Postprint: East Asian Economies' Experience of Successfully Crossing the Middle Technology Trap

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Abstract

In the latter half of the 20th century, a select few East Asian economies successfully traversed the "middle technology trap" through technological advancement and industrial upgrading. How did these economies effectively leverage externally introduced technologies to catch up to, and subsequently surpass, the middle technology level and ascend to the frontier of technological advancement? This historical experience holds significant implications for our country's efforts to overcome the "middle technology trap." This article examines Japan, South Korea, Taiwan, China, and Singapore as case studies, and systematically identifies the common elements underlying these economies' success from both external and internal perspectives: From the external dimension, these economies benefited from a liberal and open international environment, wherein cross-border flows of talent, goods, and capital served as critical conduits for technology diffusion and innovation; From the internal dimension, they profited from a progressively market-oriented policy environment, a high-quality education system and open human capital, an enterprise innovation system capable of transforming basic research outcomes into applied technologies, and a financial system with indigenous characteristics.

Full Text

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How East Asian Economies Successfully Bypassed the Middle-Technology Trap

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Abstract

In the second half of the 20th century, a select few East Asian economies successfully bypassed the "middle-technology trap" through technological advancement and industrial upgrading. How did these economies effectively utilize imported foreign technologies to subsequently catch up with and surpass the medium technology level, advancing to the frontier of technological progress? This historical experience offers powerful insights for China as it seeks to cross the middle-technology trap. This article examines Japan, South Korea, Taiwan (China), and Singapore as case studies, identifying common success factors from both external and internal perspectives. Externally, these economies benefited from a liberal international environment where cross-border flows of talent, goods, and capital served as crucial vehicles for technology diffusion and innovation. Internally, they gained from gradually market-oriented policy environments, high-quality education systems and open human capital, enterprise innovation systems capable of transforming basic research into applied technologies, and financial systems with indigenous characteristics.

Keywords: middle-technology trap, East Asian economies, technological progress, policy environment, science-education-talent system, enterprise innovation system, financial system

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In the second half of the 20th century, Japan and Asia's "Four Tigers" (South Korea, Singapore, Hong Kong, and Taiwan) successively achieved in 20-30 years what took Western developed countries over 200 years to accomplish. Except for Hong Kong, which has a service-dominated economic structure, the remaining three East Asian economies all successfully bypassed the "middle-technology trap" through technological progress and manufacturing industrial upgrading. Their successful experiences have created a demonstration effect, proving that it is feasible for latecomer economies to cross the middle-technology trap. This history holds strong implications for China today as it seeks to cross the trap,

making it essential to understand and summarize the core elements behind these successes.

China and these East Asian economies (hereafter referring specifically to Japan, South Korea, Singapore, and Taiwan) share inherent consistency and continuity in industrial development, having successively experienced labor-intensive, capital-intensive, and capital-technology-intensive stages. China's current per capita GDP level and its position in the international division of labor system are similar to those of Japan in the 1980s, and South Korea, Singapore, and Taiwan in the 1990s. From temporal, spatial, and cultural perspectives, the development trajectory of these advanced East Asian economies undoubtedly represents the most relevant learning model.

From the perspective of the actual technological catch-up process, these East Asian economies all experienced iterative patterns of technology introduction, imitation, absorption, tracking, and innovation. They all had to manage increasingly intense trade friction and technological competition with developed economies. Their historical experiences in encouraging technology introduction and absorption, and in achieving technological catch-up and innovation, offer numerous lessons for China today. However, it must be noted that due to their relatively small economic size and incomplete manufacturing sectors, their impact on U.S. industries was limited, and their alignment with the Western camp helped prevent them from facing the systematic pressures that China currently confronts .

From the evolution of government-market relations, after these East Asian economies took off, government intervention in the economy shifted from direct to indirect approaches, moving toward open and transparent state-business linkages, such as establishing sound market system networks. How government functions evolved across different development stages, particularly in managing national resources and promoting technological progress while respecting market laws, holds important reference value for China.

Based on these considerations, this paper selects Japan, South Korea, Singapore, and Taiwan as learning samples to examine their successful experiences in transforming into developed economies from the perspective of technological upgrading. Regarding the time frame, we focus on analyzing Japan since the 1970s and South Korea, Singapore, and Taiwan since the 1980s, as these periods represent critical junctures for technological progress in these economies—the transition from early catch-up stages of technology introduction and imitation to independent innovation.

