

China in the Global Economy

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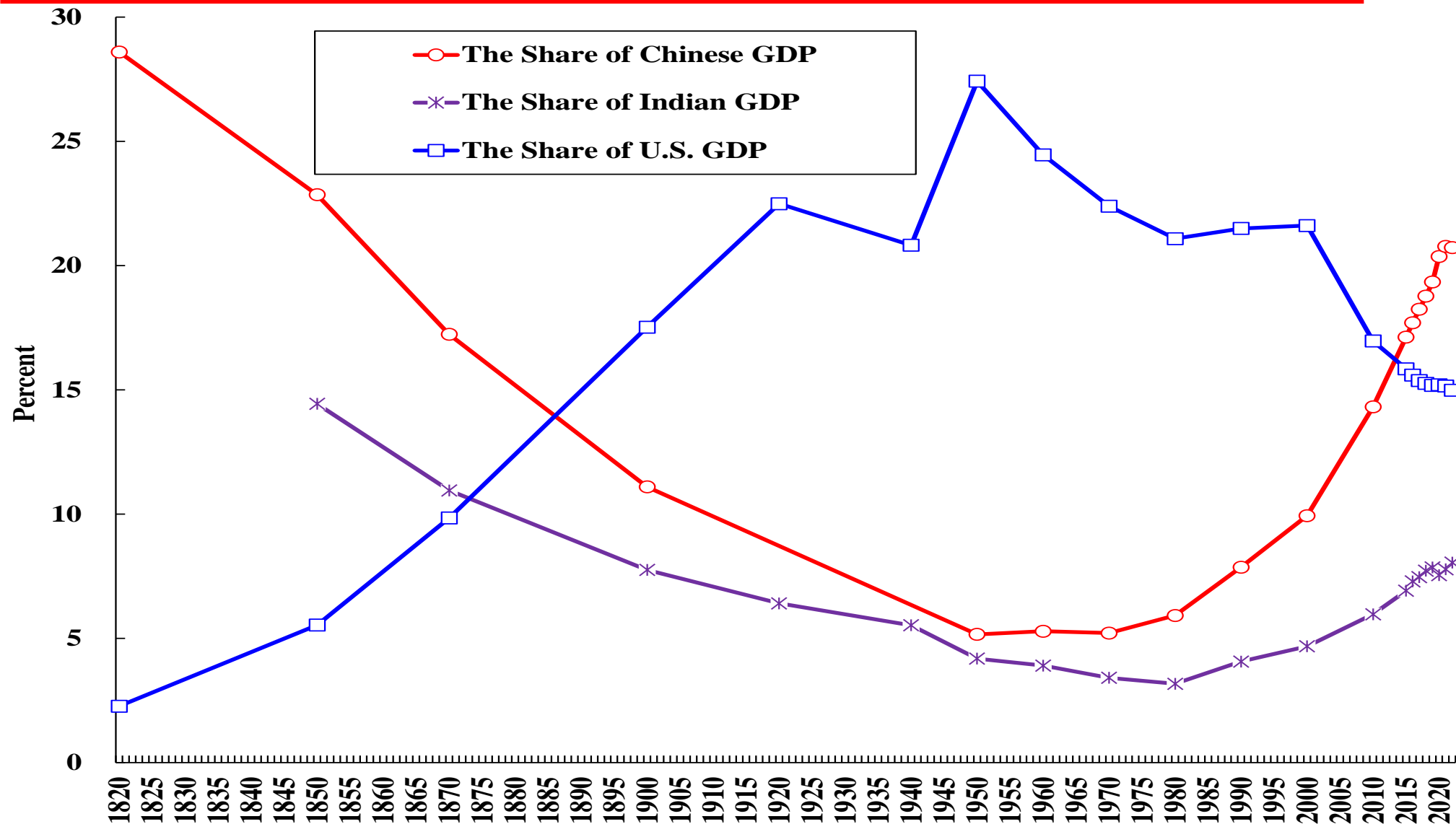
Introduction

- ◆ We begin with a historical overview of the Chinese economy from the early 19th Century to the present.
- ◆ We then examine briefly the development of the Chinese economy since 1949.
- ◆ This is followed by a review of the positions of China in different spheres of the global economy today.
- ◆ Finally, we conclude with some long-term projections of the Chinese economy to 2050.

The Fall and Rise of the Chinese Economy from 1820 to the Present

- ◆ We begin with a chart showing the shares of China, India and the U.S. of World GDP since 1820, using data from the (Angus) Maddison Project Database. The database was constructed on the basis of “Purchasing Power Parity (PPP)” international prices, and hence generates slightly different results from those studies that use market prices at market exchange rates, including this one.
- ◆ In 1820, China supposedly accounted for more than 30% of the then world GDP, India somewhere between 20 and 25%, and the U.S. less than 3%. China and India together (and hence Asia) accounted for more than half of the then World GDP.
- ◆ The Chinese and Indian shares then declined continuously to below 5%, until 1950 for China, and 1980 for India, whereas the U.S. share rose steadily to reach a peak of over 30% in 1960. The Chinese and Indian shares then began to recover from their respective bottoms.

The Shares of World GDP of China, India and the U.S. since 1820 (Maddison Project Database) PPP



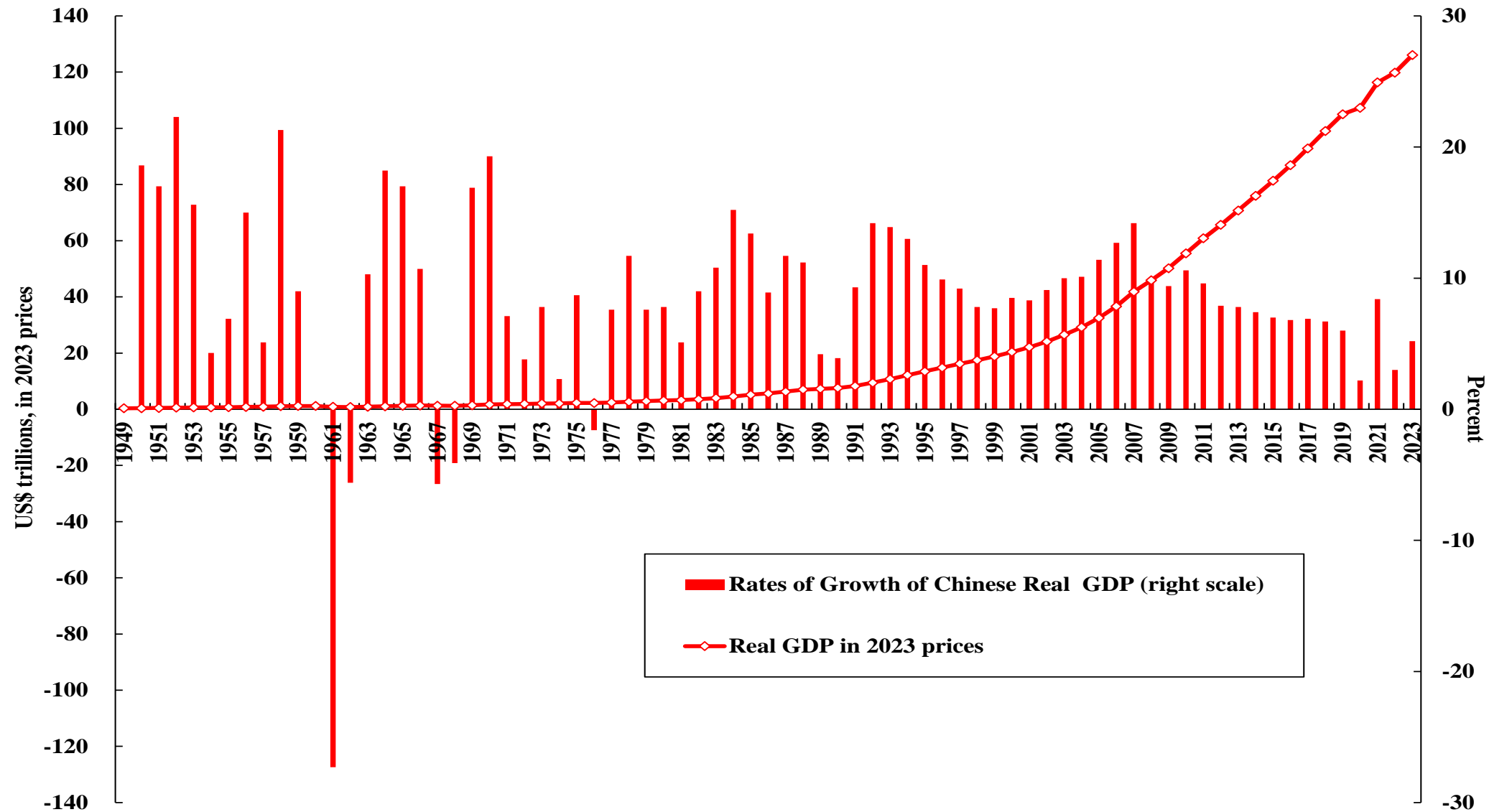
The Fall and the Rise of Economies from 1820 to the Present

- ◆ In 2014, in Purchasing-Power-Parity (PPP) terms, Chinese GDP reached parity with U.S. GDP, with each accounting for approximately 18% of World GDP. This finding was supported by both the International Monetary Fund and the World Bank.
- ◆ In PPP terms, by 2022, the Chinese and Indian shares rose to 20.7% and 8.1% respectively, but the U.S. share declined to 15.0%. Thus, the Chinese GDP was 138% of the U.S. GDP.
- ◆ However, evaluated in 2023 market prices and at the year-end 2023 market exchange rate, the Chinese GDP of US\$17.80 trillion was only 65.1% of the U.S. GDP of US\$27.36 trillion in 2023.
- ◆ Around 1800, Chinese population may be estimated at 330 million (compared to 1.41 billion today), or approximately 37 percent of the then World population. The Chinese share of World population has since fallen to a little more than 17 percent.
- ◆ For various reasons, the Chinese real GDP per capita started to fall continuously in the 19th Century until the middle of the 20th Century, to US\$86.9 in today's prices in 1949.

Economic Performance since 1949

- ◆ The performance of the Chinese economy since the establishment of the People's Republic of China in 1949 has been most impressive. Between 1949 and 2023, Chinese real GDP has grown from US\$47.1 billion to US\$17.80 trillion, in 2023 prices, converted at the Yuan/US\$ exchange rate at year-end 2023, an almost 380-fold increase (see chart).
- ◆ Chinese real GDP has grown at an average annual rate of **8.35%** over this long period of three-quarters of a century, which is historically unprecedented.
- ◆ Moreover, many qualitative indicators, such as educational attainments and life expectancies, have also improved significantly over the same period.

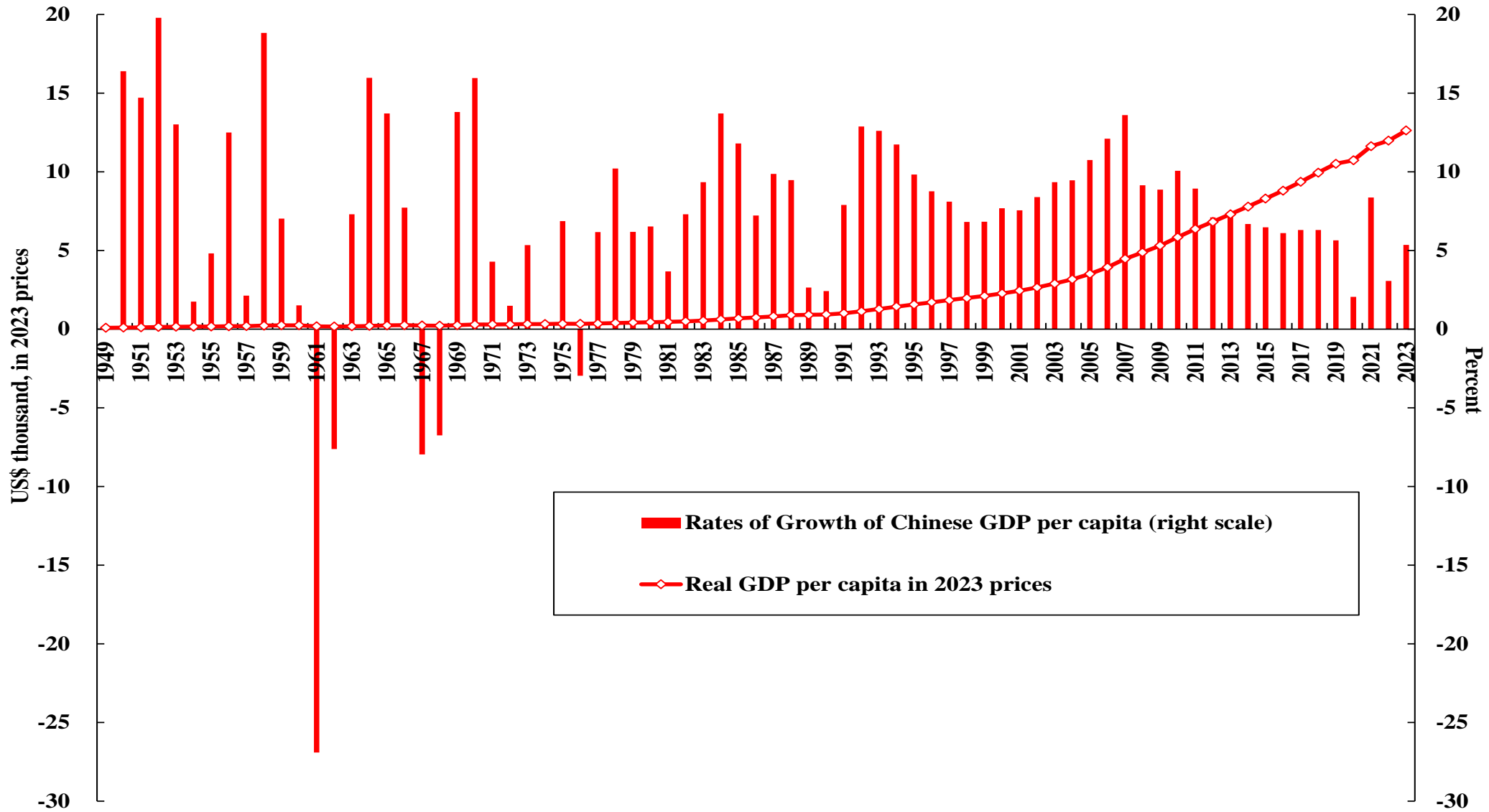
Chinese Real GDP and Its Annual Rate of Growth: 1949-2023



Economic Performance since 1949

- ◆ Between 1949 and 2023, Chinese real GDP per capita has grown more than 140-fold, from US\$86.9 to US\$12,626 in 2023 prices (see chart). Even then, the Chinese real GDP per capita was less than one-sixth of that of the U.S. of US\$81,610 and ranked below 70th among all economies in the world.
- ◆ Despite the significant fluctuations and volatility of the rates of growth during the 20 years from the late 1950s to the late 1970s, the average annual rates of growth of real GDP and real GDP per capita for the entire period of three quarters of a century from 1949 to 2023 were respectively **8.35%** and **6.96%**, a truly remarkable achievement over such a long period of time.
- ◆ We may also note that since the beginning of economic reform and opening to the World in 1978, there is not a single year in which the rate of growth of real GDP is negative or zero.

