectoral resource allocation during the period 1957–88. Sakakibara and Porter (2001), who examine the impact of tolerance of cartels on domestic competition and international trade performance, interpret their results (cartels are negatively associated with domestic competition which, in turn, is positively associated with international competitiveness) as undercutting what they perceive as the conventional wisdom that industrial policy has promoted Japanese competitiveness.

Lastly, it should be noted that this discussion has focused on issues relating to cross-sectoral resource allocation. Some argue that Japanese policy has had a “pro-producer” bias and that this may have contributed to Japan’s growth performance by increasing incentives to save, providing Japanese firms with a ready supply of low-cost capital.¹⁵ This argument is seldom, if ever, formalized however. While it has some surface plausibility, it is hard to square with the life cycle hypothesis, and research on Japanese saving behavior has not uncovered links between industrial policy and national saving.¹⁶ However, an interesting paper by Yano (2001) demonstrates that in a dynamic two-country model, lax competition policies

13 Lee (1993) examined the impact of industrial policy using a computable general equilibrium model. Unfortunately, the high degree of aggregation (only three traded goods sectors) and the calibration assumption (industrial policy in the 1950s had no impact) render his results suspect.

14 Noland (1997) obtained more ambiguous results for a more detailed menu of Japanese trade policies. Audretsch and Yamawaki (1988) investigated the impact of industrial policy by including a dummy variable for “favored industries” in a regression on US-Japan bilateral trade. The coefficient was significant with the expected sign.

15 A largely closed capital account up through the mid-1980s facilitated the maintenance of a pool of captive saving, though this is not absolutely necessary if there is home bias in portfolio allocations.

16 On this point, see Balassa and Noland (1988, chapter 4), and Horioka and Watanabe (1997).

with respect to the nontraded sector of a large trade surplus economy can act as a “beggar-thy-neighbor” policy, shifting real income to itself from its trade deficit partner.

In sum, while it is relatively easy to document the impact industrial policy interventions had on the composition of output and trade (i.e., resources were indeed being shifted), attempts to formally model the impact of industrial policy interventions uniformly uncover little, if any, positive impact on productivity, growth, or welfare. This is perhaps surprising given the theoretical potential for welfare enhancing interventions, the conventional view that the Japanese government intervened in a constructive way, and the evident growth performance of the economy over the relevant period. The question why this might be the case immediately arises.

THE POLITICAL ECONOMY OF INEFFECTIVENESS

Why would policymakers consistently intervene in ways that did not apparently enhance welfare? One possible answer is that the informational requirements for successful industrial policy interventions are not trivial and that policymakers simply did not get the interventions right. At the simplest level, industrial policy interventions must be calibrated—it is possible to tax or subsidize too much as well as too little, for example, and interventions may have to be adjusted to changing circumstances—perhaps in response to retaliation by a trade partner, for instance. But this is not solely an analytical issue: For an industrial policy to be successful, the political system has to actually deliver the desired policy. One can imagine a variety of sources of implementation failures, from simple lack of administrative capacity to the inability to resist rent seeking by vested interests, undermining a well conceived policy.

Industrial policy intrinsically supports some sectors to the detriment of others. It would seem plausible that this principle would be manifested in competition among sectors and among their bureaucratic counterparts. Within ministries, the bureaucratic hierarchy can ensure plan consistency, with conflicts resolved through conventional means. Ensuring consistency between plans of different ministries in Japan has been far more problematic.

Indeed, conflicts between competing ministries are a recurrent feature of Japanese politics. One example would be the perennial clashes between the Ministry of International Trade and Industry (MITI) (or its successor, the Ministry of Economy, Trade, and Industry [METI]) representing the interests of the electronics firms and the Ministry of Posts and Telecommunications (MPT) (or its successor, the Ministry of Public Management, Home Affairs, Posts, and Telecommunications) representing the interests of Nippon Telegraph and Telephone (NTT).¹⁷ Inevitably the desire of the electronics firms to seek telecommuni-

¹⁷ To cite one example, in 2001 Japan undertook a number of telecommunications reforms. Nevertheless, the principal theme of METI's 2001 White Paper—which was released after the telecom reforms were enacted—was the need for further reform of the telecom sector—the purview of another ministry.

cations reform to encourage the growth of electronic data transmission and other activities that could be expected to increase demand for electronic equipment, such as computers, is at issue. The result of these disputes can be protracted periods of uncertainty and policy paralysis until the interministerial conflict is resolved. One could interpret the results reported above that policy interventions were not welfare enhancing, as evidence of a lack of overall policy coherence.¹⁸ Ramseyer and Rosenbluth (1997) argue that Japanese industrial policy can best be understood as a product of self-interested political actors.

Sectoral promotion policies can be applied to any sector of the economy, including agriculture or services, though typically one thinks of industrial policy in terms of manufacturing, particularly the most advanced technology sectors within manufacturing. Clearly, Japan pursued selective intervention policies to promote preferred high technology sectors. But an examination of the pattern of direct and indirect subsidies suggests that resource transfers were worse than indiscriminate: They went predominantly to politically organized, declining natural resource sectors. Imai (2006) found that loans from government banks were systematically higher in prefectures represented by senior or electorally vulnerable Liberal Democratic Party (LDP) incumbents.

Such policies had two unfortunate side effects. First, corruption was encouraged by the policy-instigated creation and distribution of rents. Second, financial sector repression and directed capital policies encouraged a bureaucratization of the banking function, abetted by the fact that the relevant industrial firm borrowers were largely following a technology path established by the United States and other advanced countries, which simplified management decisions. As a consequence, bankers did not develop the necessary skills to evaluate alternative business plans and models. While it would be a mistake to blame Japan's banking problems and their massive clean-up costs on selective intervention policies, the industrial policy legacy contributed to the financial sector's difficulties. Similar arguments can be made with respect to South Korea and Taiwan.

This is not to say that Japan did not support the development of supercomputers or other high-technology products and sectors. It did. However, the fundamental pattern was to tax manufacturing, transferring resources to agriculture, mining, and possibly uncompetitive service sectors, and recycle a relatively small share of those revenues in industrial promotion expenditures. The industrial policies on which we normally focus amounted to partially compensatory policies in the context of a system in which the manufacturing sector was taxed on a net basis.

Thus the empirical evidence reviewed here uncovers no firm evidence that industrial policy was welfare- or growth-enhancing in the era after the immediate postwar reconstruction period. The apparent failure of policymakers could be due to their inability to identify market failures and design appropriate

¹⁸ An important question is whether the government can coordinate its incentives across ministries. Could, for example, bureaucrats threaten recalcitrant firms with retribution through actions, say, tax harassment or exclusion from government procurement, which are the purview of another ministry? Put differently, is the game firm vs. ministry, or firm vs. government?

interventions. However, industrial policies by their very nature involve the distribution of rents, which is an inherently political activity. The evidence that most resource flows went to large, politically influential “backward” sectors suggests that political economy considerations may be central to the apparent ineffectiveness of Japanese industrial policy.

MISSIONARY ACTIVITY

This conclusion—that Japan succeeded in spite of, not because of, industrial policy interventions—is far from universally accepted, most importantly by the government of Japan itself. Ironically, at roughly the moment Japan was entering a protracted period of relative decline, the Japanese government began a push to promote Japanese policies and practices as a model for emulation. In the late 1980s and early 1990s, Japan undertook a variety of initiatives to promote the “Japan model” both within Asia and globally. Within Asia these steps took the form of training and exchange programs aimed at rising policymakers in the ministries of Asian governments; a 1987 MITI proposal, the New Asian Industries Development Plan (aka “the Japanese brain”) for Tokyo to coordinate industrial policies across Asia; and the 1997 establishment in Tokyo, not Manila, of the Asian Development Bank Institute, a think tank charged with formulating an alternative development paradigm. These initiatives were supported by rising volumes of official development assistance (ODA) predominately directed towards Asia (figure 6).