1 Factual Analysis: Becoming Developed Economies and Bypassing the Middle-Technology Trap

Since the 1950s, benefiting from deepening international division of labor and the initial formation of global production networks, East Asian economies successively adopted export-oriented development models. In their early devel-

opment stages, they extensively 承接 low value-added labor-intensive manufacturing, then gradually achieved industrial transformation and upgrading toward capital- and technology-intensive advanced manufacturing. During this process, these East Asian economies experienced rapid economic growth and sustained increases in per capita GDP. Japan broadly transformed into a developed economy in the 1980s, while the later-developing Singapore, Taiwan, and South Korea successively joined and stabilized their positions among high-income economies in the 1990s [Figure 1: see original paper]. As of 2021, Japan, South Korea, Singapore, and Taiwan all have per capita GDP exceeding US$30,000 annually.

In their early development stages, East Asian economies leveraged mature technology transfer dividends and demographic dividends to undertake and develop low- and medium-end manufacturing represented by textiles and apparel. As economic development levels rose, manufacturing labor costs increased accordingly, gradually eroding the export competitiveness of labor-intensive manufacturing and creating stage-specific bottlenecks. In the process of transitioning to medium- and high-end manufacturing, East Asian economies were also constrained by insufficient independent R&D capabilities, which limited their further ascent to top-tier technological powers. Against this backdrop, East Asian economies began cultivating technology-intensive industries and promoting medium- and high-end manufacturing upgrades, with particularly notable performance in advanced industries such as machinery manufacturing, transportation equipment, electronics, and computers. Academia has metaphorically described this hierarchical, sequential industrial division system and industrial development process in East Asia as the “flying geese pattern” [1-3].

[Figure 2: see original paper] compares the trend of medium- and high-end manufacturing value-added as a proportion of total manufacturing value-added between East Asian economies and the United States. Due to data availability limitations starting only in 1990, we can observe that Japan had already surpassed the United States at that time, with high-tech industries accounting for over 50% of manufacturing. Since the 1990s, the later-developing South Korea, Singapore, and Taiwan have rapidly increased the proportion of medium- and high-tech industries in manufacturing, stabilizing at high levels above 60% in recent years. This clearly demonstrates that technological progress played a very critical role behind these economies’ rapid economic growth.

2 The International Environment in Bypassing the Middle-Technology Trap

The technological upgrading of East Asian economies cannot be separated from the open international environment under globalization. Although the main theme of globalization has occasionally encountered discordant notes (for example, Japan, South Korea, and Taiwan also experienced localized trade friction and technological competition with the United States), the overall external environment featured free and open flows of talent, goods, and capital between these East Asian economies and Western countries such as the United States .

2.1 Open and Diverse High-Skilled Talent Policies Aligned with International Standards

Talent is the most valuable resource in technology-intensive economies. East Asian economies had two-way talent interactions with the United States, not merely one-way contributions [5]. On one hand, East Asian talent entered the United States for study, research, or work ; on the other hand, promising East Asian economies also developed the capacity to attract talent back, achieving an "international circulation" of medium- and high-end talent. For example, Japan made organized efforts to incorporate its diaspora into transnational professional networks; Taiwan and South Korea encouraged their diaspora to return; Singapore even more broadly welcomed international talent, ushering in a peak of high-skilled immigration. In summary, how to cultivate, attract, and retain the world's best and brightest talent has been a priority for East Asian economies when competing technologically with developed countries.

2.2 Free International Trade, Particularly Intermediate Goods Trade, Broadens Cross-Border Technology Spillovers and Diffusion

International trade, especially intermediate goods trade with advanced economies, represents an important means for East Asian economies to broaden technology spillovers and diffusion and promote internal technological upgrading. Numerous export enterprises in East Asia have achieved technology accumulation and innovation through development paths from Original Equipment Manufacturing (OEM) to Original Design Manufacturing (ODM) and finally to Original Brand Manufacturing (OBM) . These enterprises can absorb technology spillovers from developed countries through "learning-by-doing" measures like reverse engineering during the process of importing intermediate goods.

The technology transfer East Asian economies obtained from developed economies benefited greatly from multi-level international trade institutional arrangements at global, regional, and unilateral levels. At the global multilateral level, the General Agreement on Tariffs and Trade (GATT) and later the World Trade Organization (WTO) were the most important institutional arrangements promoting global trade liberalization. At the regional level, various regional free trade agreements developed rapidly, with two mega-regional integration agreements—the European Union and the North American Free Trade Agreement—inspiring active emulation by other countries and regions. At the unilateral level, to adapt to policies encouraging overseas processing by American and European developed countries, East Asian economies 顺势 implemented trade policy adjustments in export processing trade systems, encouraging the undertaking of finished product assembly activities . In summary, benefiting from free trade international institutional arrangements, global tariffs have significantly declined since the 1970s, giving rise to deep cooperation in global industrial chains and the resulting intermediate goods trade.