Chinese Real GDP per Capita and Its Annual Rate of Growth: 1949-2023



Economic Performance since 1949

- ◆ We can attribute this success largely to the economic reform and opening undertaken by China in 1978, as well as to the long time-horizon of the Chinese economic policy makers and their single-minded focus on economic growth. With a long enough planning horizon, one can undertake investment in development-leading infrastructure, that is, infrastructure the demand for which has not yet materialised but can be created by the supply itself, infrastructure that may take a long time to pay off or pay off only through externalities. But very often “supply creates its own demand”! Such investment can stimulate demand and further development, but because of its typically long payback periods and inability to internalise the benefits, is unlikely to be undertaken privately.
- ◆ Chinese accession to the World Trade Organization (WTO) in 2001 was also pivotal because it enabled the export promotion strategy and the movement of the surplus labour in the agricultural sector to the industrial and service sectors.
- ◆ The Chinese GDP of US\$17.80 trillion in 2023 was **65.06%** of the U.S. GDP of US\$27.36 trillion, but the Chinese GDP per capita of US\$12,626 remained far₁₀ behind, at less than one-sixth of the U.S. GDP per capita of US\$81,610.

China in the Global Economy

- ◆ One of the most important developments in the global economy during the past almost half a century was the reform and opening of the Chinese economy and its participation in the World, beginning in 1978. As the most populous country in the World, China has always had the potential of having a large impact on both the supply and the demand sides of the global economy. However, the actual results of the Chinese entry into the global economy since 1978 have been surprisingly successful, as we shall show below.
- ◆ In this lecture, we review the position of China in the global economy today. First, we note that China's entry into the World has begun to shift, since 2000, the centres of gravity of the global economy, in terms of GDP, international trade, value-added in manufacturing, consumption and wealth, gradually but surely, from North America and Western Europe to East Asia, and within East Asia from Japan to China.
- ◆ China has managed to become, simultaneously, the “World's factory” as well as the “World's market”. China has also become, in the process, the highest carbon dioxide emitter in the World. However, in terms of real GDP, aggregate wealth, and the sizes of the capital and consumer markets, the U.S. still remains by far the largest in the World.

China in the Global Economy

- ◆ Second, in terms of investments in intangible capital (human capital and R&D capital), China has also made great efforts. In 1986, China introduced universal 9-year mandatory education. In 1999, China vastly expanded the number of first-year students admitted to tertiary educational institutions. As a result, China has also achieved much in terms of the educational attainments of its population, reflected in the rising proportion of the tertiary educated in its labour force, and in innovation, reflected in the growth in its numbers of publications in international scientific and engineering journals and patent awards. However, there is still a great deal of room for China to improve in these areas, especially in basic research.
- ◆ Third, since 2010, the renminbi, the Chinese currency, has also begun to be accepted as an invoicing, clearing and settlement currency in bilateral international transactions involving China. However, the U.S. Dollar still remains, by a very large margin, the international medium of exchange and store of value of choice for many economies.

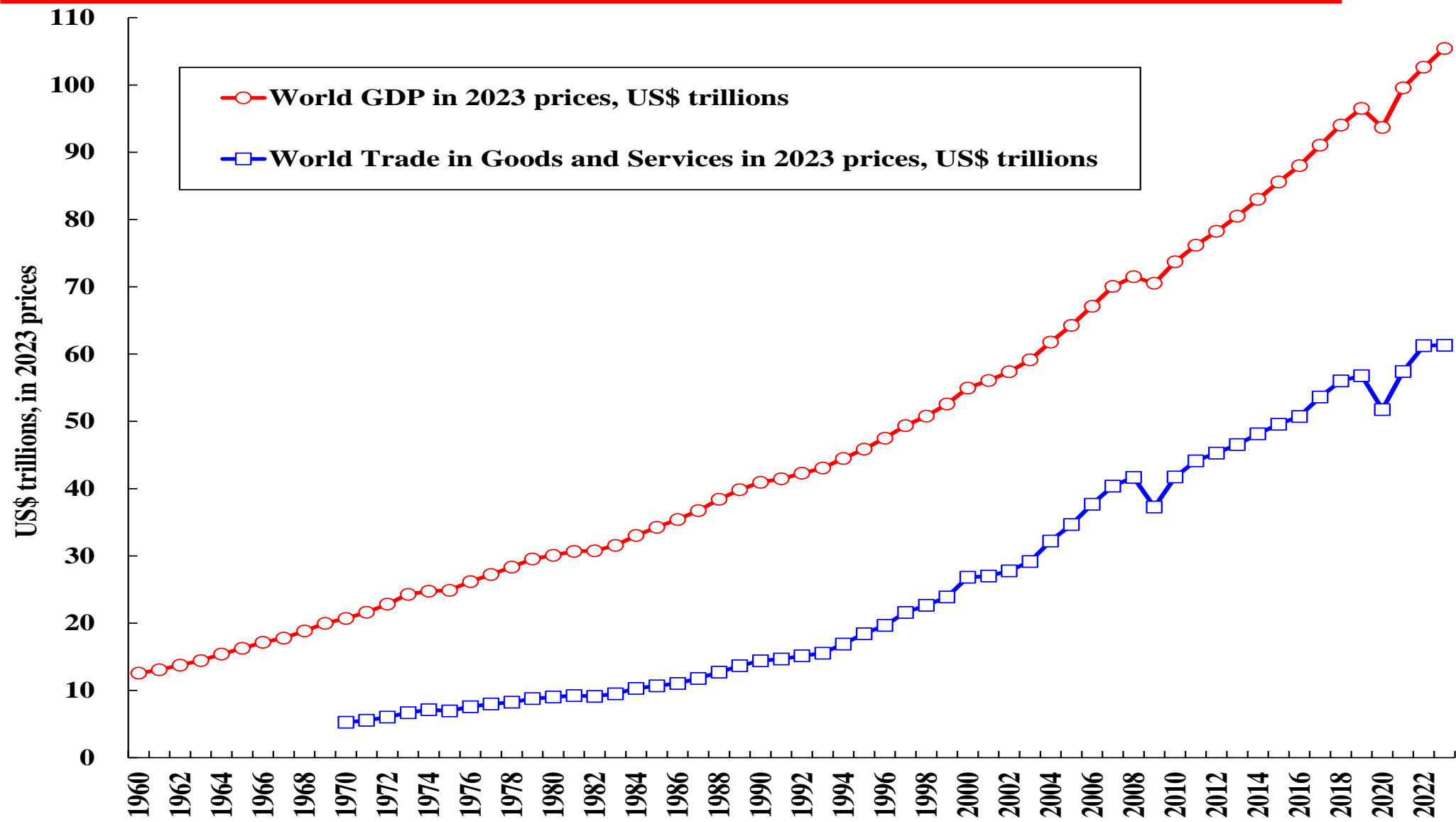
China in the Global Economy

- ◆ Fourth, because of its rapid economic growth, China has also become, since 2005, the highest carbon dioxide emitter in the World, overtaking the United States. However, China is committed to peaking its carbon emissions by 2030 and achieving net carbon neutrality by 2060. These targets appear eminently feasible.
- ◆ Already in 2023, renewable energy (solar and wind) constituted 52 percent of the total new electricity generation capacity installed in China, surpassing thermal (fossil-fuel) energy. China is today the leading pioneer in the development and application of renewable energy.

The Growth Trends in World Real GDP and Real International Trade

- ◆ In the following chart, the total values of World real GDP and real international trade in goods and services, respectively, between 1960 and 2023, are presented. Between 1960 and 2023, World real GDP grew steadily and almost continuously, at an average annual rate of 3.43%.
- ◆ Between 1970 and 2023, the real quantity of World international trade, in constant 2023 U.S. Dollar, grew even faster, at an average annual rate of 4.74%.
- ◆ However, the growth of world trade appeared to have been stalled recently—it grew only 0.1% in 2023, reflecting the effects of the COVID-19 pandemic as well as the more recent trends of economic de-globalisation, de-coupling, de-risking and rising protectionism.
- ◆ Given the threats of tariffs by U.S. President-Elect Donald Trump against various countries, it is likely that the rate of growth of the real quantity of World trade in goods and services and World GDP will continue to decline in the coming years.

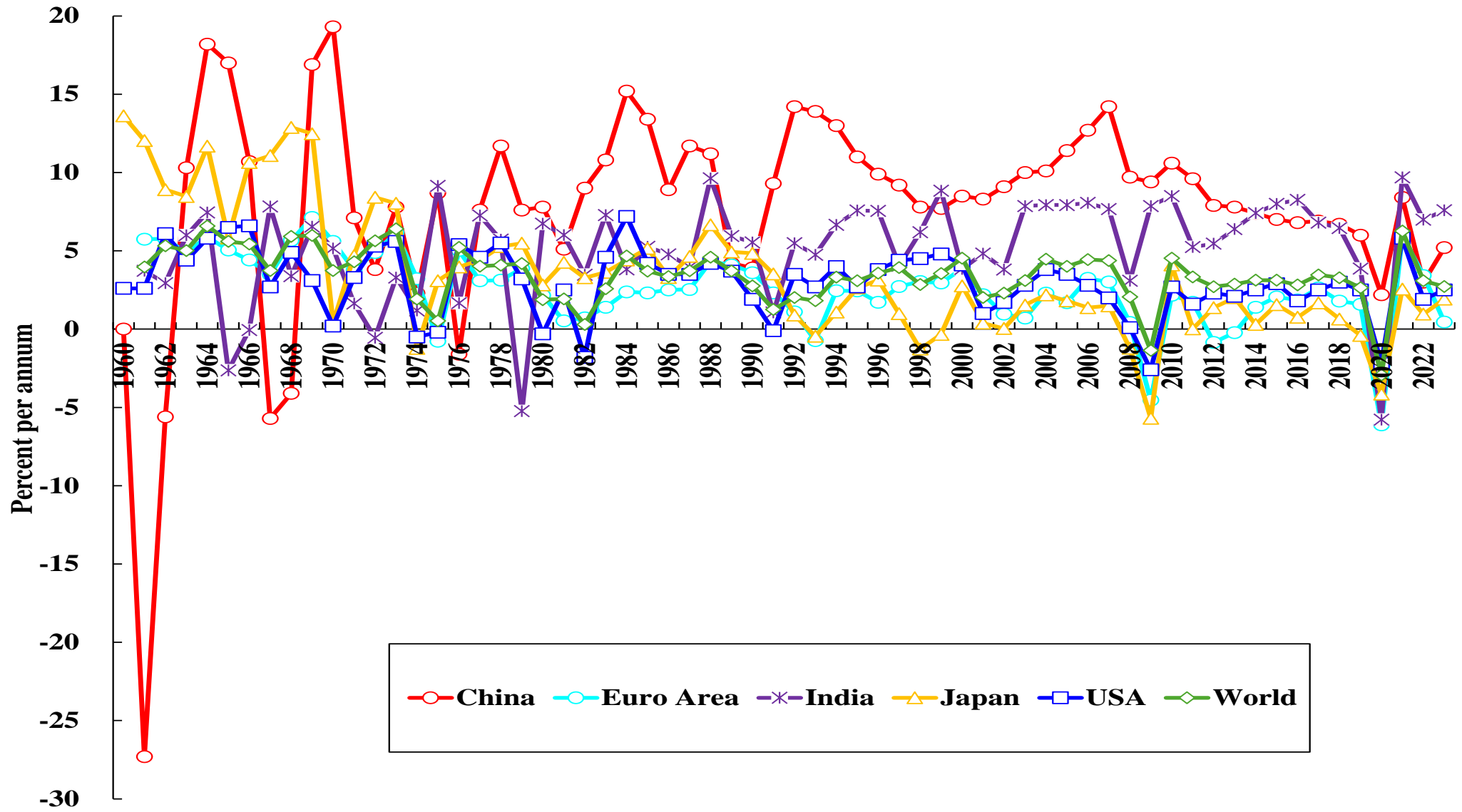
The Growth Trends in World Real GDP and International Trade in 2023 Prices, Tril. US\$



Rates of Growth of Real GDP: China, the Euro Area, India, Japan, the U.S. and the World

- ◆ In the following chart, the annual rates of growth of the real GDPs of Mainland China, the Euro Area, India, Japan, the U.S. and the World between 1960 and 2023 (in 2023 prices) are presented.
- ◆ China is represented by the red line, which shows huge fluctuations, with large positive as well as negative rates, before 1978. However, since 1978, China has stayed at the top until more recently, indicating that it has had the highest rate of growth among the included countries and regions most of the time.
- ◆ India, represented by the purple line, has since 1980 had the second highest rate of growth among this group of economies, and has even surpassed China in more recent years.
- ◆ The World as a whole, represented by the green line, is in the third place.
- ◆ The U.S., represented by the blue line, has been mostly just behind the World, in the fourth place, at around 3% per annum. The U.S. is followed by the Euro Area, represented by a turquoise line, in the fifth place, although it has fallen behind Japan in 2023. Japan, represented by the yellow line, has had high rates of growth between 1960 and 1973 (the first oil shock), moderate rates between 1973 and 1992, but the lowest rates of growth since 1992 among this group of economies.
- ◆ For all of the economies, there were major dips in their rates of growth in both 2008, the year of the Global Financial Crisis, and in 2020, the first year of the 16 COVID-19 pandemic.

Rates of Growth of Real GDP: China, the Euro Area, India, Japan, the U.S. and the World



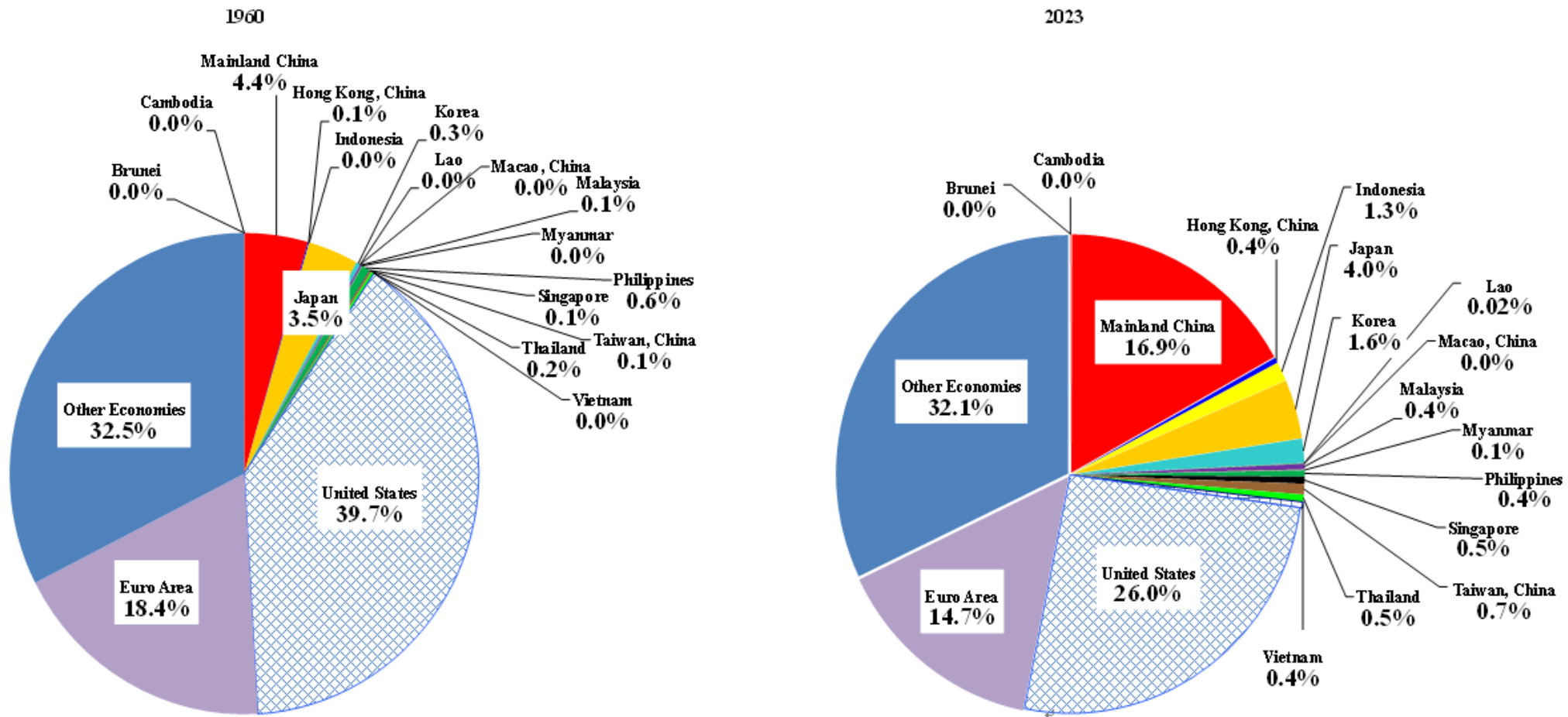
The Shifting Centres of Gravity of the Global Economy

- ◆ Already since 1960, the centres of gravity of the global economy have been shifting from North America and Western Europe to East Asia. And within East Asia, they have been shifting from Japan to China since the mid-1990s.
- ◆ With the rise of the Indian and other South Asian economies, it appears that the centres of gravity of the global economy will have been shifted to Asia in another decade or so, with Asia accounting for more than half of the World's real GDP, as it once did in the early 1800s.
- ◆ The shifts can also be seen in international trade, value-added in manufacturing, consumption, wealth, human capital and R&D capital and their outputs, and the choice of currency for the settlement of international transactions, to varying degrees. It can also be seen in terms of carbon dioxide emissions.