At the global level, Japanese officials expressed uneasiness with the ideological basis of staff work at the international financial institutions (IFIs) and the notion of policy conditionality and undertook a number of actions aimed at reorienting the ideological basis of policy at the IFIs.¹⁹ For example, Ministry of Finance (MOF) cosponsored seminars with the International Monetary Fund (IMF) in which Japanese representatives promoted the virtues of state-led capital channeling to developing-country policymakers. Japanese officials were highly critical of the World Bank’s 1991 *World Development Report*, which emphasized the advisability of relying on market mechanisms to spur growth; the Overseas Economic Cooperation Fund (OECF) issued a rebuttal, “Issues Relating to the World Bank’s Approach to Structural Adjustment: Proposal from a Major Partner,” which criticized what it regarded as the Bank’s free-market orthodoxy and which pushed industrial policies and capital channeling as an alternative. It then underwrote the research that yielded the controversial *East Asian Miracle* study (World Bank 1993).²⁰

19 See Rodrik (1994), Terry (1995, 2002), and Wade (1996) for further discussion.

20 It is notable that the Japanese government underwrote “the East Asian Miracle,” not “the Japanese Miracle.” This could be interpreted as typical Japanese diffidence; in 1997 Japanese officials initially tried to portray the Asian Monetary Fund proposal as coming from Thailand, not Japan. Alternatively, this decision could be interpreted as the product of a strategic calculation that Japanese interests would be maximized if the argument in favor of Japanese-style policies were broadened beyond Japan per se. Some officials reportedly were angered by the report’s emphasis on Southern tier economies such as Singapore, Thailand, Malaysia, and Indonesia, over former colonies South Korea and Taiwan, which hewed more closely to Japanese policies and practices.

Yet it is hard to escape the conclusion that the effectiveness of such appeals have waned in the face of relatively poor performance in Japan, falling volumes of ODA, and the rise of China. Today, leaders of developing countries more often point to South Korea and Taiwan, rather than Japan, as models of the developmental state to be emulated.²¹

FROM INDUSTRIAL POLICY TO INNOVATION POLICY

The Japanese economy appears to have reached a turning point in terms of relative economic performance around 1990, reflecting two forces (figure 1). One force was the long-term challenge posed by the disappearance of opportunities for easy technological catch-up as the country approached the international technological frontier. Japan's catch-up had been based on a model emphasizing lifetime employment and skills development within the firm, combined with a steady infusion of capital via a repressed and bureaucratized banking system, and marginal improvements in competitiveness either through process innovation-based cost reduction or incremental increases in product differentiation. Across the spectrum of innovative activity, Japanese comparative advantage was clearly in process innovation, which was relatively easy to manage, followed by applied research, and lagging in basic research, which required both more fixed investment and arguably more nuanced management. The disappearance of straightforward paths for industrial upgrading, based on imitating the prior trajectories of more advanced economies, put a heightened premium on the ability of corporate managements and their financiers to discern emerging profit opportunities. Overlaid on top of these secular trends were a series of macroeconomic policy errors in the late 1980s and 1990s that retarded growth.

The old development strategy not only was increasingly obsolete but also environmental changes were increasingly depriving Japanese policymakers of their ability to implement it using traditional policy tools. Capital channeling became more difficult as the domestic financial sector was liberalized and international capital controls were gradually removed beginning in the mid-1980s. Japan came under increasing pressure from the United States bilaterally and multilaterally through tightened World Trade Organization (WTO) rules to abandon some of the practices that had allegedly contributed to the formation and maintenance of "bastion markets" (Noland and Pack 2003). Slow growth forced adjustments in private sector practices, such as lifetime employment (which is an important basis for firm-based training), and the maintenance of cross-shareholding by *keiretsu* affiliates, which were significantly unwound. In short, for the past two decades, Japan Inc. has been a system under multiple stresses, slowly evolving into something appearing less institutionally distinct from other large industrial economies.

²¹ See, for example, the comments of Uganda's Yoweri Museveni (Richard Stevenson, *New York Times*, June 2, 2002) and Ethiopia's Meles Zenawi ("FT interview: Meles Zenawi, Ethiopian prime minister," *Financial Times*, February 6, 2007).

As Japan has approached the global technological frontier there is concomitant imperative to formulate policies and practices to meet these new challenges, yet the weakening of one system in and of itself does not constitute the creation of a viable alternative. The past emphasis on firm-specific knowledge and the relative neglect of national educational and research institutions contributed to a situation in which links to international innovative activity were demonstrably weak. Evidence suggests that both TFP and the efficiency of R&D expenditures slowed over the 1990s. These findings were particularly true in the relatively backward service sector, which accounted for increasingly large shares of innovative activity in the United States and Europe (Fukao and Kwon 2005; OECD 2006).

To paraphrase the Organization for Economic Cooperation and Development (OECD), there are five characteristics of a successful innovation system: strong industry-science linkages to facilitate the commercialization of scientific advancement; significant cross-border real-side economic linkages, given that most innovation originates abroad and may be embodied in foreign products or processes; a solid science base in institutions of higher education and research; entrepreneurship supported by an institutional environment encouraging risk taking; and appropriate framework conditions to encourage innovation and diffusion. On nearly all of these criteria, Japan lags other industrial countries, in some instances quite badly.

Regardless of commonly cited statistics such as the dearth of Japanese Nobel laureates and more recently, the decline in Japan's rank in international comparisons of student achievement, it is hard to argue that Japan's basic educational base is weak in the face of technological innovation over a sustained period. Rather, it is typically argued that the educational system does not foster creativity, and instead encourages a narrow focus and "teaching to the test" with respect to secondary school and university entrance examinations. One can say with greater confidence that Japan's relative educational advantages over the rest of the world and share of Japanese graduates in science and engineering are declining (i.e., it is becoming less human capital abundant).

Moreover, in the national university system it is still not possible to charge salaries to research grants. As a consequence, Japanese university professors continue to teach and do committee work, reducing both incentives to seek grants and their research effectiveness when they receive them. However, a recent change in regulations now allows universities to charge overhead against grants, contributing to the development of a research infrastructure, as well as giving the universities an incentive to encourage their faculty to seek grants.

Despite the historical use by Japanese corporations of academic specialists for in-house training, there is little professional mobility between academia, the private sector, and the public sector (including public sector laboratories and research institutions). Survey evidence suggests that pension formulae that include a significant lump-sum bonus upon retirement reward continuous service, and lack of portability

is the single biggest impediment to movement (OECD 2006). As a consequence, it appears that less professional cross-fertilization occurs in Japan relative to other industrial economies, with the important caveat that simple measures of job mobility do not capture consulting relationships that may fulfill the same purpose.

In some sense this is simply a particular manifestation of more general problems of inflexibility in the labor market, which appear to be particularly important in the highly regulated service sector. Labor regulations that effectively grant lifetime tenure to “regular” employees, as well as mandating a hire or fire decision for temporary fixed-contract employees, discourages flexible movement in the service sector. In terms of cross-border exchange specifically, Japan scores the lowest in the OECD in terms of penetration by foreign affiliates in the manufacturing and services sectors, which are a vector of technology transfer that may have significant spillover effects in Japan (Branstetter and Kwon 2004; Fukao and Kwon 2005; Kiyota 2006; Todo 2006). It is particularly a problem in the highly regulated service sector where productivity lags global best practices by a considerable margin.