2.3 Capital Flow Liberalization Further Promotes Intra-Product Specialization

Since the 1980s, further liberalization of international investment policies has created a convenient institutional environment for multinational corporations to allocate resources globally. East Asian economies gradually relaxed restrictions on Foreign Direct Investment (FDI), and foreign-invested enterprises played a key role in promoting their participation in intra-product international division of labor and the diffusion of international technology, providing important learning opportunities for local manufacturing enterprises in East Asian economies (especially South Korea, Singapore, and Taiwan) that undertook numerous multinational corporation outsourcing contracts.

It is worth noting that East Asian latecomer economies, particularly Taiwan and Singapore, did not passively absorb FDI but actively attracted FDI that could generate technology spillover effects [6]. They tended to control and select which industries should be promoted locally, not only encouraging foreign companies to establish assembly workshops locally but also encouraging them to bring in some intermediate goods production links. After FDI entered and established industrial bases, these host countries or regions made numerous efforts to promote the degree of international technology transfer, such as establishing vocational and technical training to improve workers' ability to absorb technology and building industrial parks with supporting measures.

Looking at the international environment comprehensively, in the era of global supply chains, cross-border technology circulation and diffusion are interconnected with other production factors. East Asian economies seized the development opportunities of liberalized international talent, trade, and capital in the globalization era, achieved value chain initiative through technological breakthroughs, occupied dominant positions in the international division of labor system for medium- and high-tech products, constructed and led East Asian regional value chains, and continuously advanced to become first-tier players in the global upstream and downstream supply chain industrial system.

3 The Internal Environment in Bypassing the Middle-Technology Trap

The successful crossing of the middle-technology trap by East Asian economies cannot be separated from a friendly international environment, but even more crucially depends on institutional arrangements and timely adjustments in internal industrial development strategies. Here we examine their experiences from four dimensions: policy direction, science-education-talent system, enterprise innovation system, and financial system.

3.1 Policy Direction: The Evolution of Government-Market Relations

In their early development stages, since the technological path during the catch-up period was clear and proven correct, East Asian governments used policy tools such as fiscal, trade, and financial policies, along with administrative guidance and other hard measures, to selectively prioritize certain target industries and rapidly achieve technological leaps [7,8]. In the post-catch-up period of technological re-innovation, governments gradually strengthened the role of market competition mechanisms to reveal future industrial development directions.

Specifically, after the 1990s, Japan's industrial policy content changed from targeting policies to positive adjustment policies advocated by the OECD [9]. After entering the 1980s, South Korea realized that although relying on chaebols to promote industrial upgrading showed good short-term performance, the government-business relationships involved could become obstacles to long-term economic development, and thus gradually began emphasizing the market's role in resource allocation. Subsequently, seizing the opportunity of the 1997 financial crisis, the South Korean government gradually transformed its functions, transitioning to a market-enhancing model with broad and diverse participation, attempting to adjust policies from supporting chaebol development to encouraging small and medium enterprises to become the mainstay of the South Korean economy, although the large enterprise-concentrated pattern remains a structural feature of South Korea's economy [10]. Similarly, for Taiwan, the developmental state also strongly intervened in industrial production in its early industrialization, but since the mid-1970s, the government's approach to promoting high-tech industries adjusted from playing a regulatory role to playing a coordinating role. Similarly, Singapore's government industrial policy tools underwent major transformations starting in the 1990s, gradually withdrawing from vertical support for specific industries and instead horizontally promoting innovation-oriented development strategies based on building a manufacturing "ecosystem" [11].

3.2 Science-Education-Talent System: The "Smartest Brains" as the Source of Technological Innovation

The value chain of technological innovation begins with "from 0 to 1" scientific ideas, with the innovation actors in this initial stage being basic research talent. Throughout the industrialization and technological upgrading processes of Japan, South Korea, Singapore, and Taiwan, two important lessons are the emphasis on both domestic cultivation of basic research talent and international talent introduction. On one hand, the education system behind high-tech talent is the main source of technological innovation; on the other hand, by introducing skilled personnel and entrepreneurs active in overseas markets and technology hubs, advanced international production, management, and technological capabilities can be brought back home.

