Preface

Only about a quarter century ago, the future of Japan was so uncertain that no one could envisage the sudden economic growth that immediately ensued. Now one can find a growing volume of literature, ranging from journalistic to pedantic, probing the secrets of Japan's economic miracle. Among the trailblazing publications was a special survey by The Economist (Norman Macrae, "Consider Japan," September 1, 1962). Five years later Macrae published another survey in the same magazine ("The Risen Sun," May 27, 1967). In both articles the author not only admired, often in a spirit of rapt fascination, the efficiency of the Japanese government's economic planning and the vitality of Japan's private sector, but he also suggested possible lessons the British economy might draw from it. In fact, he stated in the introduction to his second survey: "It is with a sad depression at opportunities missed, rather than with any proprietorial pride of discovery, that your correspondent . . . comes back now feeling like a Marco Polo with a strange and instructive story to retail of untold mysteries that he has beheld in the east."

This book is devoted to a study of one source of these unto'd mysteries: Japan's impressive advance in industrial technology. Japan's economic miracle is attributed to numerous factors, but the momentum of technological progress, gathered in the course of assimilating Western industrial arts and accelerated by Japan's own R & D effort, was a major force behind the waves of capital investment and continued high rates of economic growth. Indeed, technological progress was the backbone of Japan's extraordinary export performance in manufactured goods in the postwar period, since it improved the quality and variety of exports and maintained competitive cost conditions. Without this technological advance, Japan could not have fully exploited other favorable factors, such as the undervalued yen and the freer trade position of the United States in the postwar period. In this respect, Japan's economic miracle has actually been a technological miracle.

The present study describes Japan's postwar experience in both assimilating Western technology and developing its own capacity to engender new industrial techniques. It is concerned solely with the industrial sector, although there has been equally impressive technological progress in the agricultural sector. It should be noted, however, that the industrial sector's

progress and expansion made possible remarkable increases in Japan's agricultural productivity. As it happens, the agricultural sector played a relatively passive role in Japan's postwar economic growth. A study made by the Organization for Economic Cooperation and Development (OECD), for example, describes productivity increases in Japan's agriculture as follows:

The total agricultural production in real terms increased at an average annual rate of 3% between 1952 and 1967. Since the actively engaged agricultural workers declined by 2.5% on average per annum, this represents an increase in average labour productivity of 5.5% annually. In the same two decades the use of commercial fertilizers . . . increased by three times from 0.75 million metric tons on average in 1948–1953 to 2.14 million metric tons by 1967–68. This, along with widespread and intensive use of other sorts of current inputs (seeds, better feeds, insecticides, etc.) has obviously increased the land productivity and the output per hectare of the major commodities have risen impressively in the recent past.

The high rate of growth of average productivity of labour is due, to an increasingly large degree, to the increased efficiency of labour, as a rapidly declining stock of labour force is being equipped with improved tools, implements and power driven machines. The use of tractors and tractor driven machines has been put into use only after the fifties and their numbers are increasing rapidly. One interesting feature of the mechanization of agriculture is the adjustment of the scale and size of machines to the typical small size holding of an average Japanese farmer. . . .*

The expanding demand for labor in the nonagricultural sector induced rural workers, particularly the young males, to leave the farm for higher wages in the urban areas. The sharp decline in the supply of farm labor and rising wages led to the introduction of labor-substituting devices, including small tractors and other mechanized farm equipment, produced in the industrial sector. Thus the increase in farm output that resulted from the use of improved inputs and mechanization was essentially a by-product of industrialization.

*Montague Yudelman, Gavan Butler, and Ranadev Banerji, Technological Change in Agriculture and Employment in Developing Countries, Development Centre Studies, Employment Series: No. 4 (Paris: OECD, 1971), pp. 185–186.

Throughout the postwar period, Japan was fortunate to be in a position to enhance its industrial technology over a short span of time; that is, as a latecomer it was able to take advantage of the benefits of technological progress made in the West. Catching up with the West was the fundamental motive behind Japan's industrial drive, and a successful assimilation of Western technology was a key element in its success.

With this simple yet crucial hypothesis as the central theme, this book is organized in the following manner: Chapter 1 describes the postwar technological environment both inside and outside Japan. The Schumpeterian characteristics of economic development are identified, and Japan's double-pronged technological relationships—one with advanced Western countries, notably the United States, and the other with developing countries, especially in Asia—are examined. This unique set of relationships provided Japan with both a peculiar incentive and the necessary mechanisms to achieve technological advance. Indeed, the Japanese economy has functioned like a well-designed yacht skillfully navigated on the global ocean of economic development, carried by the favorable currents of Western countries' markets and technology, and pushed by the winds of the rising competition from developing countries. Japan's true source of vitality lies in its ability to adapt so dynamically to make the most of its unique position in the world economy.