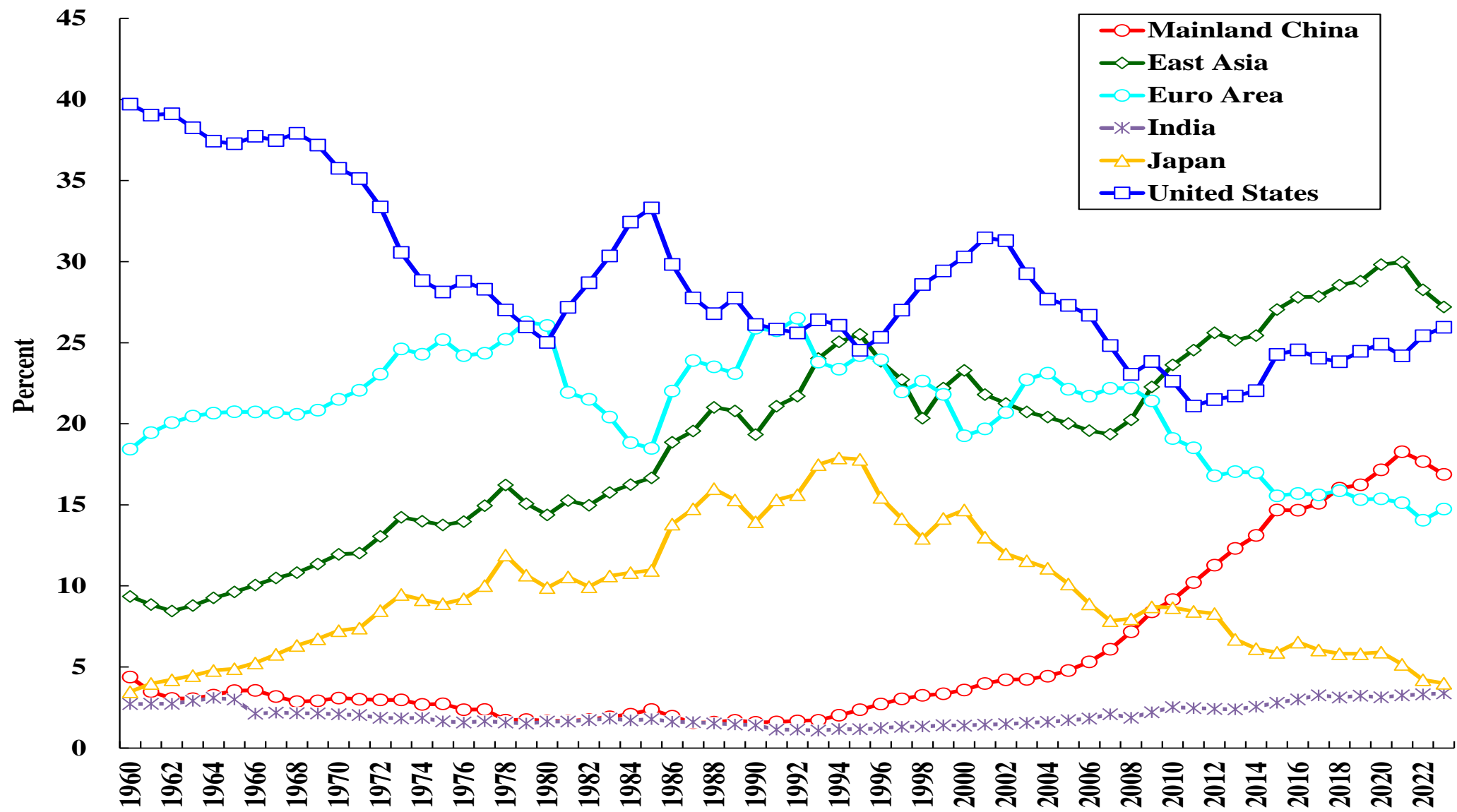
The Shifting Centres of Gravity of the Global Economy: Real GDP

- ◆ Based on market prices and exchange rates, in 1960, the United States and the Euro Area together accounted for over **58%** of World GDP. By comparison, East Asia (defined as the ten Association of Southeast Asian Nations (ASEAN)--Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam--plus 3 (China including Hong Kong, Macau and Taiwan, Japan and South Korea)) accounted for approximately **9.4%** of World GDP, with Mainland China at **4.4%** (see chart). By 2023, the share of United States and the Euro Area in World GDP has declined to approximately **40.7%** whereas the share of East Asia has risen to 27.2% and that of China to **16.9%** (see the following charts).
- ◆ During the same period, Japan's share went from 3.5% to 4.0%, although at its peak, Japan accounted for almost 18%; and India's share went from 2.7% in 1960 to 3.4% in 2022. China's share was similar to India's share before the Chinese economic reform and opening to the world.
- ◆ With the continuing growth of India, ASEAN, South Asian and Middle Eastern economies, Asia's share of world GDP is likely to exceed one half once again in another decade or so.

The Distribution of World GDP, 1960 and 2023, US\$



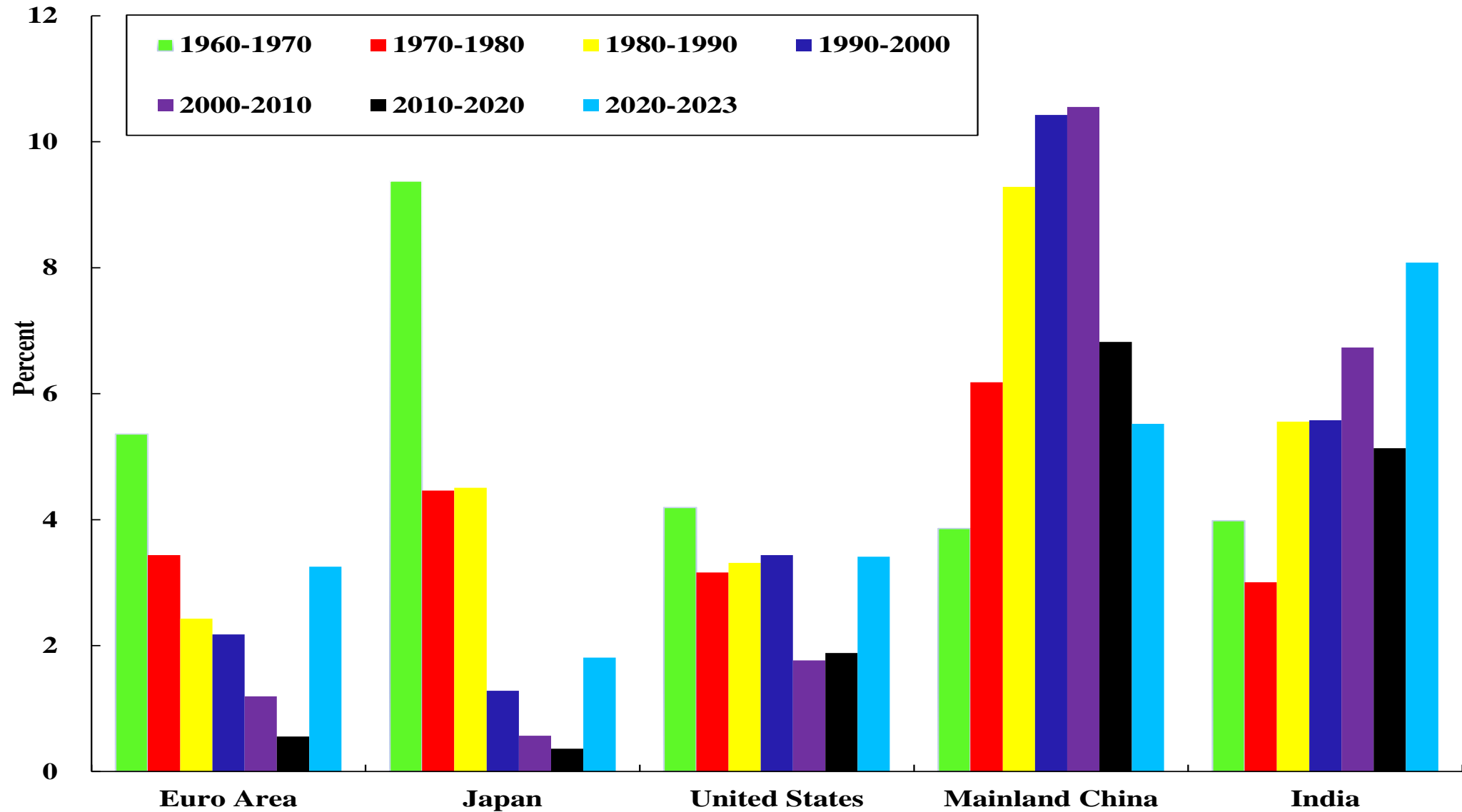
The Shares of China, East Asia, the Euro Area, India, Japan & the U.S. in World GDP, 1960-2023



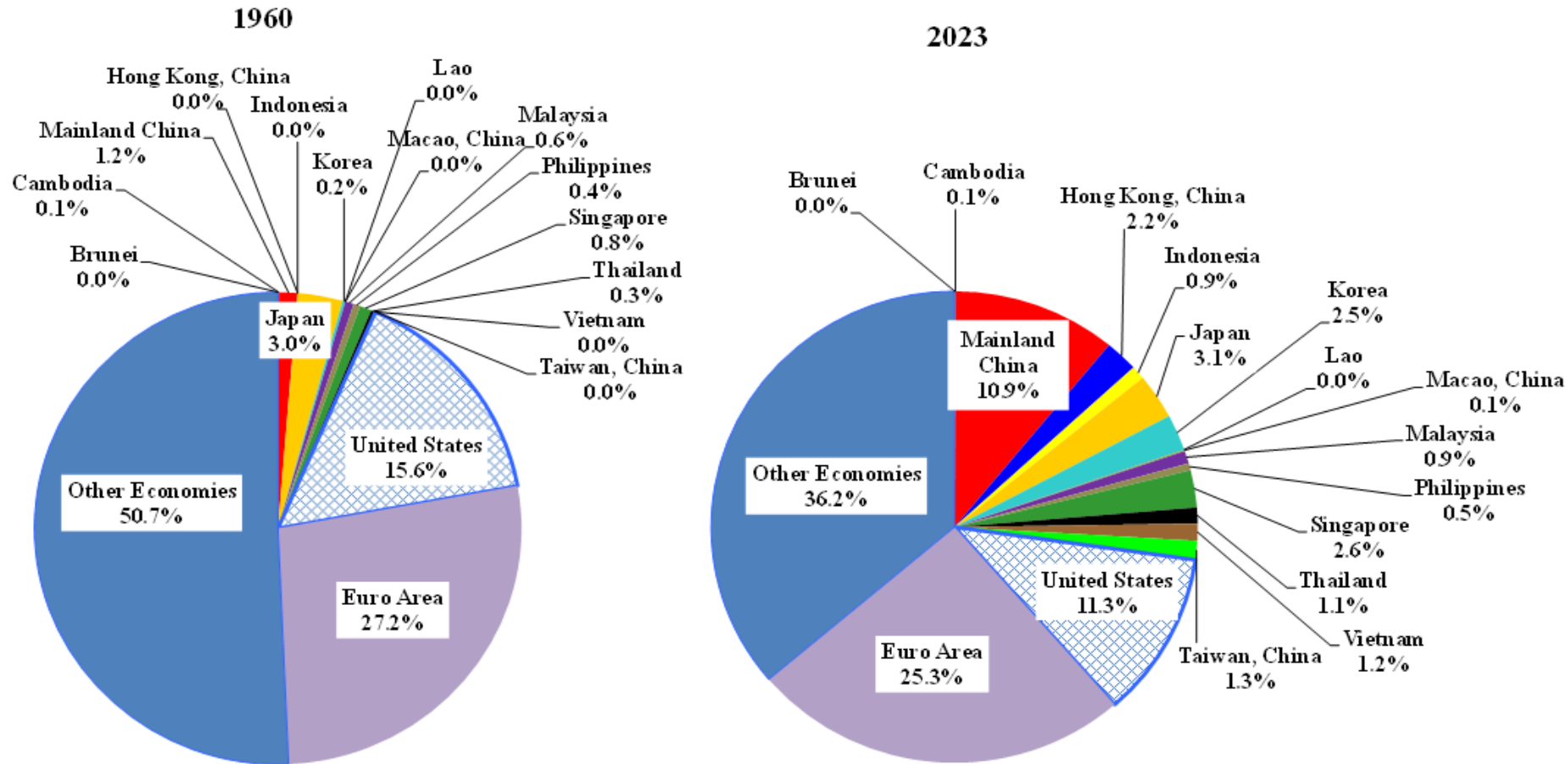
The Shifting Centres of Gravity of the Global Economy: Real GDP

- ◆ In the following chart, the average annual rates of growth of the real GDP of selected economies in different decades are presented.
- ◆ Mainland China and India are among the fastest growing economies during the past four and a half decades. Average annual Chinese growth rates exceeded 10% in the two decades between 1990 and 2010. More recently, Indian annual economic growth has exceeded 8%.
- ◆ Japan was the fastest growing economy in the 1960s but has stagnated since 1990. The U.S. and the Euro Area, being mature developed economies, have had relatively low growth rates during the past decades.