Among OECD members, Japan exceeds only South Korea in the share of highly skilled foreign workers in its labor force and is at the bottom of several indicators of cross-border R&D linkages (OECD 2006). One can argue that European countries will quite naturally score higher on such indices given their smaller economic size and physical proximity and that culture conveys natural advantages to the English-speaking countries on such indices. Nevertheless, the picture that emerges is one of a relatively isolated Japanese national innovative complex.

Japan also lags with respect to supporting entrepreneurship, scoring badly in analyses of the existence of opportunity-driven entrepreneurship and firm start-up (Reynolds et al. 2004), and the institutional environment for entrepreneurship appears relatively weak. Entrepreneurial activity is associated with populations with large shares of young adults. A supportive cultural context in which entrepreneurship is valued and regarded positively (as measured by survey responses and local media coverage) is associated with greater entrepreneurship, but personal networks and contacts have an even larger impact—people who know entrepreneurs are significantly more likely to become entrepreneurs themselves. Entrepreneurship is correlated with both past and future income growth rates, though the persistence of entrepreneurship indices from year to year suggests that the cross-country incidence of entrepreneurship is not driven purely by the pattern of macroeconomic shocks. Indeed, there is also a set of structural or institutional correlates that would appear to represent implicit and explicit opportunity costs associated with involvement in a new business, including the level of public-sector employment (possibly representing the availability of low-risk employment), collected tax revenue, employer contributions to social security, and total social security costs. All of the size of government or government burden indicators are negatively associated with entrepreneurship, with the employer’s social security costs having the largest negative

impact on “opportunity” start-ups. These correlations suggest that there is an economic calculus as well as a purely demographic component to the indices (Noland 2005). On the macroeconomic correlates, Japan does not look so bad. But the aforementioned labor regulations may play an equivalent role in terms of assuring low-risk employment, as well as discouraging the establishment and growth of start-ups.

In addition to these impediments to entrepreneurship, the absence of supportive capital market conditions may have an impact as well: Among OECD countries Japan exceeds only Slovakia in venture capital investment as a share of GDP, and the portion of venture capital going to high-technology sectors is only half the OECD average (OECD 2006). This evidence underscores that resolution of Japan’s long-standing problems in its financial sector could have considerable real externalities that may not be fully appreciated. Regulatory barriers further impede innovation, particularly in service sectors such as health care which may be characterized by considerable scope for innovation and productivity increase. One positive note in this regard is that in cases in which restrictions have been removed, the supply response has been appreciable (Bergsten, Ito, and Noland 2001). Further research is needed to disentangle how much of Japan’s weak performance with respect to entrepreneurship reflects unfavorable demographics, public policy, and possibly uniquely Japanese considerations.

Reflecting its history as a technological follower playing catch-up, Japan’s legal framework for encouraging innovation and diffusion still appears to put a greater emphasis on diffusion, with the patent system acting as a mechanism for propagating innovation rather than ensuring appropriability (Bergsten and Noland 1993; Cohen et al 2002). While this may be vexing for innovators, this may not be a bad arrangement from an economy-wide or social standpoint. In any event there appears to be scope for improving the efficiency of the system: The wait for patent examinations now exceeds two years, and METI has established a goal of getting waiting times under one year by 2013.

More broadly, the Japanese government has recognized the inadequacies in the national innovation system and put forward a series of initiatives to address these challenges. In 1995 the Science and Technology Basic Law reformed the way science and technology policy was implemented, emphasizing cooperation among national universities, public research institutions, and the private sector, as well as recalibrating support across basic research, applied research and development, and training (Hatayama 2001). A series of five year plans were subsequently formulated. In 1999 METI began reformulating laws and policies supporting innovative activities in small and medium enterprises (SME).

These are positive developments, but the pay-off depends importantly on reform of the policies and practices of the line ministries. For example, METI, which controls one-sixth of public support for R&D, continues to emphasize targeting specific sectors for promotion in its “New Industry Promotion Strategy,” either judging that market forces are insufficient to direct resources into the appropriate activities or reflecting simple political capture and the particularistic bureaucratic and personal incentives to continue the promotion of specific sectors.

There are also concerns that some proposals to encourage innovation are being degraded as they are transformed into regional development initiatives (sometimes justified as promoting “clusters”). Such an occurrence would be completely consistent with Japan’s highly unbalanced pattern of regional development and the historic use by hinterland politicians of the national budget for constituent services. Ironically, the Uruguay Round changes to the WTO subsidy rules actually encourage this phenomenon insofar as regional development expenditures constitute one of larger loopholes in the tightened subsidies code (Noland and Pack 2003).

Nevertheless, a number of other developments offer the prospect of encouraging the commercialization of innovative activities. In some sense Japan has gone from capital channeling via policy intent to capital channeling via private lender risk aversion. Progress in financial sector reform should increase the availability of risk capital for investment, as should expanded preferential tax treatment for venture capital (Yanase 2003).

Changes in the legal status of national universities and public research institutions, including the establishment of technology licensing organizations and the clarification of the legal status of patentable innovations produced by faculty at national universities, should encourage university-business start-ups. Yet as long as salaries cannot be charged against grants, one wonders if the relevant constraint has been relaxed. Motohashi (2004) provides evidence that university-industry collaborations have begun to diffuse to SMEs, where they could have particularly high pay-offs, though Branstetter and Kwon (2004) provide a more skeptical evaluation.²² Enhanced pension portability should contribute to greater employment mobility and cross-fertilization across private sector firms, universities, and public sector research institutions.

CONCLUSION

For approximately four decades following the Second World War Japan achieved unusually rapid growth and development, but since roughly 1990 it has experienced a protracted period of relative decline. The latter development reflects macroeconomic policy errors, compounded by the difficulty of transitioning from a strongly state-influenced model of economic development geared toward catch-up to a more market-driven decentralized approach more appropriate to Japan’s current position on the technological frontier.

In response to these changing demands and adjustment to a slower growth environment, distinctively Japanese private sector institutions and practices have begun to erode. In the public sphere, the impact of industrial policies is disputable: While it is clear that selective interventions affected the composition of output, it is less clear that these policies were welfare-enhancing. The pattern of interventions

²² See also Kodama and Suzuki 2006.

appears to have been largely determined by parochial politics in which large, declining sectors exerted disproportionate influence.

Effective or not, since the mid-1980s the ability of Japanese economic policymakers to employ their traditional instruments of industrial policy has been increasingly circumscribed by changes in the domestic and international environment. Ironically, this period coincided with a push to propagate the “Japan model” regionally and globally, an effort that has faded in the face of relatively poor Japanese economic performance, stagnant aid budgets, and the rise of China.

Yet the erosion of one system does not constitute the formation of a coherent alternative, and Japanese policymakers have cast about for alternatives. Today, at the technological frontier, with demographics that put an increasing premium on raising productivity, Japan faces significant challenges in encouraging innovation and entrepreneurship. One can conceptualize this process as encouraging innovation in emerging sectors or activities, while at the same time terminating practices that discourage productivity increases in existing activities. Fortunately the government is cognizant of this issue and has begun to rectify the situation. Significant factors determining outcomes in this arena that lie beyond the traditional concerns of industrial or science and technology policy may be less appreciated. Financial sector reform, for example, could have a considerable impact on the availability of capital to underwrite the commercialization of innovative activity. Changes in labor market regulations could have an equivalent impact in the labor market.