The government-controlled program to import technology, which was initiated in 1950, and the trend of technology imports are examined in detail in Chapter 2. Favorable supply conditions existed for the importation of Western technology. The chapter considers those factors that induced Western manufacturers to supply technology even at the risk of fostering Japanese competition.

Chapter 3 focuses on the 1950s, the first decade of Japan's effort to assimilate Western technology. The effects of technology imports on Japan's export performance, capital formation, and import substitution are analyzed. Strong evidence is presented that Japan's postwar export competitiveness and industrial growth indeed originated in its assimilation of advanced Western technology and know-how. Chapter 4 presents a study of interactions between local interests, protected by the Japanese govern-

ment, and Western suppliers of technology, who later became increasingly interested in setting up manufacturing operations in Japan. Japan's defensive measures against the advance of multinational foreign corporations are discussed.

Needless to say, Japan's borrowing and imitating of Western industrial arts was not done without effort. In fact, an enormous amount of effort was exerted to perfect the imported technologies, many of which were purchased in their rudimentary stages. Japan's capacity to make adaptive innovations depended upon its R & D effort. This and other features of Japan's R & D activity are examined in Chapter 5.

As indigenous technologies are developed and imported ones are improved, Japan is quickly becoming an important exporter of industrial technology, particularly to developing countries in Asia and now increasingly to Western countries. Japan's own technological advances are now helping it compete in the emerging multinationalism of the world market. The export of this new industrial resource and of direct investment capital from Japan is examined in Chapter 6. Chapter 7 analyzes the psychological factors behind Japan's economic drive in the postwar period and shows how the Japanese have reacted to the sudden changes in the world economic environment precipitated by the recent international monetary and energy crises. Japan's entire society, economic, social, and political, is at a crossroads; national values are now being reexamined and redirected. The new orientation of Japan's technological effort is described. The final chapter considers some implications of our analysis for the United States policy on technology. The effectiveness and desirability of controls on technology outflows to prolong U.S. trade advantage in high-technology products are evaluated. In short, the book describes the advance of industrial technology in Japan, shows how it has served as the backbone of Japan's postwar industrialization, and shows how it is coming to serve as a competitive factor in Japan's emerging multinationalism in the world market—all as a challenge to the West.

Throughout the book heavy reliance is placed on the official statistics and statements of the Japanese government—in some places even in an uncritical manner. Although they may be sometimes biased, important loci of

Japan's technological efforts can be outlined to facilitate our analysis and prognostication. The book is also admittedly of a journalistic rather than a scholarly nature since it often relies on newspapers and weekly periodicals. Yet the latest information about the subject matter can only be found in scattered pieces in these sources. An attempt is made to piece them together to construct a cohesive whole. The expositions presented here will possibly raise many more questions to perceptive readers than answers tentatively presented. I hope that any heuristic function that the book serves will exonerate any faulty analyses.

While the original manuscript of this book was being edited, the Middle East oil crisis struck and jolted Japan with serious repercussions not only on the future course of its economy but also, more importantly, on the political and economic relationship between the United States and Japan. I have added some observations relating this current development to my original analysis, but very cursorily to meet the publication schedule.

My interest in the present research dates back to the doctoral study program I completed at Columbia University in 1966 under the guidance of Professors Peter B. Kenen and Donald B. Keesing, to whom I am deeply indebted for intellectual enlightenment. Many parts of this book are based upon the findings of my previous research published in the following articles and monograph: "Imitation, Innovation, and Japanese Exports," in Peter B. Kenen and Roger Lawrence (eds.), The Open Economy: Essays on Trade and Finance (New York: Columbia University Press, 1968); "Should the United States Restrict Technology Trade with Japan," MSU-Business Topics (Vol. 20, No. 4, Autumn 1972), published by Division of Research, Graduate School of Business Administration, Michigan State University, reprinted by permission of the publisher; three articles in The Columbia Journal of World Business: "Japan Exports Technology to Asian LDCs" (Vol. VI, No. 1, Jan.-Feb., 1971), "Japan's Technology Now Challenges the West" (Vol. VII, No. 2, Mar.-Apr., 1972), and "Multinationalism: Japanese Style" (Vol. VII, No. 6, Nov.-Dec., 1972), published by Graduate School of Business Administration, Columbia University; and Transfer of Technology from Japan to Developing Countries, UNITAR Research Report No. 7 (New York: United Nations Institute for Training and Research, 1971). I also drew upon part of the results of my research report

commissioned by the World Bank, Labor-Resource-Oriented Migration of Japanese Industries to Taiwan, South Korea and Singapore (Economic Staff Working Paper No. 134, International Bank for Reconstruction and Development, 1972). I am grateful to the respective publishers for permission to incorporate my previous works in the present form.

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