Decade Average Annual Rates of Growth of Real GDP of China, the Euro Area, India, Japan & the U.S, 1960-2023



The Distribution of World International Trade in Goods and Services, 1960 and 2023, US\$



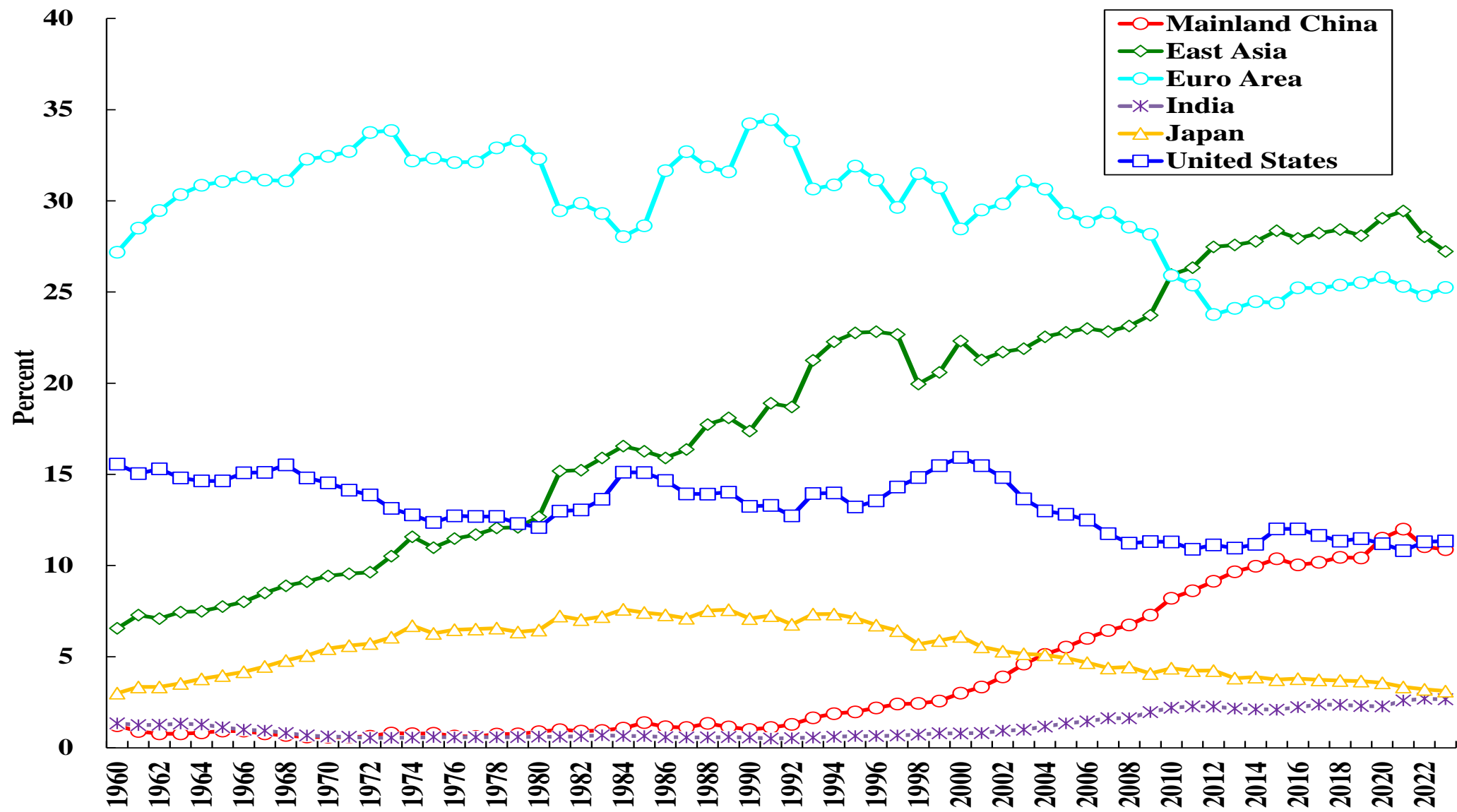
The Shifting Centres of Gravity of the Global Economy: International Trade

- ◆ Between 1960 and 2023, the share of the U.S. in World international trade in goods and services declined from 15.6% to 11.3%; and the share of Mainland China, which was similar to India's share before its economic reform and opening in 1978, rose from 1.2% to 10.9%.
- ◆ During the same period, the share of East Asia as a whole rose from 6.6% to over 27%, surpassing the Euro Area. Japan's share rose from 3.0% to 3.1% and India's share rose from 1.3% to 2.7%.
- ◆ With the continuing growth of the international trade of the ASEAN economies, India and other South Asian economies such as Bangladesh, and the oil and gas producers of the Middle East and Central Asia, Asia's share of World trade should also approach one half of the World total within the coming decade.

The Shifting Centres of Gravity of the Global Economy: International Trade

- ◆ In the following chart, we compare the distributions of world international trade in goods and services in 1960 and 2023. In 1960, the United States and the Euro Area together accounted for almost **43%** of the value of total international trade in goods and services in the World. By comparison, East Asia accounted for only **6.6%** of total World trade. By 2023, the combined share of United States and the Euro Area in World trade declined to **36.6%** whereas the share of East Asia rose to almost **27.6%**.
- ◆ The Chinese share of World trade rose from **1.2%** in 1960 to **10.9%** in 2023. The growth in Chinese international trade may be attributed in part to the reform of the Chinese exchange rate system and the adoption of current-account convertibility in 1994, accompanied by a significant devaluation, as well as to Chinese accession to the World Trade Organization in 2001. Chinese international trade accounted for 40% of East Asian international trade in 2023.

The Shares of China, East Asia, the Euro Area, India, Japan & the U.S. in World Trade, 1960-2023



The Growth of Total Real International Trade in Goods and Services

- ◆ In the following chart, the average annual rates of growth of total real international trade in goods and services for selected economies for different decades are presented.
- ◆ China and India have had the highest rates of growth in international trade, especially since the 1990s. Growth in Chinese international trade was particularly rapid during the decade of 2000-2010 because of its accession to the World Trade Organization (WTO) in 2001 and because of the expiration of the Multi-Fibre Agreement governing World trade in textiles. India also had exceptionally high rates of growth in its real international trade and in fact exceeded China since 2020.
- ◆ However, all the developed economies—the U.S., the Euro Area, and Japan—had relatively low real rates of growth of international trade during the past several decades.

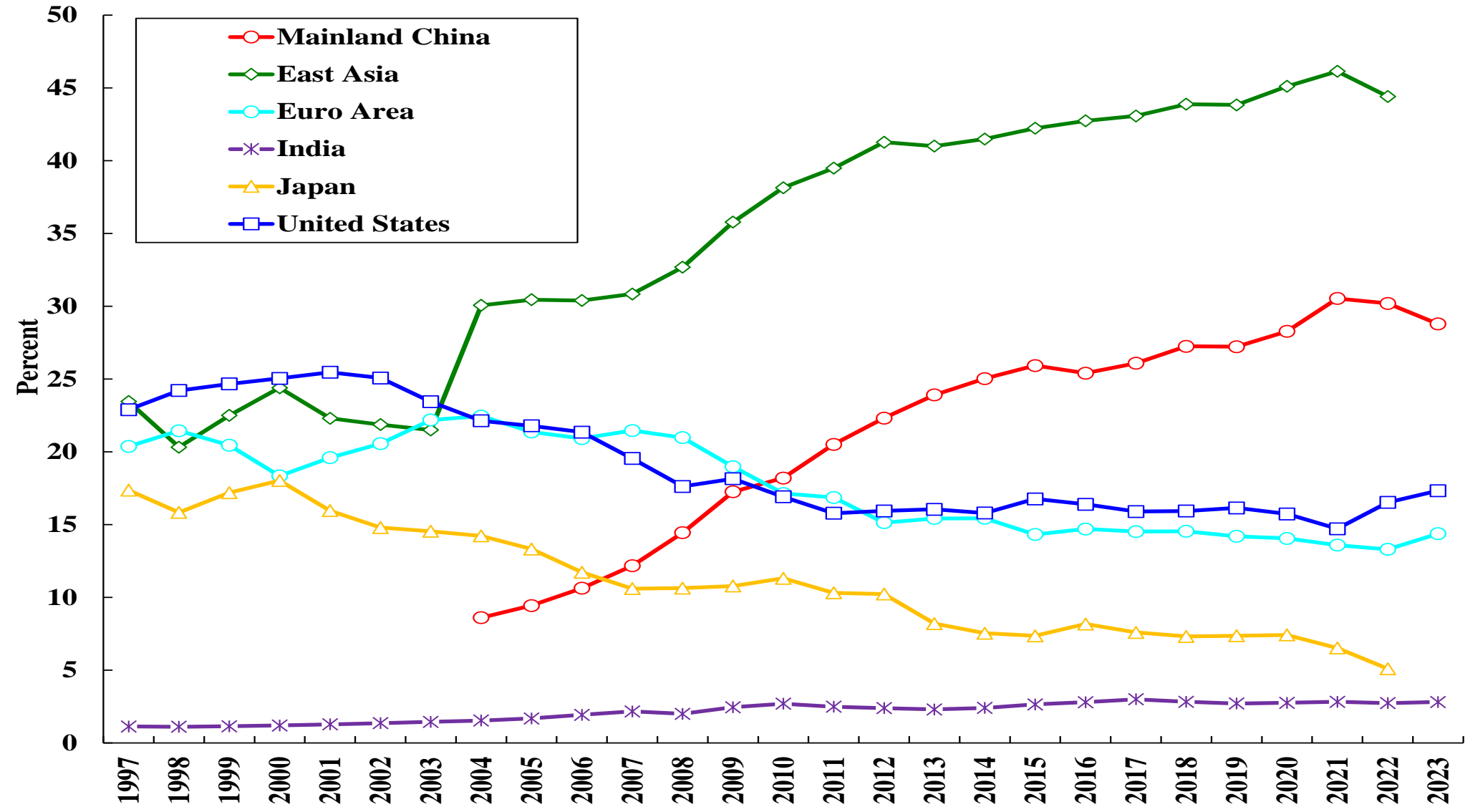
Rank of Country as Trading Partner of China of International Trade in Goods and Vice Versa (2023)

Country	Rank of Country as Trading Partner of Mainland China (2023)	Mainland Chinese Rank as Trading Partner of Country (2023)
United States	1	3
Japan	2	1
Republic of Korea	3	1
Australia	4	1
Germany	5	3
Vietnam	6	1
Brazil	7	1
The Netherlands	8	4
Mexico	9	2
Indonesia	10	1

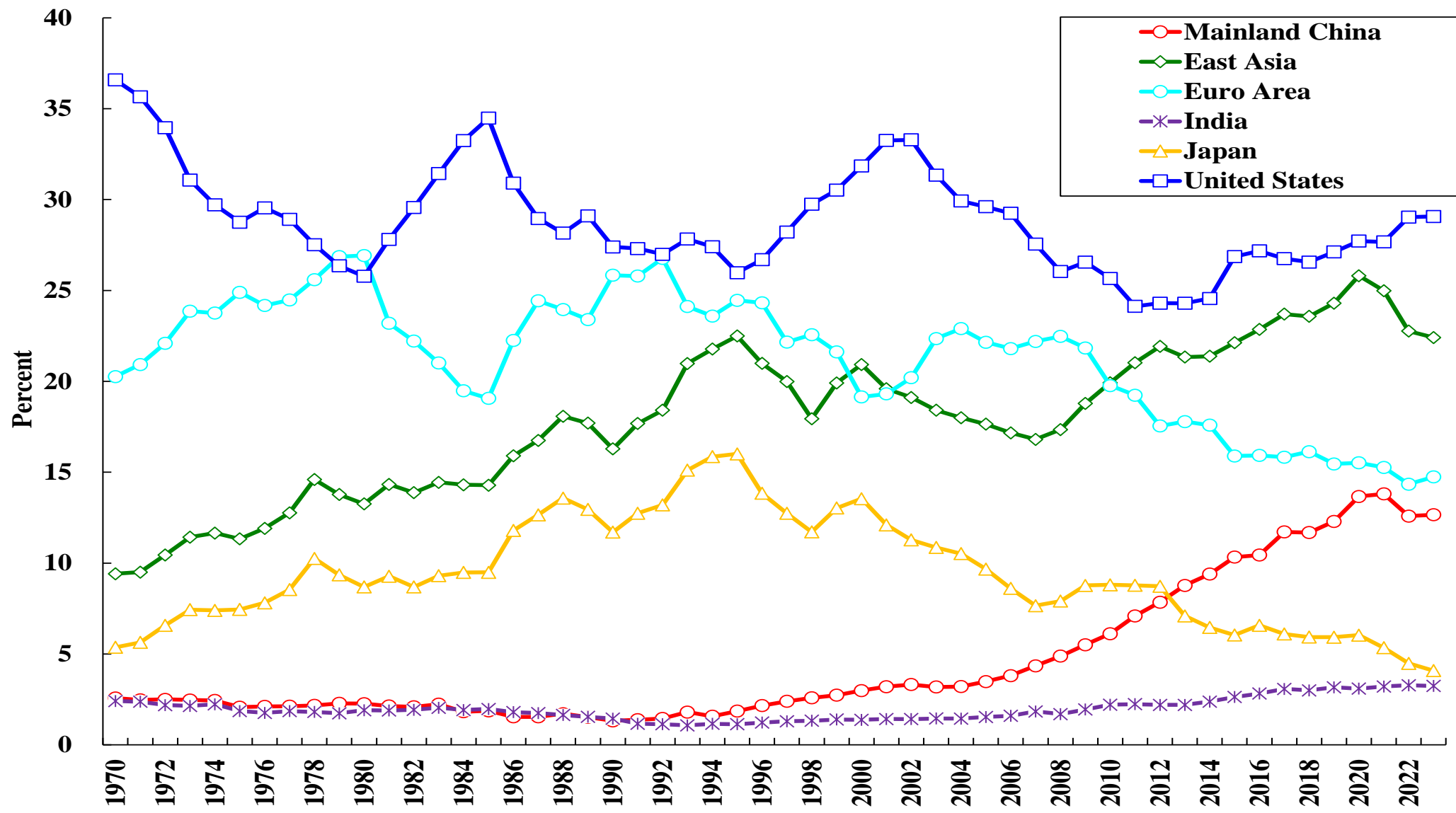
Rank of China as Trading Partner of ASEAN Country of International Trade in Goods & V.V.

ASEAN Country	Mainland Chinese Rank as Trading Partner of ASEAN Country (2023)	Rank of ASEAN Country as Trading Partner of Mainland China (2023)
Brunei	2	102
Cambodia	1	55
Indonesia	1	12
Laos	2	84
Malaysia	1	17
Myanmar	1	62
Philippines	1	30
Singapore	1	13
Thailand	1	16
Vietnam	1	8

The Shares of China, East Asia, Euro Area, India, Japan & the U.S. in World Value-Added in Manufa.



The Shares of China, East Asia, the Euro Area, India, Japan & the U.S. in World Consumption, 1970-2023



The Shifting Centres of Gravity of Individual, Corporate and Sovereign Wealth in the World

- ◆ According to the 2024 survey done by the Forbes magazine, there were a total of 2,781 US\$ billionaires in the world, amongst whom U.S. citizens accounted for 813 (29.2%), Chinese (including Hong Kong and Macau) citizens accounted for 473 (17%), and Indian citizens 200 (7.2%).
- ◆ A similar survey by Hurun for 2024, based on data of January 2024, concluded that there were a total of just under 3,300 US\$ billionaires in the world, amongst whom U.S. residents accounted for 800 (24.2%) and Chinese residents accounted for 814 (24.7%). Of course, there may well be even many more unknown US\$ billionaires in China. There were also 271 US\$ billionaires living in India (8.2%).
- ◆ Even though the exact numbers and rankings differ, it is unmistakable that aggregate Chinese household wealth is at least of the same order of magnitude as U.S. household wealth. The aggregate Chinese household wealth has also been increasing rapidly with the emergence of a sizeable middle class.
- ◆ Mainland China's stock market also has the second largest market capitalisation in the world, at US\$10.94 trillion, after the U.S., with its US\$48.98 trillion.