However, the industrial firms of the Japanese traded goods sector are generally competitive relative to their foreign counterparts. Where Japan falls behind is in a limited number of protected sectors, such as food processing and the heavily regulated service sector. The problems of these sectors appear to be due less to a lack of industrial policy than to an excess of regulation, particularly with respect to entry. If the government cannot pick winners, it could at least stop protecting losers. In this regard, the government is making progress, though the adequacy of current initiatives to address Japan’s competitive challenges remains to be seen.

In short, Japan may gain more by restructuring the lagging service sector than by expending resources in pursuit of marginal gains in the industrial sector.

REFERENCES

- Audretsch, David B., and Hideki Yamawaki. 1988. R&D Rivalry, Industrial Policy, and U.S.-Japan Trade. *Review of Economics and Statistics* 70: 438–47.
- Balassa, Bela, and Marcus Noland. 1988. *Japan in the World Economy*. Washington: Institute for International Economics.
- Baldwin, Richard E., and Paul R. Krugman 1988. Market Access and International Competition: A Simulation Study of 16K Random Access Memories. In *Empirical Methods for International Trade*, ed. Robert Feenstra. Cambridge, MA: MIT Press.
- Beason, Richard, and David E. Weinstein. 1996. Growth, Economies of Scale, and Targeting in Japan (1955–1990). *Review of Economics and Statistics* 78, no. 2: 286–95.
- Bergsten, C. Fred, and Marcus Noland. 1993. *Reconcilable Differences? United States–Japan Economic Conflict*. Washington: Institute for International Economics.
- Bergsten, C. Fred, Takatoshi Ito, and Marcus Noland. 2001. *No More Bashing: Building a New Japan–United States Economic Relationship*. Washington: Institute for International Economics.
- Borrus, Michael, Laura D’Andrea Tyson, and John Zysman. 1986. Creating Advantage: How Government Policies Shape International Trade in the Semiconductor Industry. In *Strategic Trade Policy and the New International Economics*, ed. Paul R. Krugman. Cambridge, MA: MIT Press, 99–114.
- Branstetter, Lee, and Hyeog Ug Kwon. 2004. *The Restructuring of Japanese Research and Development: The Increasing Impact of Science and Technology on Japanese R&D*. RIETI Discussion Paper Series 04-E-021. Tokyo: Research Institute of Economy, Trade, and Industry.
- Branstetter, Lee, and Mariko Sakakibara. 2002. When Do Research Consortia Work Well and Why? Evidence from Japanese Panel Data. *American Economic Review*, 92, no.1: 143–59.
- Cohen, Wesley M., Akira Goto, Akiya Nagata, Richard R. Nelson, and John P. Walsh. 2002. R&D Spillovers, Patents, and the Incentives to Innovate in Japan and the United States. *Research Policy*, 31, no. 8–9: 1349–67.
- Flamm, Kenneth. 1996. *Mismanaged Trade? Strategic Policy and the Semiconductor Industry*. Washington: Brookings Institution.
- Fukao, Kyoji, Goushi Kataoka, and Arata Kuno. 2004. *How to Measure Non-Tariff Barriers? A Critical Examination of the Price-Differential Approach*. RIETI Discussion Paper Series 04-E-015. Tokyo: Research Institute of Economy, Trade, and Industry.
- Fukao, Kyoji, and Hyeog Ug Kwon. 2005. *Why Did Japan’s TFP Growth Slow Down in the Lost Decade?* RIETI Discussion Paper Series 05-E-005. Tokyo: Research Institute of Economy, Trade, and Industry.

- Goto, Akira, and Ryuhei Wakasugi. 1988. Technology Policy. In *Industrial Policy of Japan*, ed. Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura. San Diego: Academic Press, 183–204.
- Harayama, Yuko. 2001. *Japanese Technology Policy: History and New Perspective*. RIETI Discussion Paper Series 01-E-001. Tokyo: Research Institute of Economy, Trade, and Industry.
- Hausmann, Ricardo, and Dani Rodrik, 2003. Economic Development as Self-Discovery. *Journal of Development Economics* 72: 603–33.
- Helpman, Elhanan, and Paul R. Krugman. 1989. *Trade Policy and Market Structure*. Cambridge, MA: MIT Press.
- Horioka, Charles Yuji, and Wako Watanabe. 1997. Why Do People Save? A Micro-Analysis of Motives for Household Saving in Japan. *Economic Journal* 107: 402, 537–52.
- Imai, Masami. 2006. Political Determinants of Government Loans in Japan. Wesleyan University. Photocopy (September 21).
- Itoh, Motoshige, and Kazuharu Kiyono. 1987. Welfare-enhancing Export Subsidies. *Journal of Political Economy* 95, no.1: 115–37.
- Johnston, Bruce F., and Peter Kilby. 1975. *Agriculture and Structural Transformation*. New York: Oxford University Press.
- Kiyota, Kozo. 2006. *Reconsidering the Effects of Intranational and International R&D Spillovers on Productivity Growth: Firm-level Evidence from Japan*. RIETI Discussion Paper Series 06-E-001. Tokyo: Research Institute of Economy, Trade, and Industry.
- Kodama, Fumio, and Jun Suzuki. 2006. *Characterizing Receiver-Active National System of Innovation*. RIETI Discussion Paper Series 06-E-013. Tokyo: Research Institute of Economy, Trade, and Industry.
- Komiya, Ryutaro, Masahiro Okuno, and Kotaro Suzumura. 1988. *Industrial Policy of Japan*. San Diego: Academic Press.
- Lawrence, Robert Z., and David E. Weinstein. 2001. Trade and Growth: Import-led or Export-led? Evidence from Japan and Korea. In *Rethinking the East Asian Miracle*, ed. Joseph E. Stiglitz and Shahid Yusuf. Oxford: Oxford University Press.
- Leamer, Edward E. 1987. Paths of Development in the Three-Factor, n -Good General Equilibrium Model. *Journal of Political Economy* 95, no. 5: 961–99.
- Lee, Hiro. 1993. General Equilibrium Evaluation of Industrial Policy in Japan. *Journal of Asian Economics* 4, no 1: 25–40.
- McClelland, David C. 1961. *The Achieving Society*. New York: The Free Press.

- Morishima, Michio. 1982. *Why Has Japan 'Succeeded'? Western Technology and the Japanese Ethos*. Cambridge: Cambridge University Press.
- Motohashi, Kazuyuki. 2004. *Economic Analysis of University-Industry Collaborations: the Role of New Technology Based Firms in Japanese National Innovation Reform*. RIETI Discussion Paper Series 04-E-001. Tokyo: Research Institute of Economy, Trade, and Industry.
- Noland, Marcus. 1993. Industrial Policy and Japan's Trade Pattern. *Review of Economics and Statistics* 75, no. 2: 241–48.
- Noland, Marcus. 1996. Research and Development Activities and Trade Specialization in Japan. *Journal of the Japanese and International Economies* 10, no. 2: 150–68.
- Noland, Marcus. 1997. Public Policy, Private Preferences, and the Japan Trade Pattern. *Review of Economics and Statistics* 79, no. 2: 259–66.
- Noland, Marcus. 2005. Popular Attitudes, Globalization, and Risk. *International Finance* 8, no. 2: 199–299.
- Noland, Marcus, and Howard Pack. 2003. *Industrial Policies in an Era of Globalization*. Washington: Institute for International Economics.
- OECD (Organization of Economic Cooperation and Development). 2006. *OECD Economic Surveys: Japan*. Paris.
- Ogura, Seiritsu, and Naoyuki Yoshino. 1988. The Tax System and the Fiscal Investment and Loan Program. In *Industrial Policy of Japan*, ed. Ryotaro Komiya, Masahiro Okuno, and Kotaro Suzumura. San Diego: Academic Press.
- Okuno-Fujiwara, Masahiro. 1988. Interdependence of Industries, Coordination Failure, and Strategic Promotion of an Industry. *Journal of International Economics* 25: 25–43.
- Porter, Michael E., and Mariko Sakakibara. 2004. Competition in Japan. *Journal of Economic Perspectives* 18, no.1: 27–50.
- Psacharopoulos, George. 1973. *Returns to Education*. San Francisco: Jossey-Bass
- Ramseyer, Mark, and Frances Rosenbluth. 1997. *Japan's Political Marketplace*. Cambridge, MA: Harvard University Press.
- Reynolds, Paul D., William D. Bygrave, and Erkko Autio. 2004. *GEM 2003 Global Report*. Babson Park, MA: Babson College. Available at the Global Entrepreneurship Monitor's web site, www.gemconsortium.org (accessed on February 2, 2007).
- Rodrik, Dani. 1994. King Kong Meets Godzilla: The World Bank and the East Asian Miracle. In *Miracle or Design? Lessons from the East Asian Experience*. Policy Essay 11. Washington: Overseas Development Council.

