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Innovation and the Asian Economies

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This book is about crisis and choice, an enduring relationship in world politics and, especially, in economic change. Modern social science is filled with "shock adjustment" metaphors invoked to characterize the ways in which change occurs.[1] Much like our understanding of evolutionary biology, notions of "punctuated equilibrium" or "paradigm shifts" presume that significant institutional and normative adjustments follow sudden major challenges to a previously stable system. War is the most common "punctuation." We speak confidently of a post–World War II world that operated under different rules (as set by the superpower confrontation) and with different institutions (e.g., those of Bretton Woods) than the prewar one. New ideas, such as Keynesianism or communism, can have the same effect.[2]

[1] Peter J. Katzenstein, *Small States in World Markets: Industrial Policy in Europe* (Ithaca: Cornell University Press, 1985); and Peter Gourevitch, *Politics in Hard Times* (Ithaca: Cornell University Press, 1986), are particularly important studies in this genre. Both look at war and depression as institution-shifting events in Western Europe. Alexander Gershenkron, *Economic Backwardness in Historical Perspective: A Book of Essays* (Cambridge, Mass.: Harvard University Press, 1966), posits the industrial revolution as the shock that transformed the developmental strategies of late-developing states. See Wade Jacoby, *Imitation and Politics: Redesigning Modern Germany* (Ithaca: Cornell University Press, 2000), for a more recent example. Earlier work includes the essays in Gabriel Almond et al., eds., *Crisis, Choice, and Change* (Boston: Little, Brown, 1973). Robert Putnam, *Making Democracy Work* (Princeton: Princeton University Press, 1993), is weighted in the other direction. It privileges stability and discounts disequilibrating shocks. For recent theoretical treatment, see Ellen M. Immergut, "The Theoretical Core of the New Institutionalism," *Politics and Society* 26, no. 1 (March 1998): 5–34; and Ira Katznelson, "Structure and Configuration in Comparative Politics," in Mark Irving Lichbach and Alan S. Zuckerman, eds., *Comparative Politics: Rationality, Culture, and Structure* (Cambridge: Cambridge University Press, 1997). Brett Kubicek, "Social Mechanisms and Political Creativity" (Ph.D. dissertation, Massachusetts Institute of Technology, forthcoming) is an important critique of this model.

[2] The standard theoretical treatment of this is the notion of scientific revolution introduced in Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd ed. (Chicago: University of Chicago Press, 1996). For the example of Keynesianism, see Peter Hall, ed., *The Political Power of Economic Ideas: Keynesianism across Nations* (Princeton: Princeton University Press, 1989).

Similarly, technological innovations – in transportation, communication, or other elements of infrastructure – can also provide dramatic "punctuation" of a stable order.[3] Entrepreneurs had different expectations of markets before the Industrial Revolution than later, before the diffusion of railways or of telephones than afterward, or prior to the introduction of just-in-time production than they do today. Similarly, microelectronics and then the Internet each transformed the business models deployed for generating wealth and profit. In each case, new technology led to the redistribution of economic and political power. New products, like new world orders, can transform what we believe to be the "normal" social, political, and economic conditions within which we make choices.

Stephen Krasner captures the way in which social science focuses on the effects of the adjustment, effects that canalize choice and set in place new institutions that channel and constrain action in a new "normal" political economy. The resulting institutions in turn are dislodged only by shocks of equal or greater magnitude: "New structures originate during periods of crisis. They may be imposed through conquest or be implanted by a particular fragment of the existing social structure. But once institutions are in place they can assume a life of their own, extracting societal resources, socializing individuals, and even altering the basic nature of civil society itself."[4]

The contributors to this volume test these ideas against the Asian financial crisis of 1997–98, the most significant challenge to the ways in which innovation and production had been organized in the most dynamic corner of the global economy at the turn of the past century. While the crisis was financial, at least initially, the choices and outcomes on which our authors focus are technological ones. Their chapters seek to understand and explain whether and to what extent the Asian financial crisis shifted the institutions of science, technology, and innovation in Asia and across the globe.