The Stock Market Capitalisation of Selected Economies, Year-End 2023

Economy	Market Capitalisation
United States	48.98
Mainland China	10.94
Japan	6.15
India	4.34
Hong Kong, China	3.97

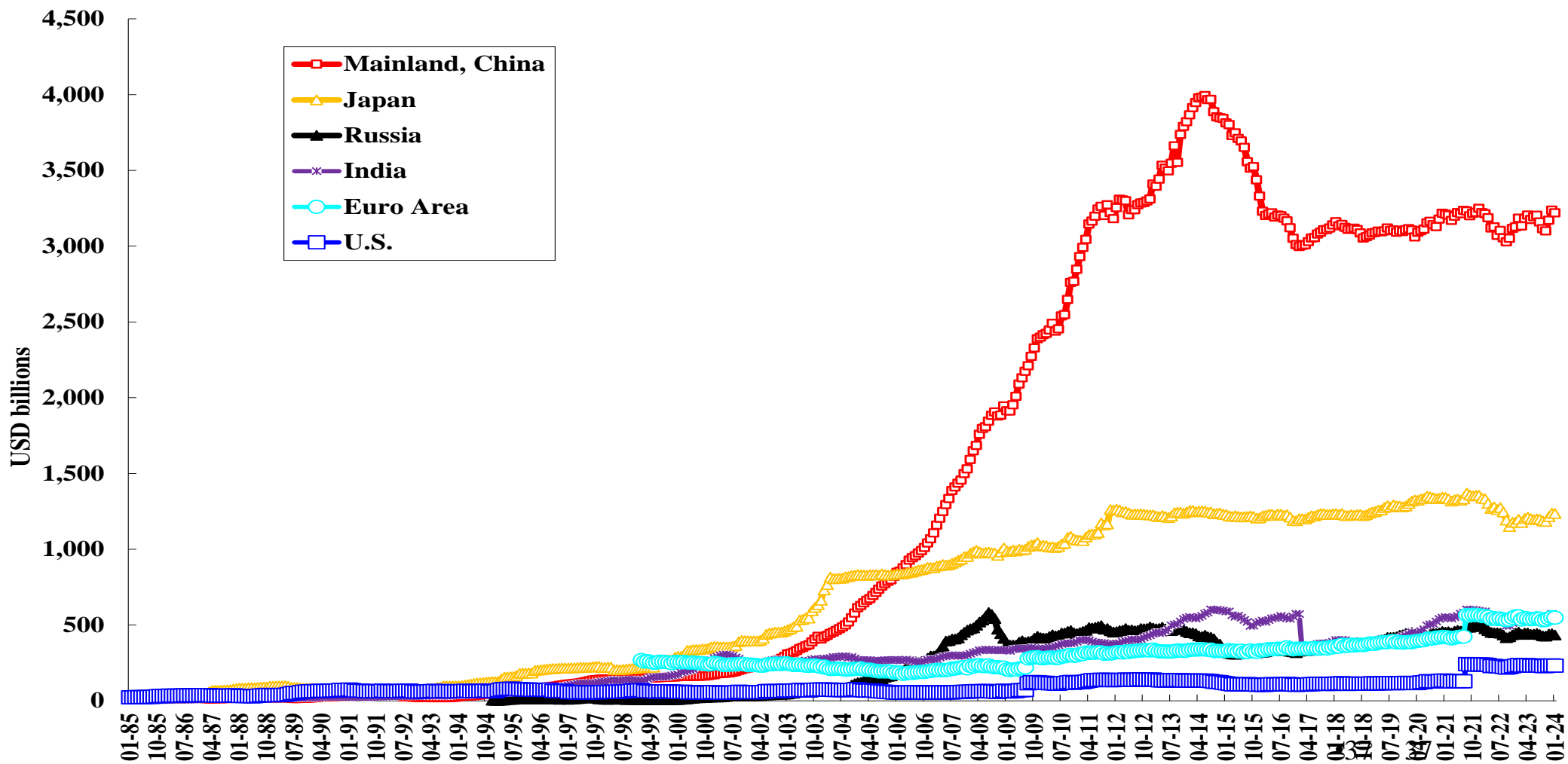
Source: World Federation of Exchanges Statistics Portal

The Shifting Centres of Gravity of Individual, Corporate and Sovereign Wealth in the World

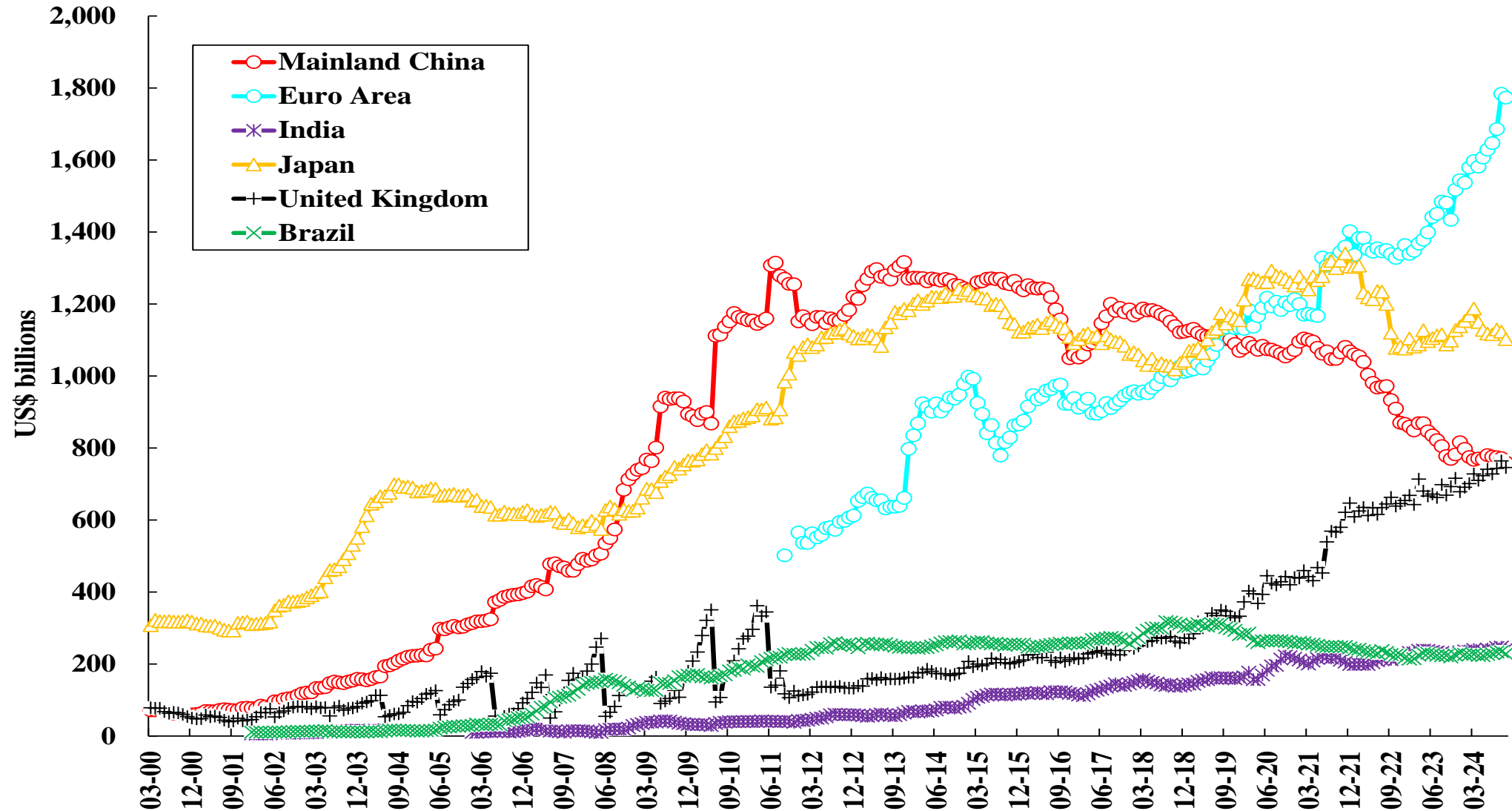
- ◆ China today has the world's largest official foreign exchange reserves, at approximately US\$3.2 trillion, followed by Japan with approximately US\$1 trillion. The central banks of Japan and China used to be the largest and second largest holders respectively of U.S. Treasury and Agency securities. However, the central banks of the Euro Area have recently taken over the top spot from the Bank of Japan, and the People's Bank of China and the Bank of England are currently the joint third largest holder.
- ◆ In addition, at year-end 2023, the assets of the Chinese state-owned enterprises totaled 271.9 trillion Yuan, or almost US\$ 40 trillion, more than twice the annual Chinese GDP.

Total Foreign Exchange Reserves minus Gold: Selected Economies

Total Foreign Exchange Reserves minus Gold, Selected Countries and Regions



U.S. Treasury and Agency Securities Held by the Central Banks of Selected Economies



Economic Globalisation and De-Globalisation

- ◆ Just as economic globalisation increases the welfare of all participating economies because of the enlargement of their choice sets, economic de-globalisation will reduce the welfare of all the formerly participating economies because of the shrinkage of their choice sets. When the choice sets expand, welfare cannot decrease; when the choice sets contract, welfare cannot increase.
- ◆ However, just as economic globalisation creates winners and losers in every participating economy, economic de-globalisation will also create winners and losers in every formerly participating economy. The free market will reward the winners but not the losers. It is up to the individual governments to compensate the losers.
- ◆ De-coupling or de-risking may be viewed as a form of diversification and is not all bad. It has costs but also benefits. In the short term, it will cause disruptions of the existing supply chains and increase costs. However, it will eventually make economies more resilient and markets much more competitive through having multiple sources of supply for almost every product and service. The competition among the multiple sources will lower prices and improve quality of products and services for consumers and users worldwide, and reduce the risks of supply interruption for whatever reason, and everyone will be better off. It will also make export restrictions ineffective.

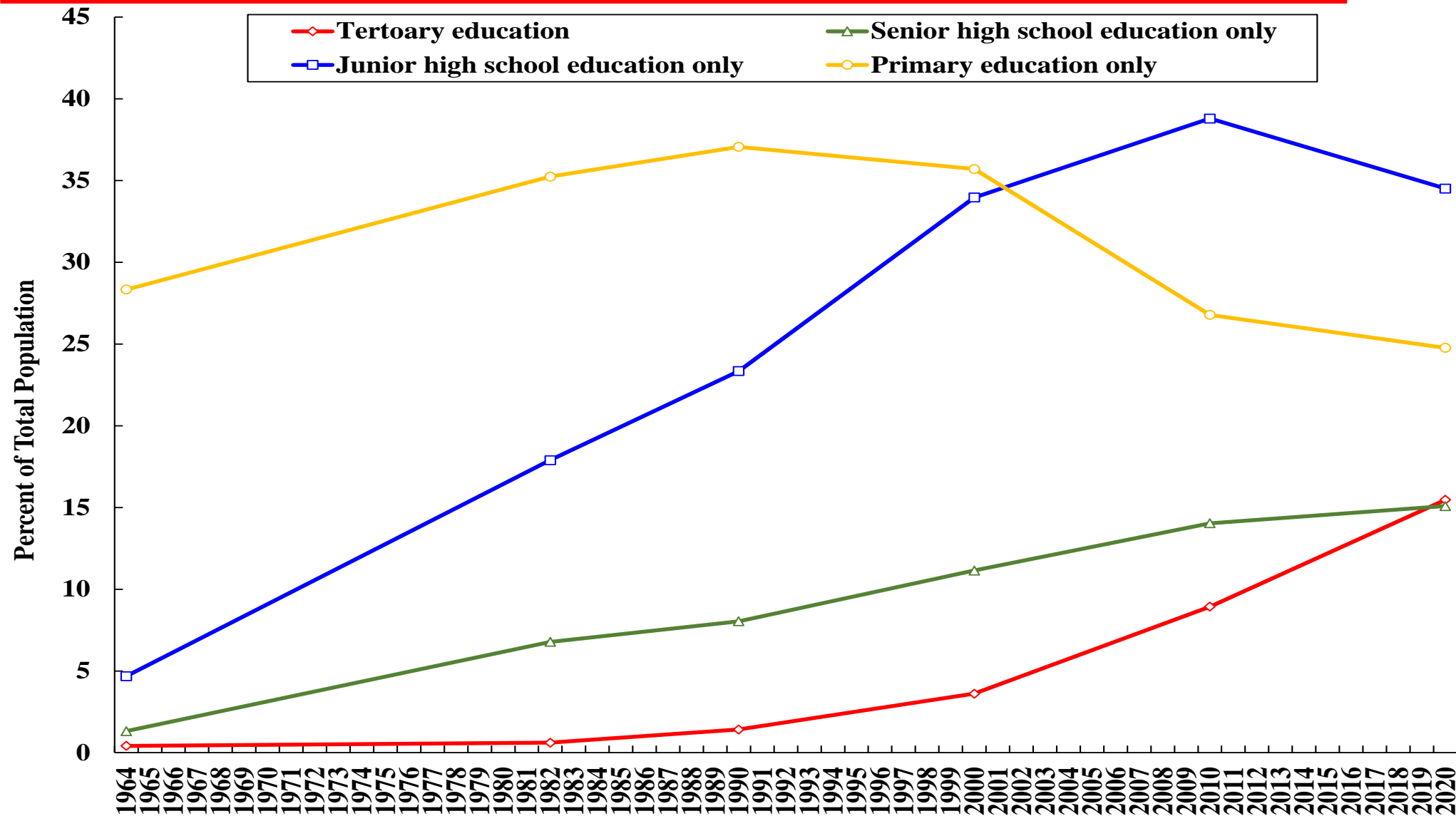
Intangible Capital

- ◆ Two types of intangible capital may be distinguished: human capital and technology capital. Human capital may be measured as the discounted present value of the stream of future labour earnings. An important indicator of the quantity of human capital is the number of years of schooling per person in the labour force or working-age population.
- ◆ Technology capital may also be measured as the discounted present value of the stream of future earnings from intellectual capital (property). An important indicator of the quantity of technology capital is the stock of real R&D capital, which may be measured as the cumulative real R&D expenditures less an annual depreciation of 10%.
- ◆ R&D may be further distinguished by basic research, applied research and development. Basic research is essential for any break-through discovery or invention but is not expected to have a positive real internal rate of return. Thus, it is mostly financed by grants from the government or non-profit organisations.