- Sakakibara, Mariko, and Michael E. Porter. 2001. Competing at Home to Win Abroad: Evidence from Japanese Industry. *Review of Economics and Statistics* LXXXIII, no. 3 (May): 310–22.
- Saxonhouse, Gary R. 1983. What is All This About ‘Industrial Targeting’ in Japan? *The World Economy* (September) 253–74.
- Terry, Edith. 1995. *How Asia Got Rich: World Bank vs. Japanese Industrial Policy*. JPRI Working Paper No. 10. San Francisco: Japan Policy Research Institute.
- Terry, Edith. 2002. *How Asia Got Rich: Japan and the Asian Miracle*. Armonk, NY: M.E. Sharpe.
- Todo, Yusuyuki. 2006. Knowledge Spillover from foreign direct investment in R&D: Evidence from Japanese firm-level data. *Journal of Asian Economics* 17: 996–1013.
- Wade, Robert. 1996. Japan, the World Bank, and the Art of Paradigm Maintenance: The East Asian Miracle in Political Perspective. *New Left Review* I, no. 217 (May–June): 3–36.
- Weinstein, David E. 1995. Evaluating Administrative Guidance and Cartels in Japan (1957–88). *Journal of the Japanese and International Economies* 9: 200–23.
- World Bank. 1993. *The East Asian Miracle*. Washington: World Bank.
- Yamamura, Kozo, and Yasukichi Yasuba. 1987. *The Political Economy of Japan, Volume I: The Domestic Transformation*. Stanford, CA: Stanford University Press.
- Yanase, Tadao. 2003. Challenges and Directions of Economic and Industrial Policy in Japan. Ministry of Economy, Trade, and Industry. Photocopy (October).
- Yano, Makoto. 2001. Trade Imbalance and Domestic Market Competition Policy. *International Economic Review* 42, no. 3: 729–50.

Table 1 Human capital and per capita income, mid-1950s

Country	Year	Human capital index	Per capita income	Ratio of human capital index to per capita income
Japan	1955	1673	519	3.2
Korea	1955	494	217	2.3
Philippines	1956	738	277	2.7
Israel	1954	1,200	609	2.0
Thailand	1955	302	181	1.7
Greece	1956	693	468	1.5
Malaysia	1957	334	351	1.0
United States	1955	2,293	2,443	0.9
Italy	1956	787	971	0.8
Turkey	1955	267	365	0.7
Argentina	1955	760	1,059	0.7
Mexico	1955	352	637	0.6
Spain	1955	389	652	0.6

Note: The human capital index is educational expenditure embodied in the labor force. See Psacharopoulos (1974). Values for Japan, Mexico, Spain, Turkey, and the United States interpolated from 1950 and 1960 observations; values for Greece and Italy interpolated from 1951 and 1961 observations; values for Argentina and Thailand interpolated from 1947 and 1960 observations. Per capita income is a purchasing power adjusted figure in international dollars from the Penn World Tables.

Table 2 Ratio of capital subsidy to investment, Japan (percent)

Industry	1968			1976			1984		
	Loan	Tax	Total	Loan	Tax	Total	Loan	Tax	Total
Mining	9.38	1.36	10.74	13.28	1.48	14.76	3.83	1.29	5.12
Food processing	0.65	0.49	1.14	1.24	0.81	2.05	0.51	0.46	0.97
Textiles	0.66	1.60	2.26	2.59	0.88	3.47	0.22	0.51	0.73
Pulp and paper	0.01	0.26	0.27	0.03	0.66	0.69	0.03	0.42	0.45
Chemicals	0.71	0.54	1.25	1.63	0.39	2.02	0.44	0.17	0.61
Petroleum and coal products	0.00	n. a.	2.83	0.14	2.97				
Nonmetallic products	n. a.	n. a.	n. a.	0.72	0.11	0.83	0.44	0.13	0.57
Iron and steel	0.50	0.87	1.37	1.39	0.58	1.97	1.52	0.96	2.48
Nonferrous metal	0.48	0.46	0.94	8.40	0.34	8.74	0.62	0.35	0.97
Metal products	0.85	1.16	2.01	1.52	0.75	2.27	0.57	0.63	1.20
General machinery	0.35	0.50	0.95	2.02	0.43	2.45	0.28	0.20	0.48
Electrical machinery	0.37	0.84	1.21	1.25	0.47	1.72	0.39	1.45	1.84
Transportation machinery	2.95	0.79	3.74	3.76	0.71	4.47	0.56	0.20	0.76
Precision instruments	n. a.	n. a.	n. a.	0.54	0.47	1.01	0.05	n. a.	n. a.

Source: Noland (1993).

Table 3 Normalized sectoral tax rates, Japan, 1955–90

Industry	1955–90		1955–73		1974–90	
	Normalized tax rate	Industry rank	Normalized tax rate	Industry rank	Normalized tax rate	Industry rank
Electrical machinery	-0.403	8	-0.26	8	-0.56	10
General machinery	-0.403	8	-0.26	8	-0.56	10
Transportation equipment	-0.403	8	-0.13	7	-0.56	10
Fabricated metal	-0.069	7	-0.26	8	-0.35	8
Petroleum and coal products	-0.009	3	0.30	3	0.14	3
Precision instruments	-0.403	8	-0.26	8	-0.35	7
Ceramic, stone, and glass products	-0.009	3	0.30	3	-0.56	10
Pulp and paper	-0.891	13	-0.13	6	0.00	5
Chemicals	-0.009	3	-1.72	13	0.04	4
Basic metals	-0.069	6	0.30	3	-0.35	8
Processed foods	-0.736	12	-1.52	12	0.00	5
Mining	6.658	1	0.92	2	1.04	1
Textiles	0.719	2	11.68	1	0.50	2