[Figure 3: see original paper] and [Figure 4: see original paper] compare the researcher ratio and R&D expenditure intensity of these East Asian economies with OECD averages, showing that since the 21st century, developed economies have continuously intensified their emphasis on science-education talent and basic research, with international competition becoming increasingly fierce; while East Asian economies have placed research expenditure at the core of their industrial development overall situation.

(1) Japan. Systematic and stable investment in basic research began in the 1980s, focusing on supporting cooperative R&D in basic and cutting-edge technologies such as new materials, biological functions, and new functional elements . Since the 1990s, after establishing its "Science and Technology Creation Nation" strategy, Japan relaxed restrictions on teaching staff engaging in non-academic activities and transformed national universities into independent administrative corporations, strengthening close ties between university researchers and industry.

(2) South Korea. South Korea refers to its technological revolution movement as the "Second Independence Movement," placing special emphasis on independent R&D and independent cultivation of scientific talent [12]. South Korea's R&D expenditure as a proportion of GDP has continued to climb, far exceeding the OECD average, demonstrating its generous investment in basic science and education. It is worth noting that South Korea's higher education internationalization level is high, with active cooperation and exchanges with international universities and research institutions. As early as 1994, nearly 80 talents with experience at American Bell Labs had returned to work in South Korea; additionally, hundreds of talents were brought back from leading U.S. technology centers such as Caltech and MIT [13].

(3) Taiwan (China). Taiwan actively cultivates local technical talent, vigorously strengthening higher education, particularly engineering education; establishing a diversified vocational and technical education system to cultivate advanced technical talent, producing a considerable number of excellent engineers and high-quality labor talent for Taiwan's technology industries [14]. Meanwhile, Taiwan actively implements overseas talent introduction programs, establishing specialized youth talent agencies. The introduction of returnee talent has contributed greatly to its high-tech industries: during 1989-1993 and 1994-1999, 1,139 and 1,963 overseas semiconductor technicians respectively returned to the Hsinchu Science Park [15].

(4) Singapore. To meet the needs of transitioning to a knowledge-intensive economy, the Singaporean government places greater emphasis on innovation, R&D, and targeted basic research. In addition to domestic cultivation, Singapore attaches great importance to foreign talent introduction, establishing comprehensive and diversified institutional measures. To balance its national human resource needs and attract foreign talent on demand, Singapore's Ministry of Labor was reorganized into the Ministry of Manpower in 1998. In terms of specific measures, multiple preferential treatments are granted to foreign tal-

ent, including tax benefits, children's education and medical insurance, and visa and immigration policies . Taking visa and immigration policies as examples, the Singaporean government issues "Special Skills Work Visas" for talents with specific skills and experience, and "Startup Visas" for entrepreneurs; Singaporean enterprises can provide employer sponsorship and training programs for foreign employees to help them more easily obtain work permits. Regarding immigration, Singapore has also launched policies such as "Investment Immigration" and "Professional Talent Immigration" [16] to attract foreign talent to invest and start businesses locally.

3.3 Enterprise Innovation System: Transforming Basic Research into Advanced Technology

The value chain of technological innovation requires not only "from 0 to 1" scientific ideas but also practical implementation, and the enterprise innovation system is precisely the implementation link that transforms basic research into cutting-edge technology. During the critical period of crossing the middle-technology trap, the governments of Japan, South Korea, Taiwan, and Singapore all took the lead in establishing intermediary transformation institutions, utilizing industry-university-research integration mechanisms to build open enterprise innovation systems, thereby promoting industrial value chain upgrading driven by breakthroughs in key generic technologies.

(1) Japan. As early as the 1970s, industry-government-university cooperation led by Japan's Ministry of International Trade and Industry successfully promoted breakthroughs in frontier technologies and market transformation of scientific achievements, with the Very Large-Scale Integration (VLSI) R&D project being a typical example [17]. In the 1980s, Japan's Ministry of International Trade and Industry and Ministry of Education successively introduced relevant measures for industry-university cooperation, promoting joint research between universities and enterprises using private funds .

(2) South Korea. The South Korean government actively promotes cooperation between enterprises and public research institutions, forming "Industrial Technology Research Alliances" to jointly conduct research projects. By 2010, South Korea had 105 regional innovation centers and 18 technology parks, as well as 7 joint projects aimed at strengthening the competitiveness of industrial cluster projects.