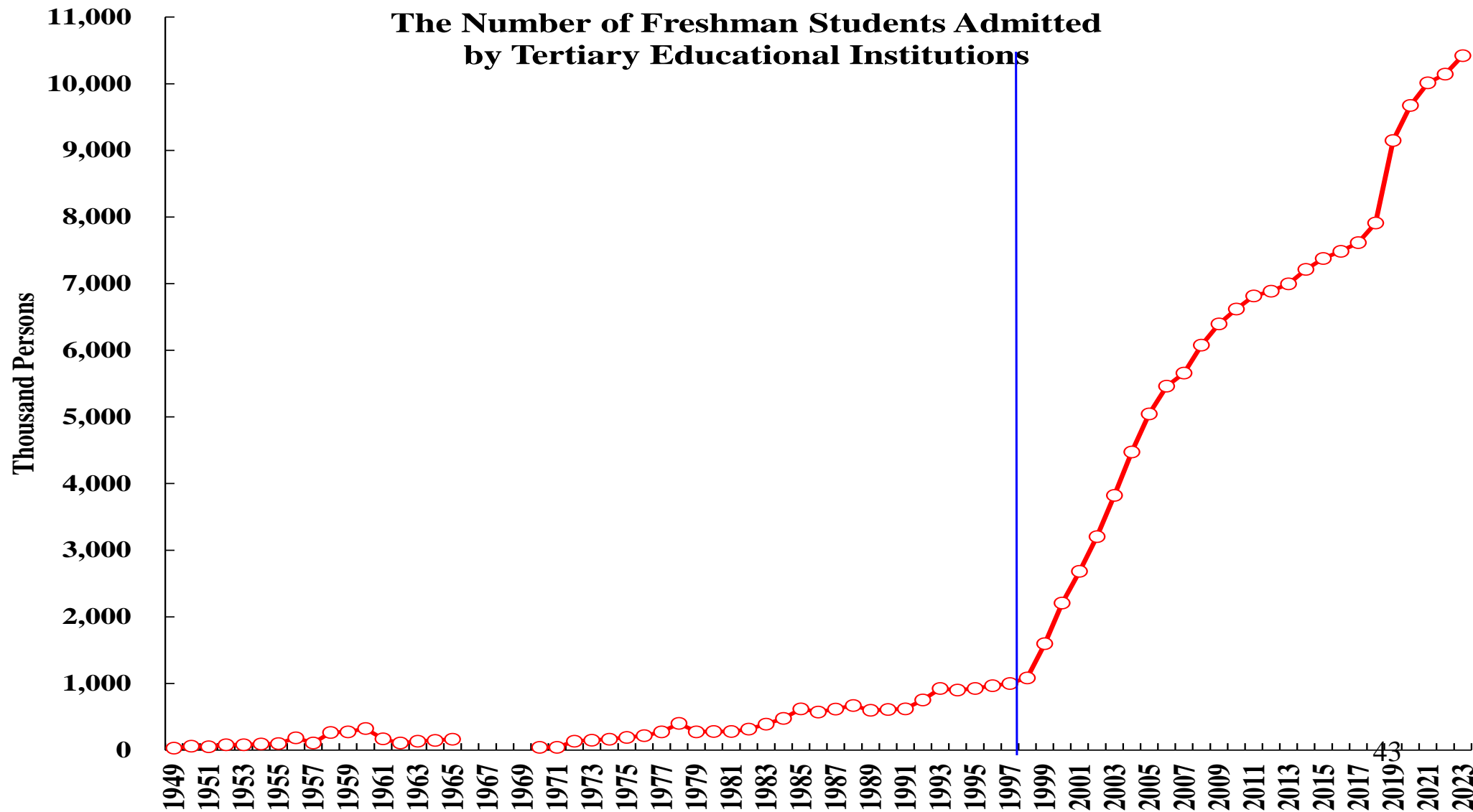
Educational Attainments

- ◆ Mandatory 9-year education for all was introduced in China in 1986. Today, most young people have had at least 12 years of education, even though senior secondary education is still not yet mandatory at this time.
- ◆ The proportions of people with only primary education (the yellow line) or junior secondary education (the blue line) have already peaked and begun to decline.
- ◆ The tertiary enrolment rates of graduates of secondary schools was 24.6% in 1989 and rose to 94.5% in 2016. This means almost everyone who wishes to attend a tertiary educational institution is now able to do so. (However, the proportion of the population aged 18-22 that were enrolled in tertiary education institutions in 2021 was only 57.8%, indicating that not everyone in that age cohort was able to complete senior secondary education.)
- ◆ The proportion of the total population with tertiary education (the red line), which was only 0.42% in 1964, rose to 15.47% in 2020, and is expected to increase further with time, given the massive expansion of tertiary educational enrolment since 1999.

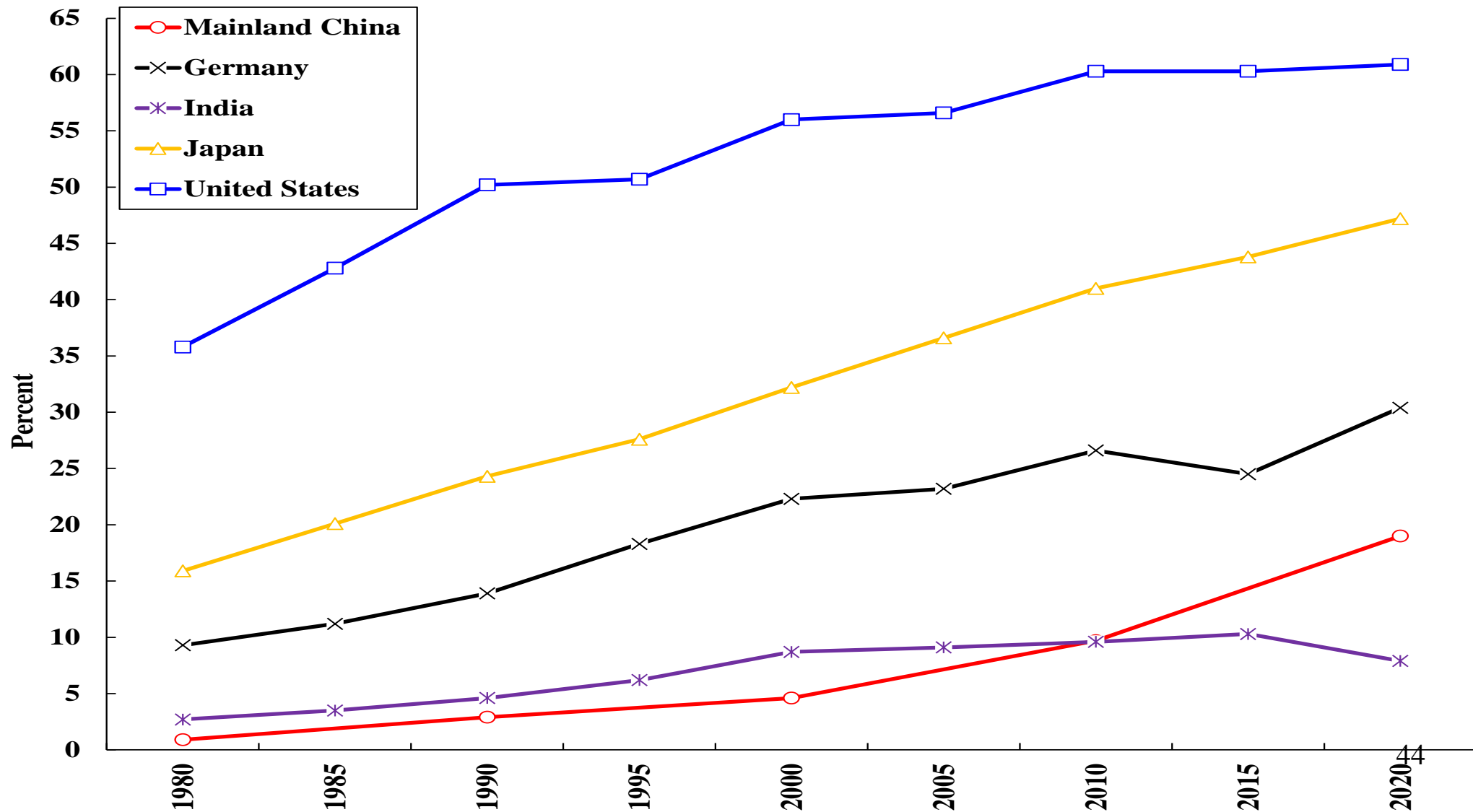
Educational Attainment Rates (Percent)



The Number of Freshman Students Admitted by Tertiary Educational Institutions, 1949-2023

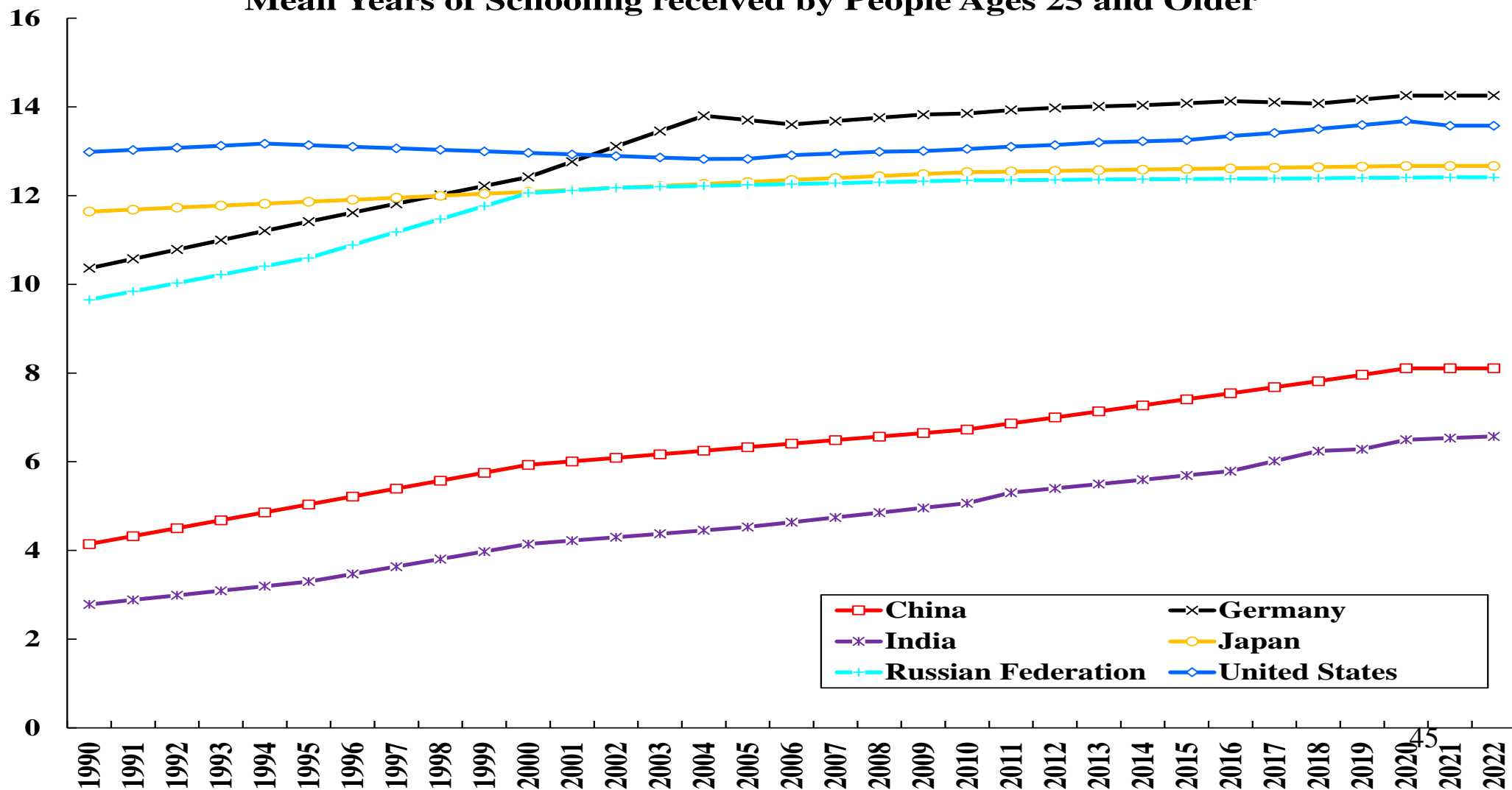


The Share of Population Aged 25-64 with Tertiary Education, 1980-2020



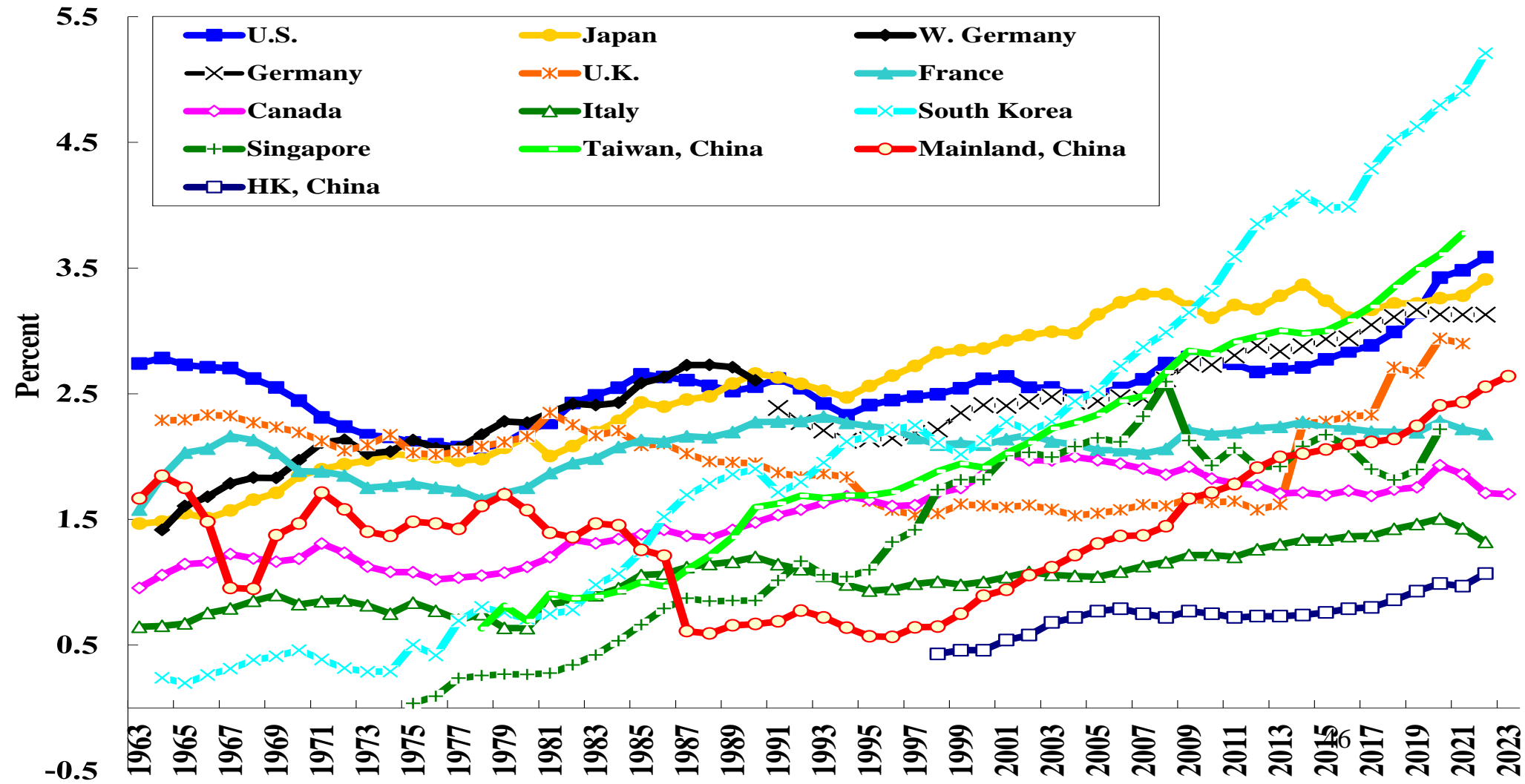
Average Number of Years of Education of the Population Aged 25 or Above (HDR)