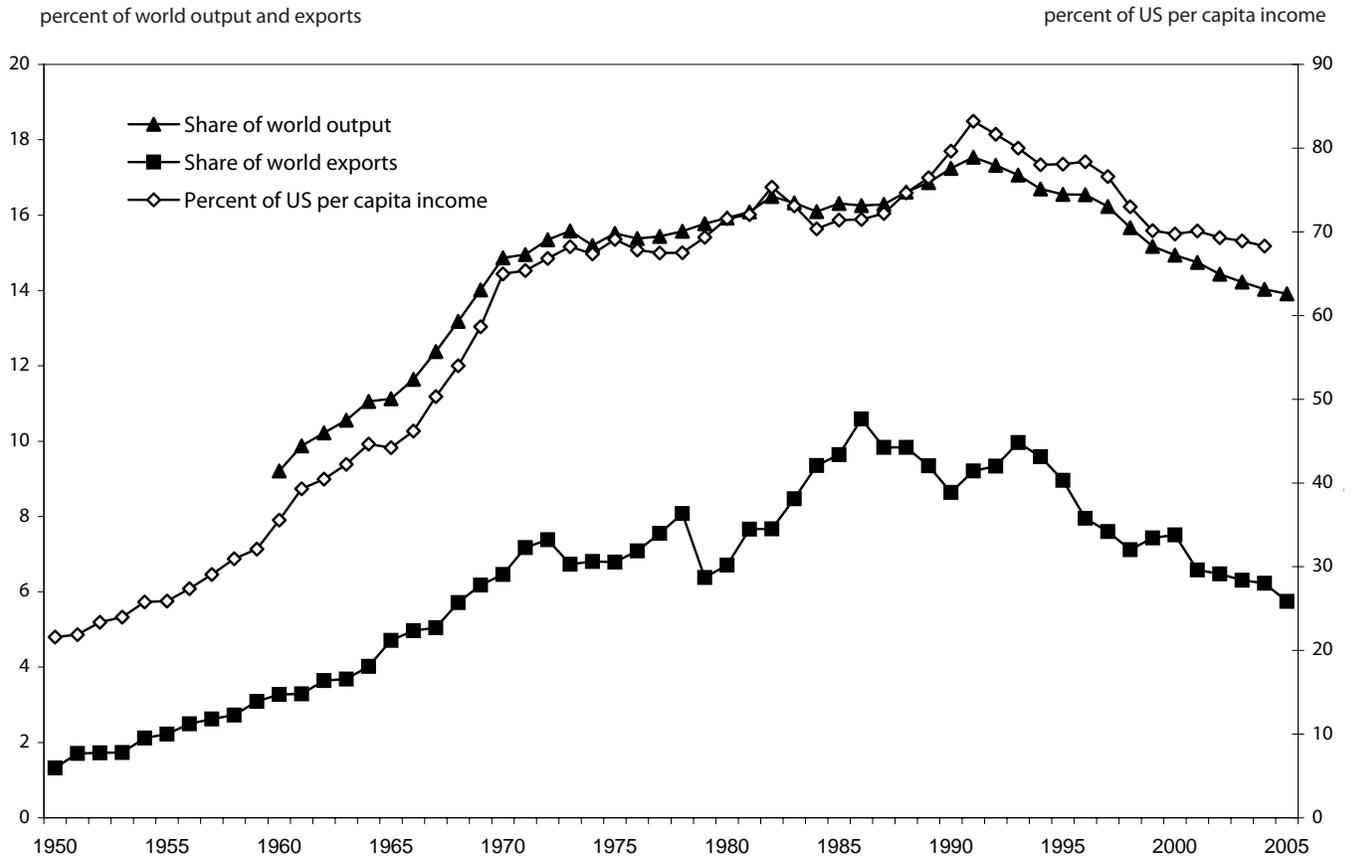
Source: Beason and Weinstein (1996, table 1).

Table 4 Government subsidy share of total R&D, Japan, 1968–2000

Industry	1968	1976	1984	1992	2000
Mining	3.2	3.2	14.0	29.1	34.3
Food processing	0.0	0.1	0.4	0.3	0.3
Textiles	0.7	0.2	1.1	0.5	1.8
Pulp and paper	0.8	0.3	0.0	0.1	n.a.
Chemicals	0.5	0.3	0.8	0.2	0.1
Petroleum and coal products	1.0	0.3	7.2	4.6	7.0
Nonmetallic products	1.0	0.8	1.8	0.2	0.1
Ceramic, stone, and glass products	n.a.	n.a.	n.a.	0.6	1.1
Iron and steel	0.2	0.6	1.7	0.1	0.7
Nonferrous metal	0.8	1.5	2.9	1.9	2.0
Metal products	0.1	0.2	0.2	0.3	0.4
General machinery	1.4	2.2	1.2	0.6	1.4
Electrical machinery	1.7	1.5	1.4	0.3	0.3
Transportation machinery	1.0	4.4	4.7	3.4	2.3
Precision instruments	1.8	0.3	0.1	0.1	0.1

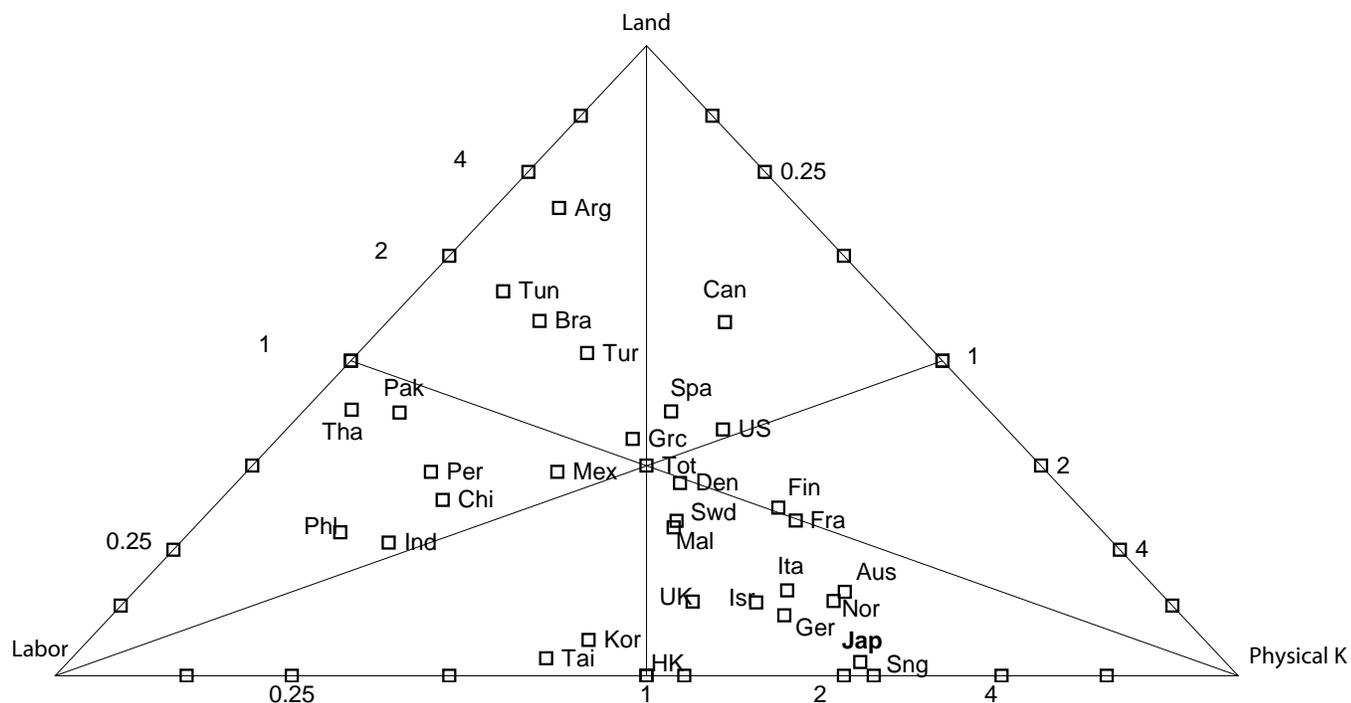
Source: *Kagaku Gijutsu Kenkyu Chosa Hokoku* (Report on the Survey of Research and Development), various issues.