(3) Taiwan (China). Taiwan's institutional design for its enterprise innovation system also adopts the form of public-private R&D alliances, supporting enterprise technology absorption, transfer, and application to diffuse R&D results and promote commercialization of innovation outcomes. Important components of this organizational form include the technical legal person support system and science parks. Technical legal persons differ from research institutions or universities engaged in basic research, specializing instead in applied research and technology development to assist local companies in innovation

commercialization [14]. Science parks have relatively strict entry thresholds, provide extensive and generous subsidies to promising startups, and are located near universities to jointly assist in the formation of high-tech industry clusters [15].

(4) Singapore. The Singaporean government has established a batch of professional institutions supporting technological innovation, including the Agency for Science, Technology and Research, the National Research Foundation, and the Infocomm Media Development Authority, providing funding support and technical consulting services to enterprises, encouraging the adoption of digital technology, enhancing digital transformation levels, and promoting the transformation and industrialization of scientific achievements. Additionally, it has built a number of science and technology innovation parks, such as Singapore Science Park, Nanyang Technological University Innovation Center, Sentosa Science Park, LaunchPad, and Singapore Biomedical Park. These parks have attracted a large number of multinational leading enterprises, providing a series of infrastructure and services to create favorable R&D and production environments. Following the successful establishment of these innovation parks, Singapore has replicated and promoted this successful model overseas, successfully establishing Singapore industrial parks in China, Germany, Israel, Thailand, Vietnam, and other locations. At this stage, the success of Singapore's enterprise innovation system lies in long-term planning, diversified development, international vision, and benefit sharing.

3.4 Financial System: Matching Financing Mechanisms Give Wings to Tech Startups

Accelerating technological innovation capabilities and crossing the middle-technology trap is a systematic project that requires not only the "smartest brains" and most advanced technologies but also financial empowerment. Every key breakthrough and technological leap by tech startups requires finance as "wings" to give wings to technological innovation. East Asian economies all attach great importance to the role of financing mechanisms in technological innovation, providing suitable financing channels for tech startups at different development stages, and continuously building and improving a virtuous cycle of "technology-industry-financing mechanism." More broadly, matching financing mechanisms have a boosting effect on tech entrepreneurship and relate to the competitive advantages of an economy.

(1) Japan. Japan's financing mechanism has gradually evolved from bank-dominated to market-based indirect financing. Japan started with an indirect financing system based on the main bank system, where banks not only provided loans to enterprises but also maintained close relationships through mutual shareholding and personnel exchanges, making enterprise borrowing and bond issuance heavily dependent on banks. During the 1970s-80s, due to the dual shocks of the first oil crisis and the Plaza Accord, direct financing instruments such as bonds and stocks rose rapidly, but Japan's financing mechanism

remained primarily bank-dominated indirect financing. Since the 1990s, with the collapse of Japan's bubble economy and the outbreak of the Asian financial crisis, the Japanese government intensified financial reforms, with the banking sector continuously developing toward a mature market-oriented direction and developing multi-layered, flexible securities and stock trading markets.

(2) South Korea. Similar to Japan, South Korea also had a bank-dominated financial structure in its early development. It was not until the outbreak of the 1997 Asian financial crisis that a wave of venture capital enterprises truly emerged, with the main driving factor being the major opportunity of South Korea's industrial structure adjustment. The South Korean government hoped to seize the development opportunities of the global information revolution to achieve a knowledge-based economy and strategic shift to cutting-edge industries; venture capital was seen as an incubator for high-tech, high value-added industries, aligning perfectly with the government's high-tech industry goals, and thus received strong government support.

(3) Taiwan (China). One of the most distinctive features of its financing system is the construction of an Asian venture capital market considered most similar to Silicon Valley, with the emergence of a large number of pioneering venture capital institutions, including H&Q Asia Pacific, China Development Corporation, Walden International, Acer Venture Capital, and WI Harper Group. Riding the wave of the Information Technology (IT) industry boom, Taiwan's venture capital industry entered a golden age of development in the 1990s. By 2000, Taiwan had become the world's third most active venture capital market after the United States and Israel [18].

(4) Singapore. Singapore's financial system is highly developed, well-regulated, and effectively resistant to global financial risks. The Monetary Authority of Singapore, together with the Government of Singapore Investment Corporation and Temasek Holdings, forms the "troika" of Singapore's state-owned asset management system. The robust financial system provides fundamental guarantees for Singapore's venture capital system. Singapore's venture capital ecosystem is also highly internationalized. By emulating the Israeli model, it established a technology entrepreneurship investment fund in 1999 with a scale of US$1 billion and cooperated with world-class venture capital firms to introduce international venture capital to support the development of local innovative enterprises [19].