Mean Years of Schooling received by People Ages 25 and Older



R&D Expenditures as a Percent of GDP: G-7 Countries, 4 East Asian NIES & China

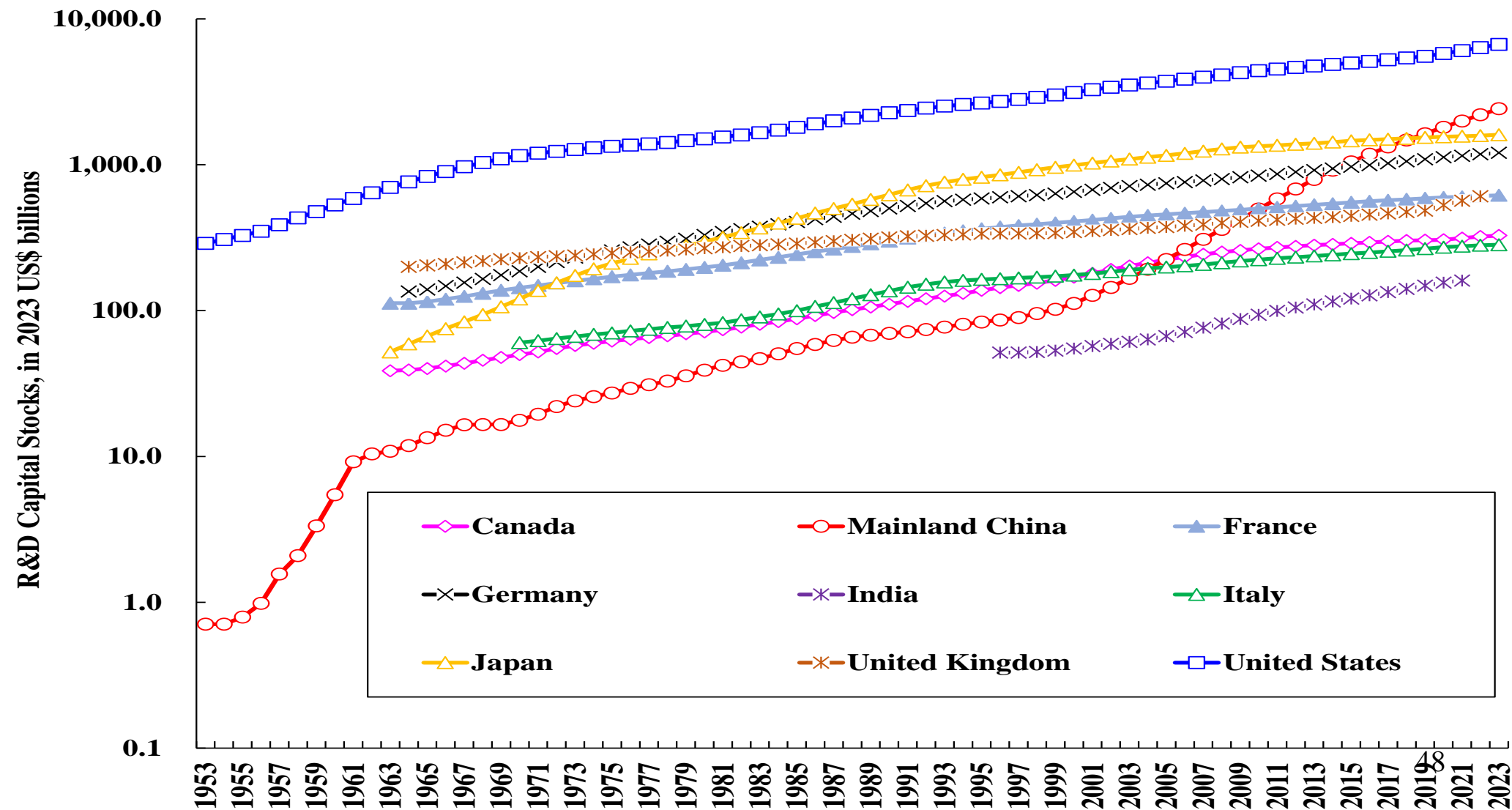
R&D Expenditures as a Ratio of GDP: G-7 Countries, 4 East Asian NIEs & China



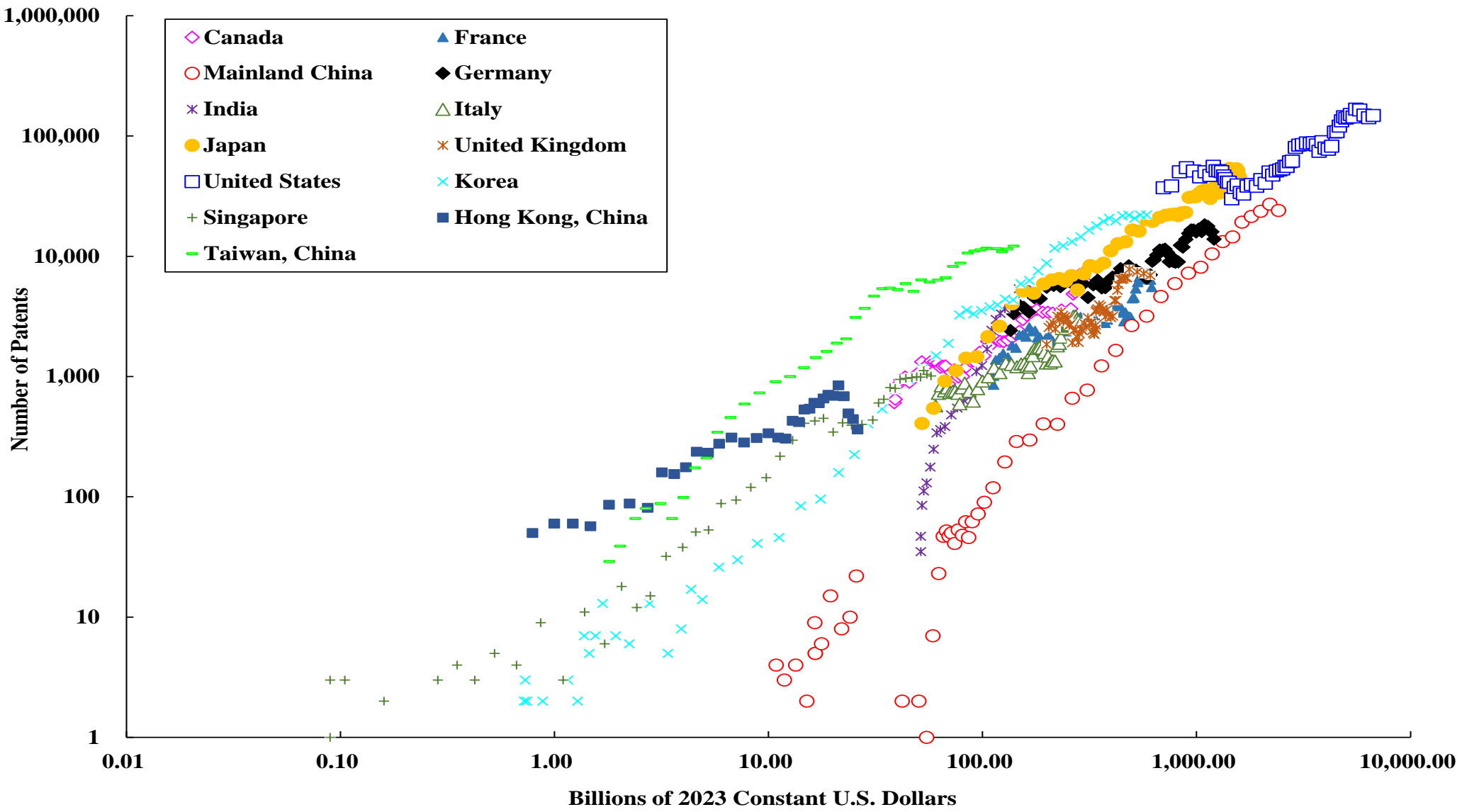
The Real R&D Capital Stock

- ◆ The R&D capital stock of a country is defined as the cumulative real expenditure on R&D less a depreciation of 10% per annum.
- ◆ Lawrence J. Lau and Yanyan Xiong have established a positive and monotonically increasing relationship between the number of patents granted by the U.S. Patent and Trademark Office (USPTO) and the quantity of real R&D capital stock for a selection of developed and developing countries and regions in their book, Are There Laws of Innovation?, Singapore: World Scientific Publishing Company, 2022.
- ◆ Basically, the larger the quantity of real R&D capital stock of a country or region is, the greater the number of USPTO patents received by that country or region will be.

The Stock of Real R&D Capital, in 2023 US\$ billions, Selected Economies



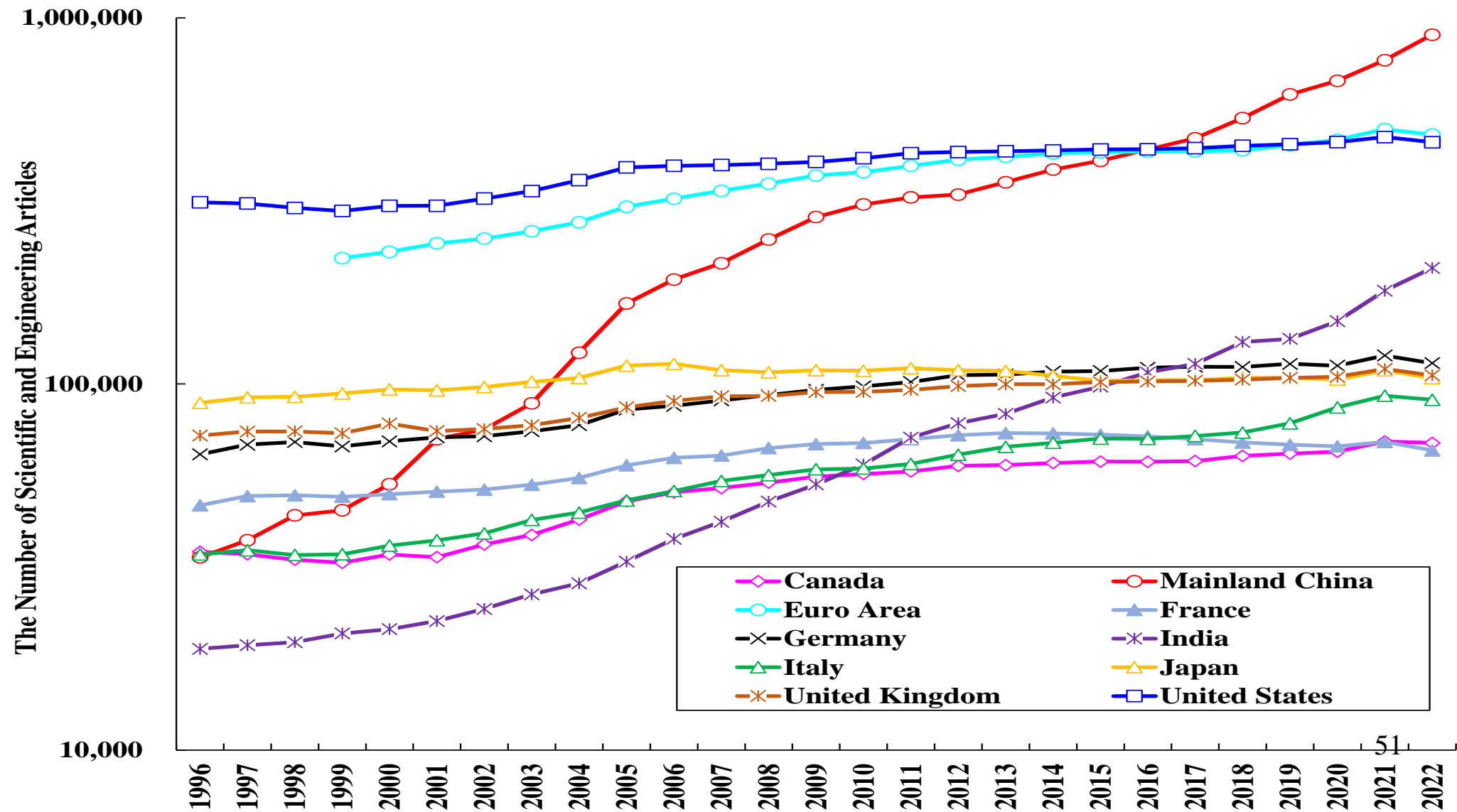
Patents Granted in the United States and R&D Capital Stocks, Selected Economies



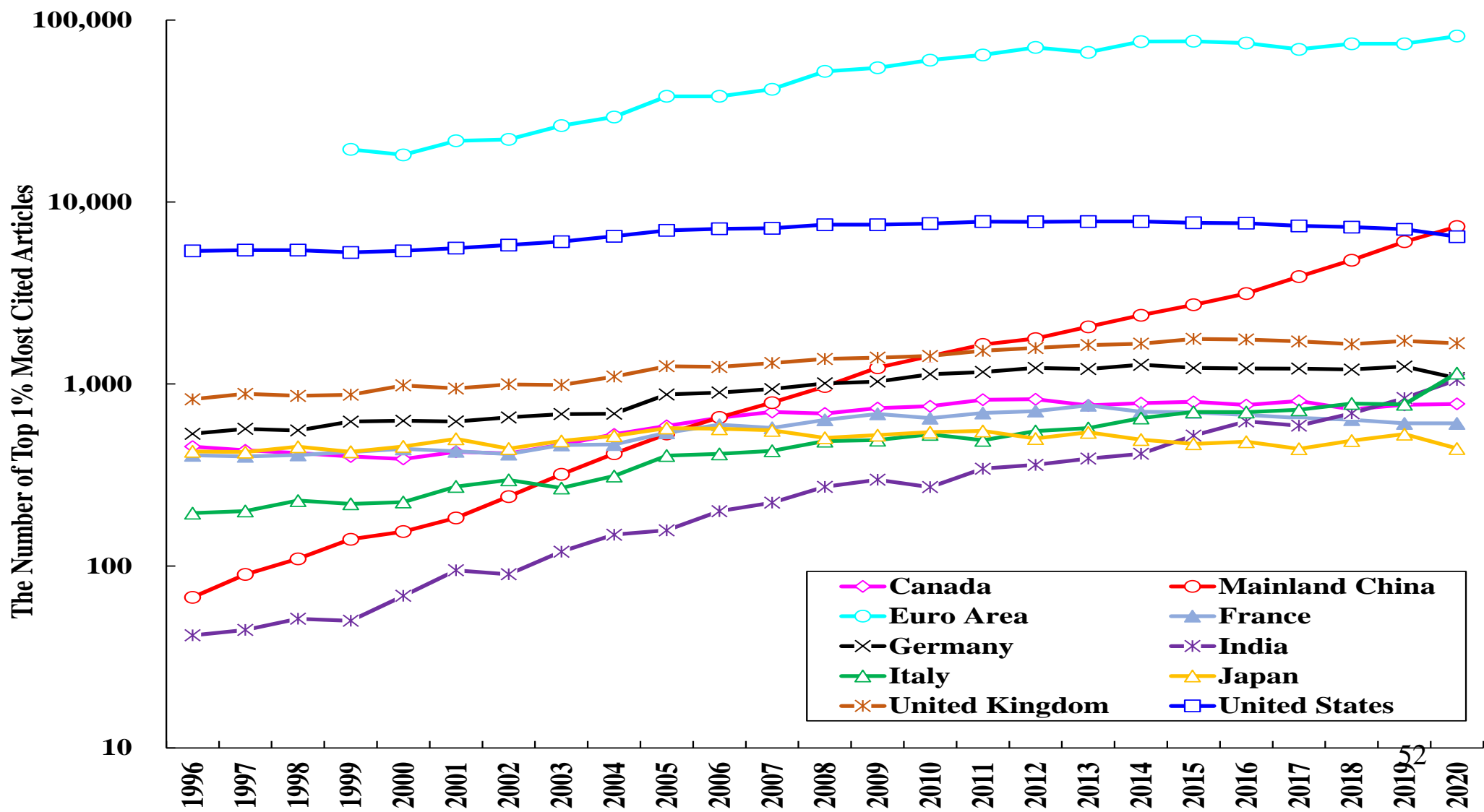
Science and Engineering Articles Published

- ◆ Since 2014, China has strengthened intellectual property right protection significantly by establishing special intellectual property courts with sole nationwide jurisdiction over such matters.
- ◆ One of the outputs of R&D is the number of publications. The total number of science and engineering scholarly articles published in international professional journals by Chinese authors exceeded that by U.S. authors since 2017. Chinese authors now collectively publish the largest number of such articles in the world.
- ◆ Chinese authors also surpassed U.S. authors in the number of top 1% most cited scientific articles in 2020. China trailed the U.S. and the European Union countries for many years⁵⁰.