Figure 1 Japanese share of world output and exports and per capita income relative to the United States, 1950–2005 (percent)



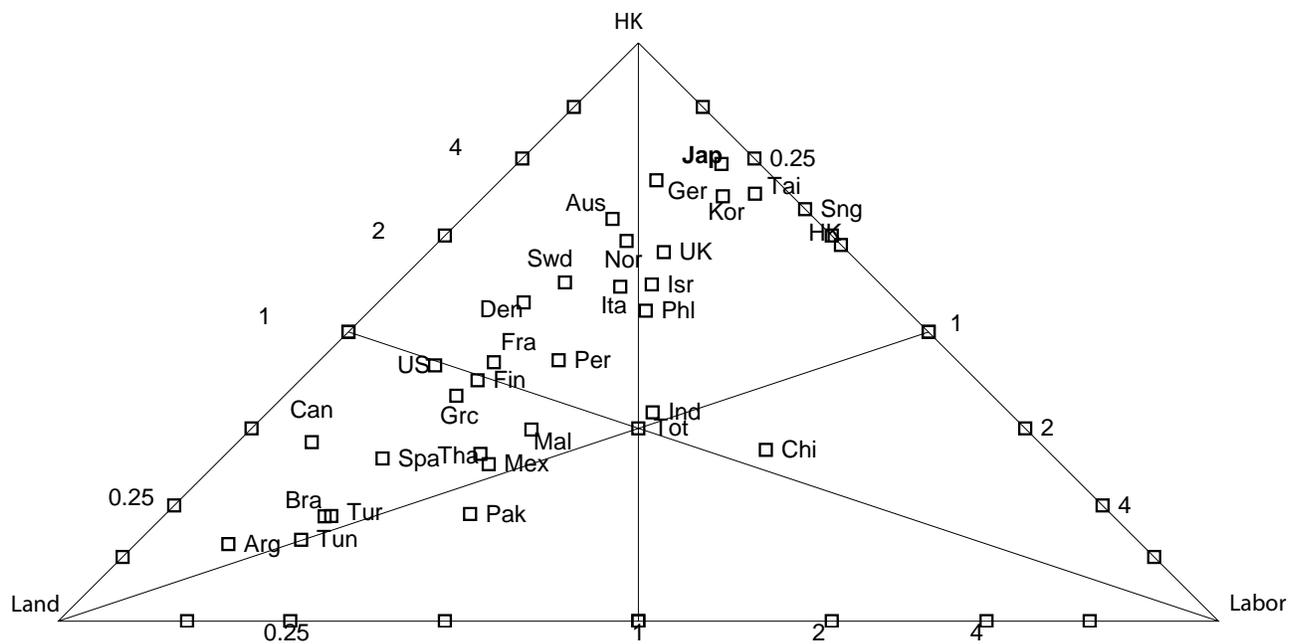
Sources: IMF, *International Financial Statistics* (February 2007); World Bank, *World Development Indicators* (2006); Heston, Summers, and Aten, *Penn World Tables*, Version 6.2 (September 2006).

Figure 2 Labor, physical capital, and land endowments (1968 data)



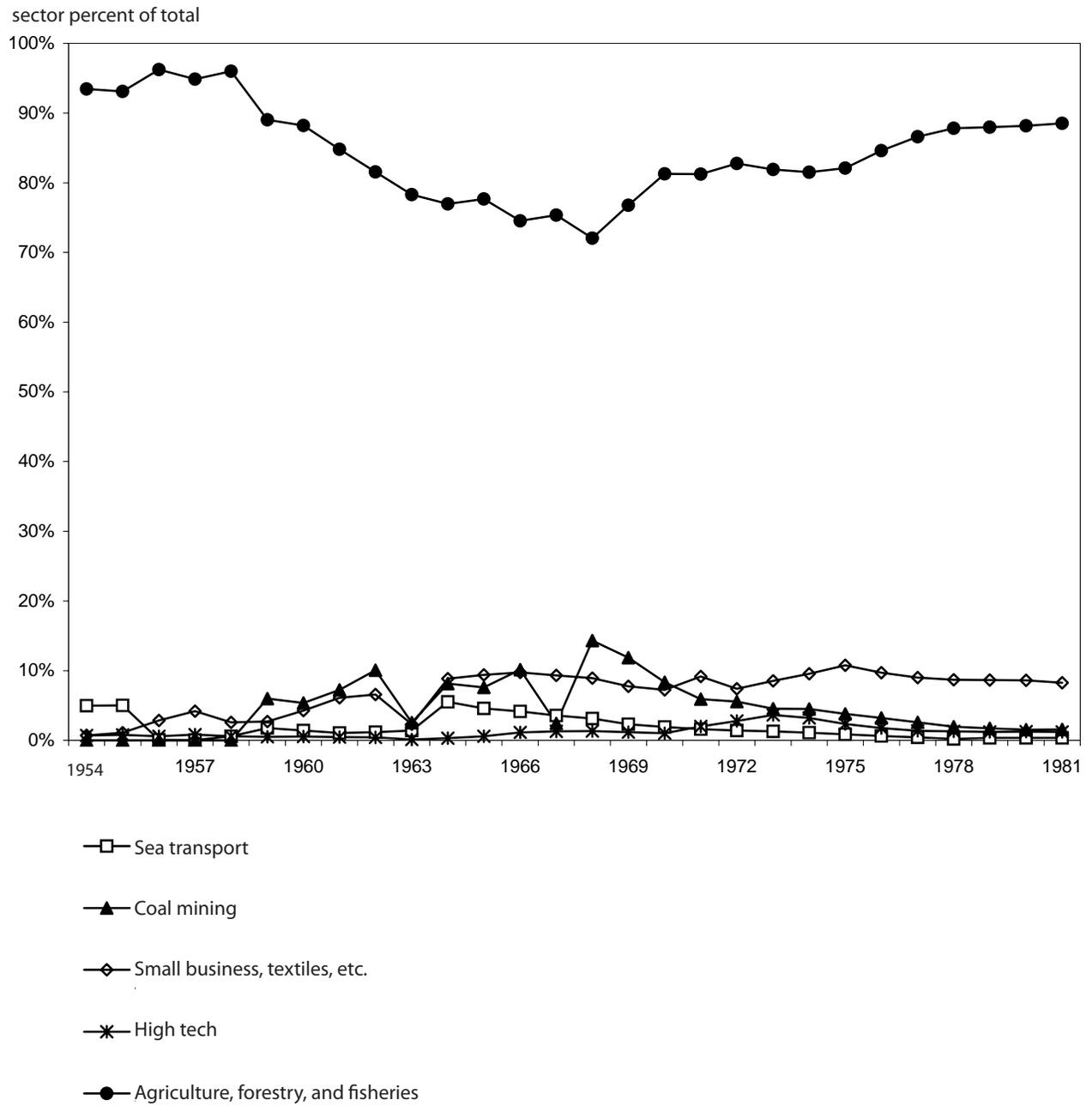
Source: Noland and Pack (2003).

Figure 3 Labor, human capital, and land endowments (1968 data)



Source: Noland and Pack (2003).