In mid-May 1997 a financial crisis expanded outward from Southeast Asia after a broad and deep attack by private investors on the baht, the Thai currency. The crisis spread rapidly across the region. The five "crisis countries" – Thailand, Malaysia, Indonesia, the Philippines, and South Korea – all experienced similar symptoms, including massive capital outflows, collapse of the stock market, exhaustion of foreign reserves, and successive currency depreciations. The central banks at first responded by intervening to defend currency values. They raised interest rates and, as one contemporary institutional

[3] See Christopher Freeman, *Technology Policy and Economic Performance* (London: Pinter, 1987).

[4] Stephen D. Krasner, "Approaches to the State: Alternative Conceptions and Historical Dynamics," *Comparative Politics* 16, no. 2 (January 1984): 240. For recent theoretical treatments of these relationships, see Paul Pierson, "Increasing Returns, Path Dependence, and the Study of Politics," *American Political Science Review* 94, no. 2 (June 2000): 251–68; and James Mahoney, "Path Dependence in Historical Sociology," *Theory and Society* 29 (2000): 507–48.

account put it, "tightened capital and exchange controls, particularly on forward or derivative transactions and their financing. However, these responses failed to restore investor confidence, and further capital outflows, sharp depreciations of the exchange rate, and falls in the stock market took place."[5]

The scale of this crisis was unprecedented.[6] The five "crisis countries" sustained a net reversal of more than $100 billion in private capital flows, approximately 11 percent of GDP, during the last half of 1997. Concurrently, the value of the currencies in these countries continued to fall sharply.[7] The Asian nations listed in Figure 1.1 experienced declines in GDP from 1.1 to 13.1 percent in 1998. Within a year, the crisis had taken on global dimensions.

The timing and depth of the crisis varied widely from country to country across the region. Thailand's economy contracted almost immediately following the onset of the financial crisis, even for the year 1997. Japan, Korea, Indonesia, Malaysia, and Thailand all lost ground the following year. Of the countries displayed in Figure 1.1, only China and Taiwan were relatively unaffected in terms of overall economic growth. Over the next two years, all of these countries, except Japan, experienced a significant rebound in part due to a powerful upsurge in the silicon cycle, driven by consumer demand for electronic equipment and corporate demand for telecommunications infrastructure.

The slowing of the U.S. and European economies that began in 2001, however, hampered the Asian recovery. Sales in the semiconductor industry – which is often considered a bellwether for the electronics-oriented economies of East Asia – were forecast to fall 26 percent to $35 billion for the Japanese market, and 23 percent to $39 billion for the Asia Pacific market in 2001.[8] A generalized slump in the information technology industries, especially telecommunications, extended and broadened the nature of the Asian economic downturn. By mid-2001 Japan's trade surplus was half the level of its 1998 peak. The Asian "economic miracle" that had stimulated so much awe, admiration, and even dread, now invoked empathy and apprehension in greater measure.

Of course, these concerns may well be premature or misplaced. It remains to be seen if the economies of East and Southeast Asia will heal and, if in doing so, they might once again provide alternative models for the organization of innovation and economic development. During the final decades of the past century, there was an intense debate about forms of capitalism in general and about the organization of national scientific and technological

[5] International Monetary Fund, "The East Asian Crisis: Macroeconomic Development and Policy Lessons," Working Paper, Washington, D.C., August 1998, p. 20.
[6] Stephan Haggard, *The Political Economy of the Asian Financial Crisis* (Washington, D.C.: IIE, 2000), p. 1.
[7] OECD, *Asia and the Global Crisis: The Industrial Dimension* (Paris, 1999), p. 9.
[8] SIA Press Release, "Semiconductor Industry Association Forecasts Semiconductor Recovery for 2002–2004," November 8, 2001.