In summary, Japan, South Korea, Taiwan, and Singapore successfully bypassed the middle-technology trap thanks to their control over internal environmental factors. These four economies invested substantial resources in policy direction, science-education-talent systems, enterprise innovation systems, and financial empowerment systems (Table 1), mutually reinforcing each other and making timely adjustments according to different development stages, thereby forming a virtuous cycle of technological upgrading and innovation systems that successfully completed the goal of catching up with developed countries.

4 Success Factors in East Asian Economies' Crossing of the Middle-Technology Trap

How Japan, South Korea, Singapore, and Taiwan effectively utilized imported technologies to subsequently catch up, surpass, and advance to the technological frontier has always been one of the most exciting topics in academic and policy research. The industrialization experiences of these economies achieving massive technological innovation demonstrate that reaching this goal requires interaction between external and internal aspects. While no universal standard applies everywhere, some common elements can be identified.

4.1 External Environment: The Tailwind for Technology Diffusion and Innovation

The external environment these economies faced: the more liberal and free the international environment, the smoother the cross-border flows of talent, goods, and capital, and the more significant the resulting technology diffusion and innovation. An important prerequisite for East Asian economies' economic progress was their high degree of openness, which required adopting advanced technologies and quality standards, orienting toward world markets, and integrating with the international division of labor system.

4.2 Internal Factors: The Core Driver of Technology Upgrading

In addition to leveraging external tailwinds, these economies' successful crossing of the middle-technology trap was even more inseparable from internal factor drivers.

(1) Exit mechanism for strong governments. As governments repositioned themselves across different technological stages, the two forces of industrial policy and market power underwent dynamic adjustments. In the early catch-up stage, East Asian governments tended to adopt policies that directly intervened in markets to promote specific industries, with policy consensus being the implementation of "catch-up and surpass" industrial policies led by big governments. As technology upgraded, governments' industrial policies gradually shifted toward market-friendly, competition-neutral approaches that built sound institutional environments to support technological innovation (especially supporting cutting-edge technological innovation); meanwhile, governments increasingly emphasized utilizing market mechanisms to leverage the role of competition and competition policy. During the process of crossing the middle-technology trap, East Asian economies' industrial policies underwent major adjustments, abandoning traditional industrial policy practices of direct intervention and competition restriction, and emphasizing the market's decisive role in resource allocation. How to dynamically adjust industrial policies and market competition represents East Asian experience that China must carefully study and absorb.

(2) Establish high-quality research institution systems and overseas talent introduction mechanisms. The industrial upgrading of these East Asian economies progressed from textiles to simple machinery assembly, and then to high-tech industrial products such as electronics. This journey relies on high-quality education systems and open human capital. If China wishes to become a global talent center, it should learn from these East Asian economies' experiences in cultivating high-tech talent and designing technical immigration policies to attract outstanding international talent (particularly Singapore's experience).

(3) Establish enterprises or institutions that transform basic research into applied technology. The common experience of East Asian economies shows that strengthening key generic technology research through industry-government-university cooperation is crucial, and on this basis promoting the commercialization and application of technological innovation achievements.

(4) Develop financial systems with indigenous characteristics. East Asian economies did not completely replicate the U.S. direct financing model. Japan transformed from bank-dominated indirect financing to market-based indirect financing, South Korea also built a financial system that could accommodate banks, while Singapore and Taiwan developed a series of market-friendly, competition-neutral financial markets that gave rise to more abundant venture capital funds under successful government policy guidance. Therefore, how these East Asian economies developed multi-level financing systems consistent with local conditions on the basis of the dominant position of traditional banking systems is a noteworthy area.

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Notes: Japan's economic size and technological advantages posed the most intense challenge to U.S. economic hegemony. In the late 20th century, when trade

friction occurred between Japan and the United States, Japan already ranked as the world's second-largest economy and had achieved sufficient competitive advantages in technology-intensive industries such as home appliances, automobiles, and semiconductors. However, the political alliance between Japan and the United States was an important factor in keeping their differences controllable, ensuring that economic friction always revolved around economic issues.

Although Japan, South Korea, and Taiwan also experienced localized trade friction and technological competition with the United States, overall, the flows of talent, goods, and capital between these East Asian economies and Western countries such as the United States were free and open.

East Asian talent entered the United States for study, research, or work in the capacity of visiting scholars, students, and immigrants.

OEM (Original Equipment Manufacture), ODM (Original Design Manufacture), OBM (Original Brand Manufacture).

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Note: Figure translations are in progress. See original paper for figures.