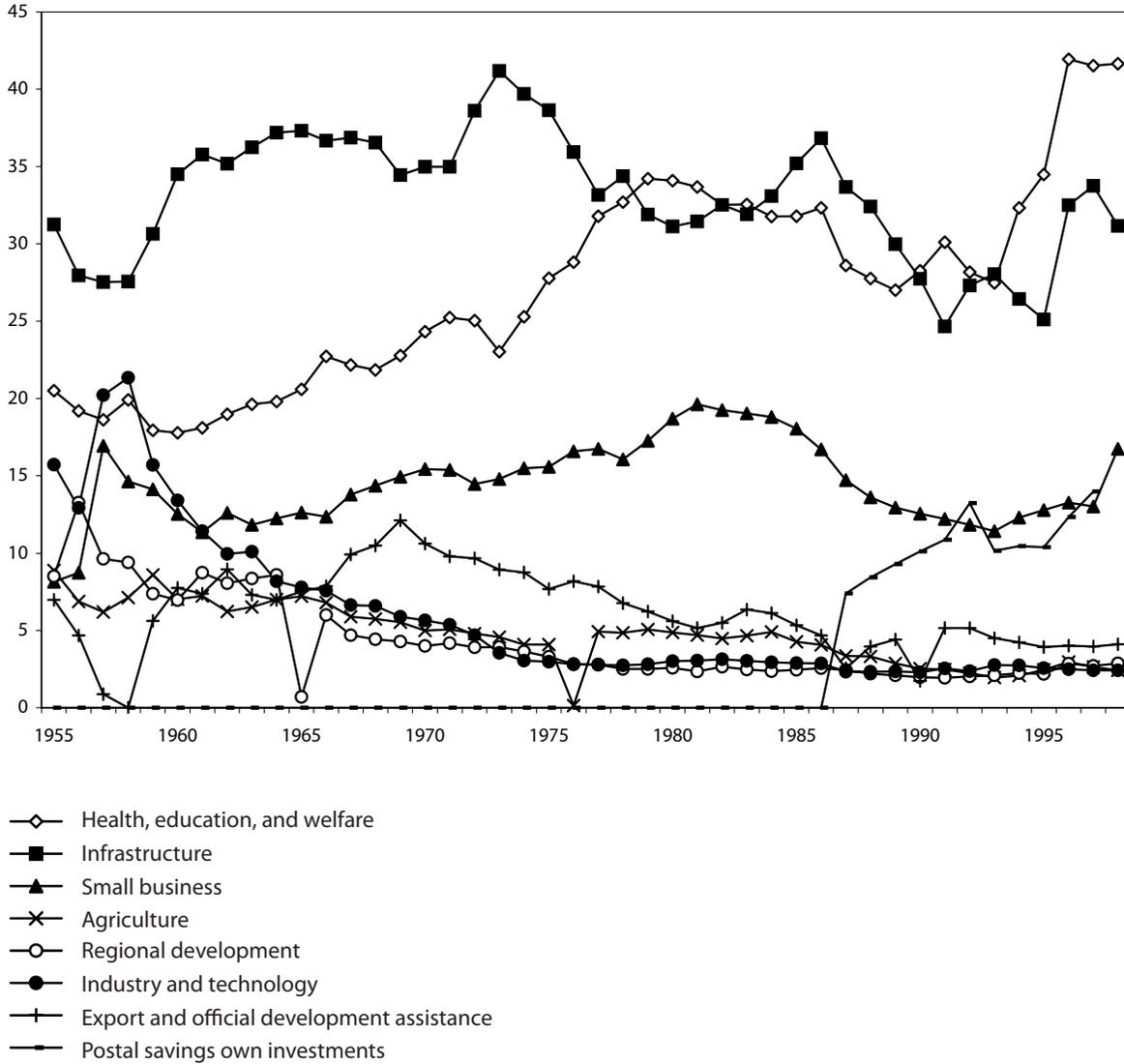
Figure 4 Sectoral composition of on-budget subsidies in Japan, 1954–81



Source: Ogura and Yoshino (1988, table 1).

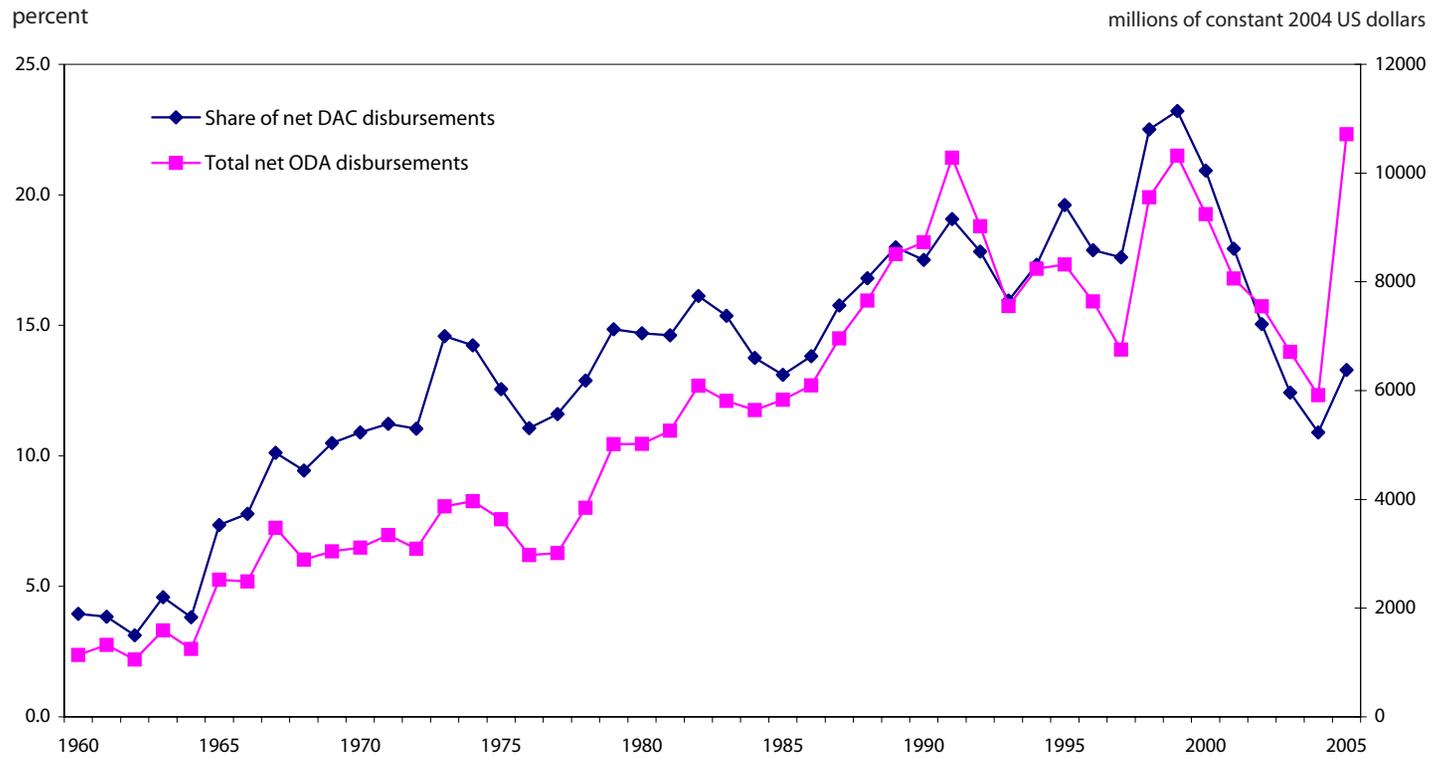
Figure 5 Patterns of off-budget expenditure in Japan, 1955–98

percent of total FILP funds



Source: Ministry of Finance, *Fiscal and Monetary Statistics Monthly* (FILP volume).

Figure 6 Japanese official development assistance (ODA), 1960–2005



Source: OECD, Development Assistance Committee (DAC) Statistics Database.