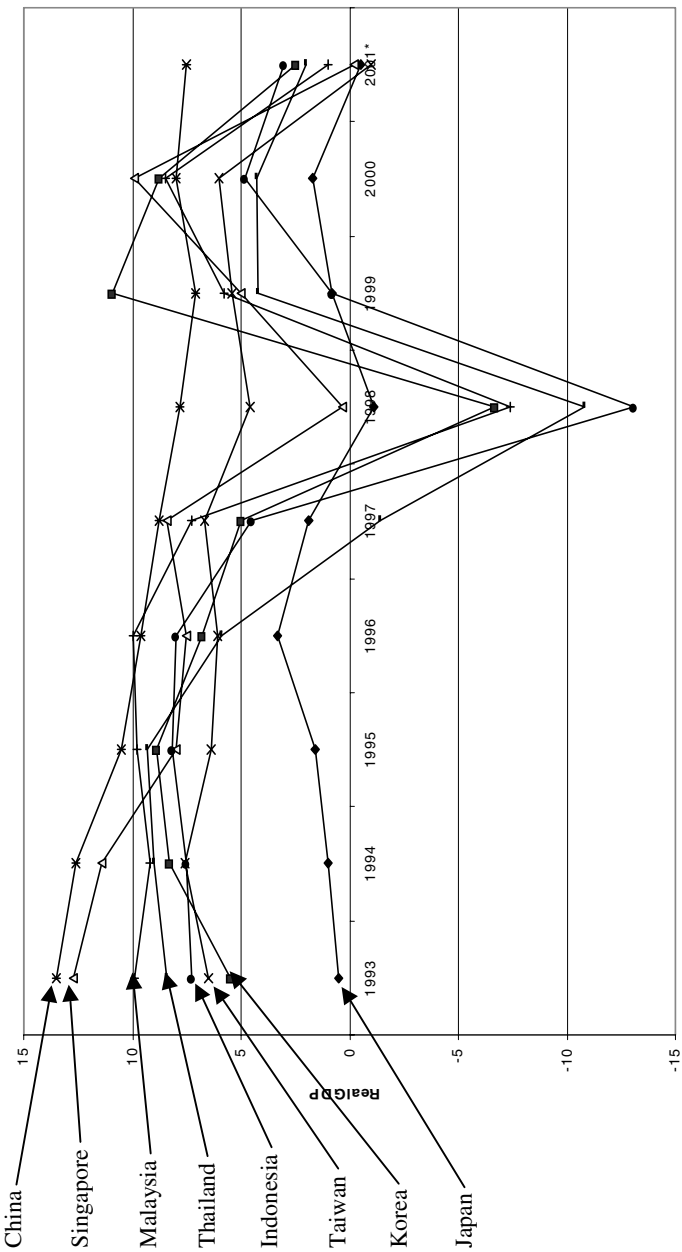

FIGURE 1.1. Percent change in real GDP of selected Asian countries. Asterisks indicate projections for 2001.
Source: IMF, *World Economic Outlook May 2001*, Statistical Appendix, table 1.7, p. 32. IMF, *World Economic Outlook*, Statistical Appendix, tables 2 and 6, p. 166, p. 173.
<http://www.imf.org/external/pubs/ft/weo/2001/01/pdf/append.pdf>.

infrastructures in particular.[9] National governments, with their governing ideologies and industrial policies, were seen by many as exerting a profound influence on the development of science and technology within their borders. Domestic scientific and technological capabilities, in turn, were seen as key to national economic success – and to national security – at the dawn of the new millennium.

This debate was only the latest version of one that has framed the choices of states and firms for centuries. Following Adam Smith in the late eighteenth century, liberals have emphasized the self-regulating virtues of politics and markets. Governments would always distort the essentially benign workings of markets, and states should do no more than provide rules that safeguard private property. The government could properly protect private property and provide collective goods such as education or defense but should otherwise stand clear of the more efficient marketplace. Where markets were most open and where trade was most unfettered by tariffs or by regulation, innovation would flourish and wealth would be generated.

Friedrich List was the most prominent among several influential nineteenth-century "national economists," who expressed doubt about the self-regulating virtues of markets. List disagreed fundamentally with free-trade liberals, whose views derived from Adam Smith and David Ricardo, over how to ensure the generation of national wealth. On his account, the productive power of manufactures was central to national security, and the provision of national security could not be left to competition among narrowly constituted private interests. Some sectors needed protection before they could succeed. They could not be expected to produce the collective goods upon which national wealth and security depend unless they were nurtured to maturity. Free trade was fine, indeed desirable, but only after critical national industrial capabilities were assured. List argued that national advantage was not only bequeathed by history and by naturally occurring factor endowments; it could (indeed, it should) be created through temporary insulation from world markets if need be. List's view has resonated ever since in the industrial policies of late-developing states.

Indeed, despite the dramatic increases in trade and cross-border investment associated with "globalization" in the 1980s and 1990s, some economies

[9] Although the success of Japan in the 1980s stimulated considerable debate about the varieties of capitalism (see, e.g., Chalmers Johnson's landmark study of Japan as a "developmental state": *MITI and the Japanese Miracle* [Stanford: Stanford University Press, 1982]), research on the varieties of capitalism has long been a staple of comparative political economy. See Gershenkron, *Economic Backwardness in Historical Perspective*; Andrew Shonfield, *Modern Capitalism: The Changing Balance of Public and Private Power* (New York: Oxford University Press, 1965); Michel Albert, *Capitalism vs. Capitalism* (New York: Four Walls Eight Windows, 1993); and Peter A. Hall and David W. Soskice, eds., *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage* (New York: Oxford University Press, 2001).

seemed to nurture more insular systems of innovation. They were more likely than others to apply science and technology policy to explicit national goals. The success of "developmental" programs, involving both direct and subtler state intervention, suggested that there were ways to deploy public policy to accelerate and deepen economic advancement for the benefit of a nation's citizenry. On the other hand, more "liberal" economies seemed headed inexorably toward the same sorts of relatively more open scientific and technological institutions associated with the industrial states of Western Europe and North America.[10] This was a high stakes debate. Getting capitalism and the institutions of investment and innovation "right" could mean millions of jobs, billions of dollars of profits, and realignment in the global balance of power.[11]

But, as the contributors to this volume reveal, "getting it right" has meant different things to different actors. The industrial and industrializing economies of Asia that have received so much attention have never been monolithic. Nor do they seem likely to become so, theories of convergence to neoliberal institutions and ideologies notwithstanding. China (since 1979) and several of the ASEAN states were relatively open to direct foreign investment and to dependence on the foreign technology that often accompanies such investment.[12] While not "liberal" in a neoclassical sense, they appeared willing to pay some of the costs in reduced autonomy that can result from foreign control over domestic assets.

Other states in the region, such as Japan and the Republic of Korea, made a different calculation. While they, too, were eager to acquire foreign technology, they chose to do so at a more distant arm's length, eschewing the foreign influence that comes with direct foreign investment. Their rather more mercantile orientation invited intense pressures from foreign firms and governments for liberalization. Not opening their markets indiscriminately required that they bear a greater share of the costs of nurturing their more autonomous technology systems.

Whether relatively open or closed, each of the economies in East and Southeast Asia had grown enormously in the last quarter of the twentieth century. And each faced a crisis that might force it to change.

[10] See the essays in Suzanne Berger and Ronald Dore, eds., *National Diversity and Global Capitalism* (Ithaca: Cornell University Press, 1996). Accounts of the "developmental state" are Johnson, *MITI and the Japanese Miracle*; Meredith Woo-Cummings, ed., *The Developmental State* (Ithaca: Cornell University Press, 1999).

[11] See Wayne Sandholtz et al., eds., *The Highest Stakes* (New York: Oxford University Press, 1992), for a snapshot of these concerns during the precrisis years when the United States seemed in secular decline.

[12] ASEAN is the acronym for Association of South East Asian Nations. The member states are Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Miramar, Philippines, Singapore, Thailand, and Vietnam.

Modeling Crisis and Choice

In general, there are four classes of factors that constrain and channel choice in the face of crisis: the institutional configuration of states, the ideological preferences of political actors, the material capabilities of economic actors, and the creativity of political and economic leaders. Here we introduce each set of factors in turn and match them briefly to the technology and manufacturing base of the national economies examined in this volume.

Institutions

The elements of institutional configuration of a political economy – its regulatory structure, the organization of private interests, their relationship to the state, and the location of local firms in the value-added supply chain – may each be critical in determining its capacity to resist external shocks. For the purposes of this volume, however, the "innovation system" is the institutional configuration of greatest significance. The concept of national innovation systems was introduced in the mid-1980s by scholars who were dissatisfied with the neoclassical treatment of innovation as an exogenous variable. It has drawn largely from the field of evolutionary economics, stressing the endogenous nature of innovation in its own development. An innovation system is "the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies."[13]

A *national* innovation system comprises firms, universities, nonprofit entities, and public agencies that produce or support the production of science and technology within national borders. There seem to have been enduring differences in the national innovation systems of the leading industrial states in North America, Europe, and Asia – differences in the style and focus of supporting policies, in the ways in which research and development (R&D) is funded, where it is conducted, and in the technical orientation of industrial research.[14] On this view, innovation systems that span sectors in the same country have more in common with each other than they do with the same industrial sector in other countries. It follows that one wonders if firms ever really leave their nationality at the shores of their home economy. Are they really amoral utility maximizers, shorn of their nationality when they cross borders? Or are Japanese firms still Japanese, and U.S. firms still American, and German firms still European when they invest and operate in Singapore, Taiwan, or Guangdong? Would Chinese and South Korean business executives hold different views on this subject?

The host economies are also important in the *national* innovation system model. The national economies, in which multinationals invest, shape

[13] Freeman, *Technology Policy and Economic Performance*.
[14] Paul N. Doremus, William W. Keller, Louis W. Pauly, and Simon Reich, *The Myth of the Global Corporation* (Princeton: Princeton University Press, 1998), p. 60.

innovation within their borders through public policies and political ideology. On this view, their policies and interventions are likely to be consistent and have similar effects across sectors. Whether these policies conflict with, or respond to, the preferences of indigenous firms, political battles involving R&D tax incentives, subsidies, technology transfer requirements, capital controls, or even educational reforms will determine much of the character of innovation within national borders.

The alternative institutional perspective is *sectoral*. A sectoral innovation system comprises similar relationships and institutions, but they interact within a functionally delimited domain, which may be nationally, regionally, or globally distributed. On this view, firms in the same business, even if in different countries, have more in common with one another (and organize their R&D in the same ways) than do firms in different sectors in the same country. Companies, and the states that hope to nurture them, have to respond to similar sets of technological imperatives. Here there is more coherence within types of production or processes than within types of states. Aerospace industries in Russia, Japan, and Indonesia – like computer industries in Korea, Taiwan, and India – have more in common with one another than do aerospace firms and computer firms in any one of these states.

Clearly there is a division of labor in the same industrial sector across states, sometimes referred to as the "regional" R&D and production systems model. Richard Doner and Bryan Ritchie argue in this volume, for example, that Singapore, Malaysia, and Thailand occupy quite different rungs in a regional hierarchy of countries that produce hard disk drives. Walter Hatch suggests that the Japanese dominate sectoral production systems by integrating them vertically across the region from headquarters in Tokyo or Osaka. As these contributors and others demonstrate, institutional arrangements vary considerably across the region, and by sector. Each is interested in delineating these differences and in determining for our readers how they vary systematically.

Whether an innovation system is bounded by a national economy or by an industrial sector, it can be understood to comprise (or be animated by) distinctive political norms. But politics has rarely been incorporated into models of innovation systems. Economists who focus on national characteristics to explain innovation argue that certain country-specific institutional variables, such as market structure or legal systems, shape innovative processes across sectors within national borders. Those who focus on sectors see a functional logic specific to particular business segments or supply chain characteristics. Although some political scientists have addressed the politics of innovation systems, the strategic, normative, and material bases for R&D are usually left unexplored.[15] All agree that technological innovation

[15] Herbert Kitschelt, "Industrial Governance Structures, Innovation Strategies, and the Case of Japan: Sectoral or Cross-National Comparative Analyses?" *International Organization* 45, no. 4 (1991): 453–93, is an exception. He has gone furthest in endeavoring to combine

is one of the most important engines of economic growth. All agree that investment in learning and innovation repays firms and nations. But few examine the extent to which the dynamics of innovation are politicized – that is, determined by power relations among and within states, and between states and firms, both domestic and foreign. We turn, therefore, to ideology as an alternative to institutions.

Ideology

Different institutions and different capabilities may be informed by different ideas, and the strength and resilience of these ideas may be tested in times of crisis. The ideological preferences of actors in the world of innovation and production systems and their fundamental assumptions about the value of indigenous research and development can be characterized ideal-typically as the difference between technonationalism and technoglobalism.[16]

States that embrace "technonational" norms are less willing to open their markets to direct foreign investment out of a concern that more mature foreign-based firms and technologies would snuff out nascent domestic ones. Technonationalists are convinced that their domestic economies need protection not only from predatory foreign investors, but also from the foreign technology and competition that they would introduce. They believe that a domestic economy can be mature, and the nation secure, only if it exerts substantial control over the generation of knowledge and the standards by which design and manufacture are undertaken. Importantly, this perspective informs choices independent of public policy. That is, conational firms that operate under technonational assumptions may be more comfortable with one another and more willing to cooperate than are firms that are – as in the neoclassical paradigm – rational utility maximizers, always poised to change production locations or suppliers to achieve further advantage. Firms that adhere to a technonational ideology are more likely to maintain supply chain relationships with conationals without regard to geographic location, striving to keep the higher value-added activities in their domestic economies.

the sectoral and national approaches. For a variety of national and sectoral analyses by economists, see Bengt-Ake Lundvall, ed., *National Systems of Innovation* (London: Pinter Publishers, 1992); David C. Mowery, *Science and Technology Policy in Interdependent Economies* (Boston: Kluwer Academic Publishers, 1994); Sylvia Ostry and Richard R. Nelson, *Techno-Nationalism and Techno-Globalism* (Washington, D.C.: Brookings Institution, 1995); Richard R. Nelson, ed., *National Innovation Systems: A Comparative Analysis* (Oxford: Oxford University Press, 1993); and U.S. Congress, Office of Technology Assessment, *Multinationals and the U.S. Technology Base*, OTA-ITE-612 (Washington, D.C.: U.S. Government Printing Office, September 1994).

[16] Robert Reich, "The Rise of Techno-Nationalism," *Atlantic* 259, no. 5 (May 1987): 62–69. See Richard J. Samuels, *"Rich Nation, Strong Army": National Security and the Technological Transformation of Japan* (Ithaca: Cornell University Press, 1994); chapter 1 provides a short intellectual and economic history of "technonationalism."

Technonationalists discern a difference between proprietary and generic technical information that has national, rather than corporate, borders. Under technonational assumptions, when conational firms share information in the development of new technology, they are collaborating. Such collaboration, which may involve joint research and technology sharing, is viewed as a public good that would not otherwise be provided. And as a public good, it transcends antitrust or competition policy considerations. In a technonational setting, firms may also enter into intense competition, which may be muted by the state in infant industries or used as a device to winnow out the weaker players to promote a limited number of world-class contenders. Thus, the technonationalist perspective emphasizes autonomy over dependence on foreign technology, the diffusion of knowledge among national users, and the nurturance of domestic scientific and technological capabilities. A "developmental state" may be the spider in the national web of technology development, but the connections and mutual trust among conationals do not require state sanction.[17]

Japan is the paradigmatic case of technonationalism.[18] For more than 150 years, Japanese firms and the Japanese governments embraced technology and the economy as matters of national security. State planners and technonationalists in the private sector fused industrial, technological, and security priorities. These were driven by military ambition in the first half of Japan's industrialization and by commercial needs in the second. Japanese planners carefully and consciously navigated between the Scylla of technological backwardness and the Charybdis of foreign dependence. As a result, each subsequent generation of Japanese products – whether aircraft, machine tools, eyeglasses, or chemicals – depended less than its predecessor on foreign technology. As one MITI official put it: "ichigo yūnyū, nigo kokusanka" (the first time, we import, the second time, we do it ourselves). This helps explain why as late as the early 1990s as much as half of Japanese manufactured imports came from Japanese firms abroad, and why as much as 70 percent of the growth in Japanese imports between 1990 and 1997 came from "captive" (Japanese owned) firms.[19] In Japanese practice, technology was often a quasi-public good developed and distributed through elaborate networks of producers and bureaucracies. As a consequence, Japan built an extensive network of "technology highways" – an infrastructure comprising at least as many lanes, but perhaps fewer roadblocks than in counterpart systems where antitrust and collusion were of greater concern.

In Japanese thinking, institutions such as research consortia and manufacturing alliances enable competitors to achieve common technical goals before

[17] Johnson, *MITI and the Japanese Miracle*, introduces the concept of the "developmental state."
[18] Samuels, "*Rich Nation, Strong Army*."
[19] Richard D. Katz, "Foreign Direct Investment, Shareholder Power, and Competition: Promoting a Virtuous Cycle," Research Institute on Economy, Trade and Industry (RIETI), May 21, 2001, Tokyo.