The Number of Science and Engineering Articles Published



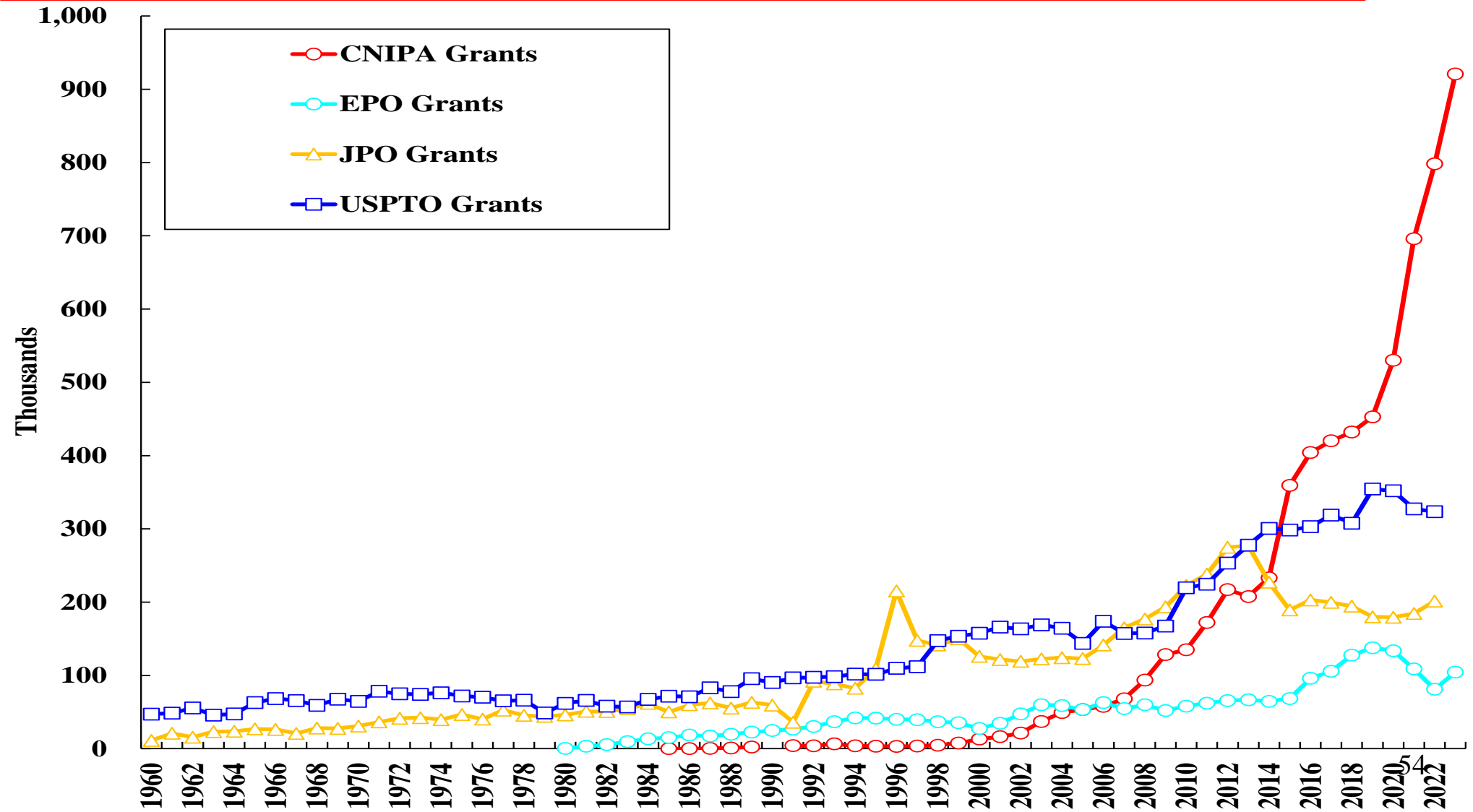
The Number of Top 1% Most Cited Articles



Patent Grants Awarded

- ◆ The total numbers of patents awarded to discoverers and inventors worldwide by respectively the United States Patent and Trademark Office (USPTO) (blue line), the European Patent Office (EPO) (turquoise line), and the China National Intellectual Property Administration (CNIPA) (red line), have all been increasing by leaps and bounds in recent years, and especially for CNIPA, but not so much for the Japan Patent Office (yellow line).
- ◆ Chinese investors and discoverers have received the highest number of patent grants worldwide. However, in terms of patents granted by the United States Patent and Trademark Office (USPTO), China is still considerably behind the U.S., Japan and the European Union.
- ◆ China is now also the recipient of the largest number of patent grants in the world from these three patent offices combined (red line), followed by the U.S. (blue line) and Japan (yellow line).
- ◆ China is today the largest awarder of patent grants and its nationals as a group is also the largest awardee of patent grants worldwide. It has every incentive to

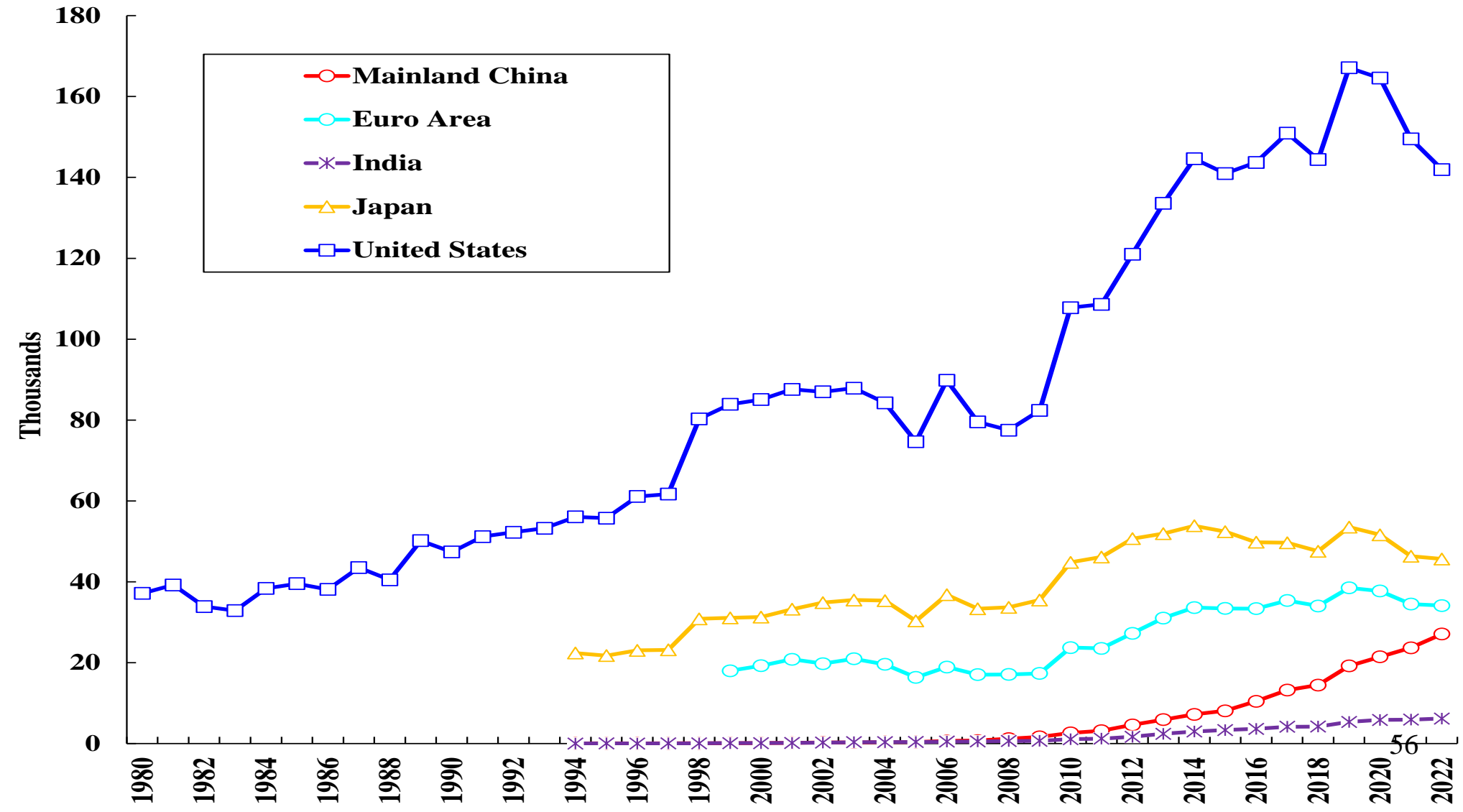
Total Number of Patent Grants Awarded by USPTO, EPO, CNIPA and Japan Patent Office



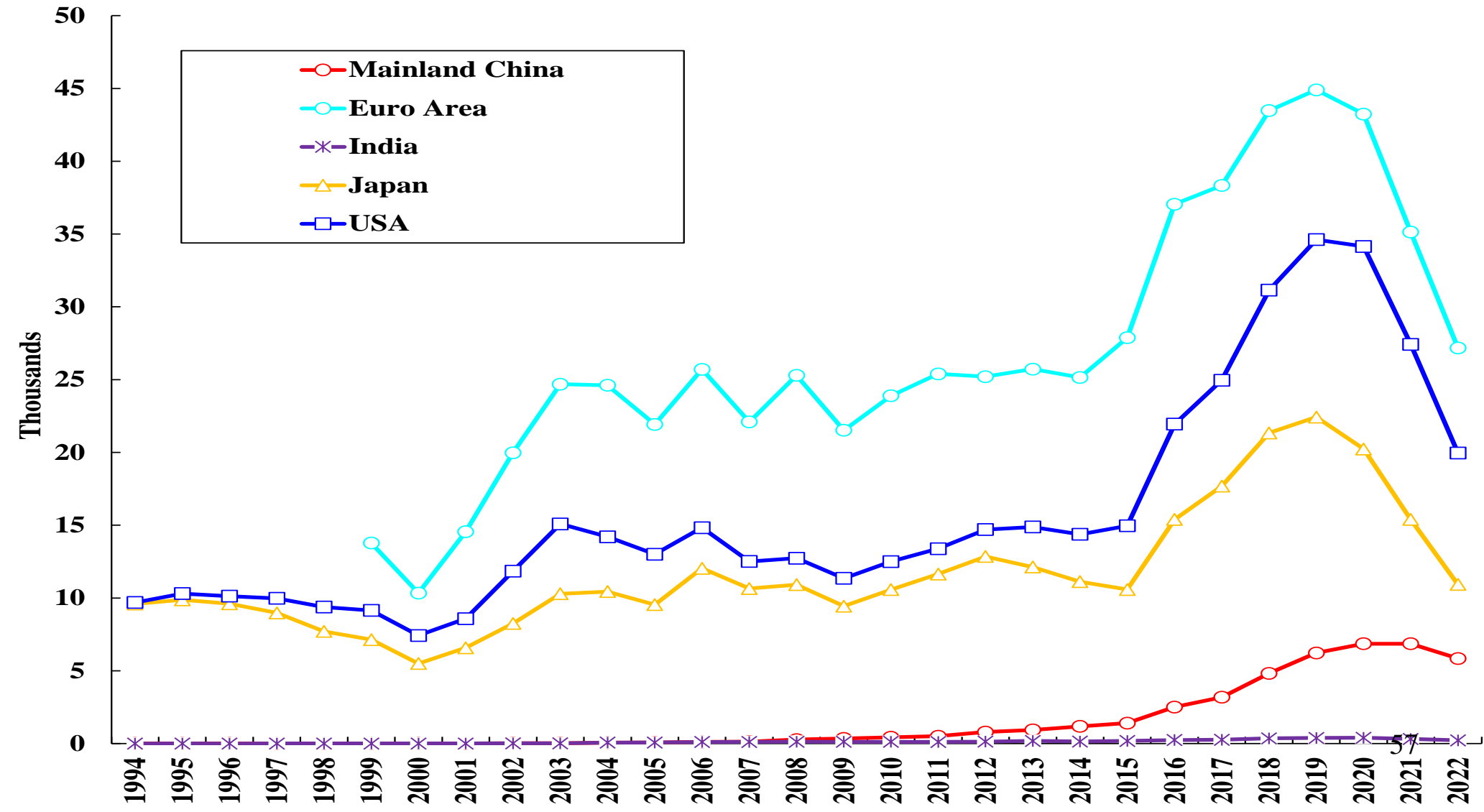
Patent Grants Awarded

- ◆ The China National Intellectual Property Administration (CNIPA), China's patent office, today awards the largest number of patent grants of any country in the world.
- ◆ However, in terms of the number of the United States Patent and Trademark Office (USPTO) patents awarded, China still lags behind the U.S., Japan and the E.U. In fact, China also lags behind in terms of patents awarded by both the European Patent Office (EPO) and the Japan Patent Office.

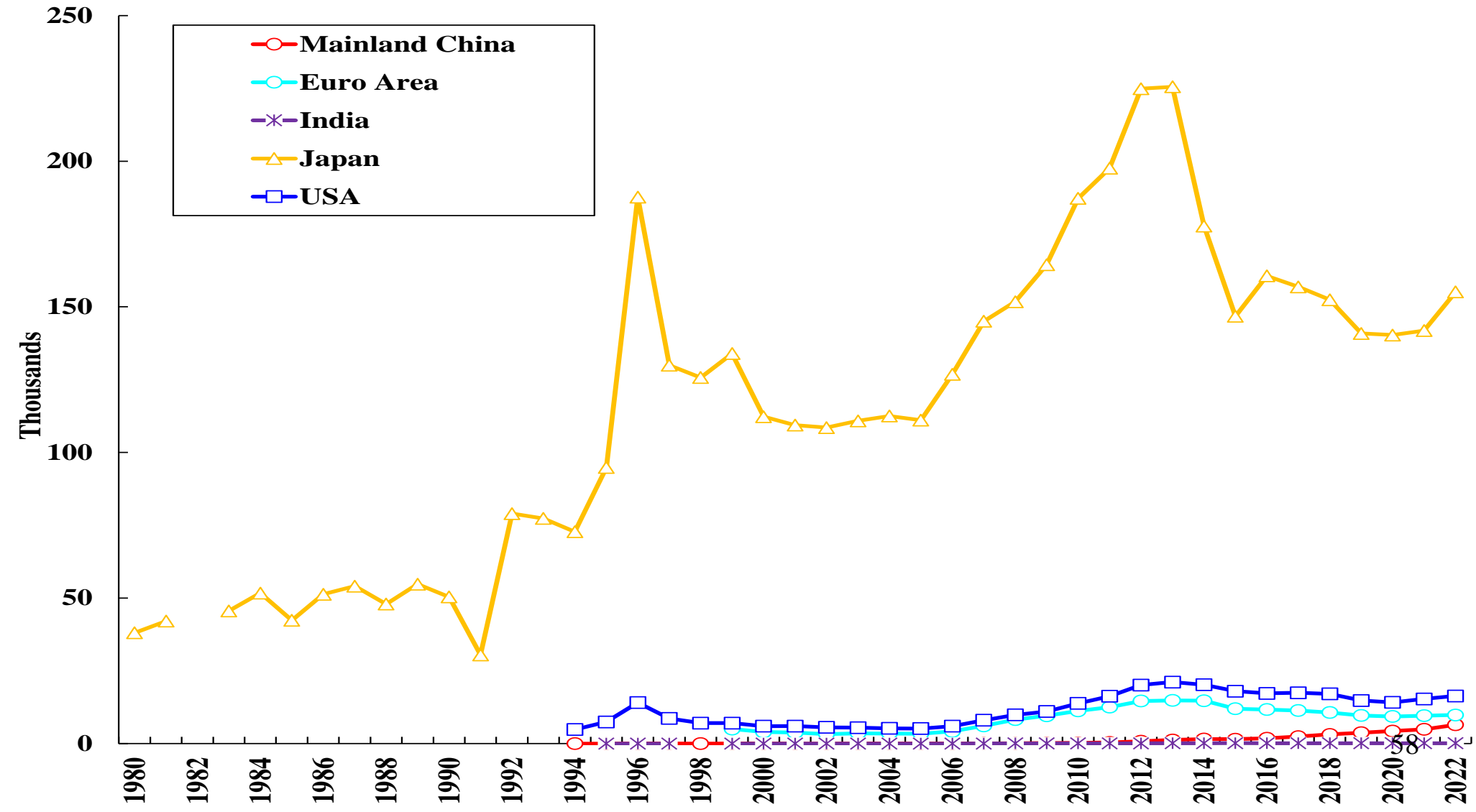
The Number of USPTO Patents Received by China, the Euro Area, India, Japan and the U.S.



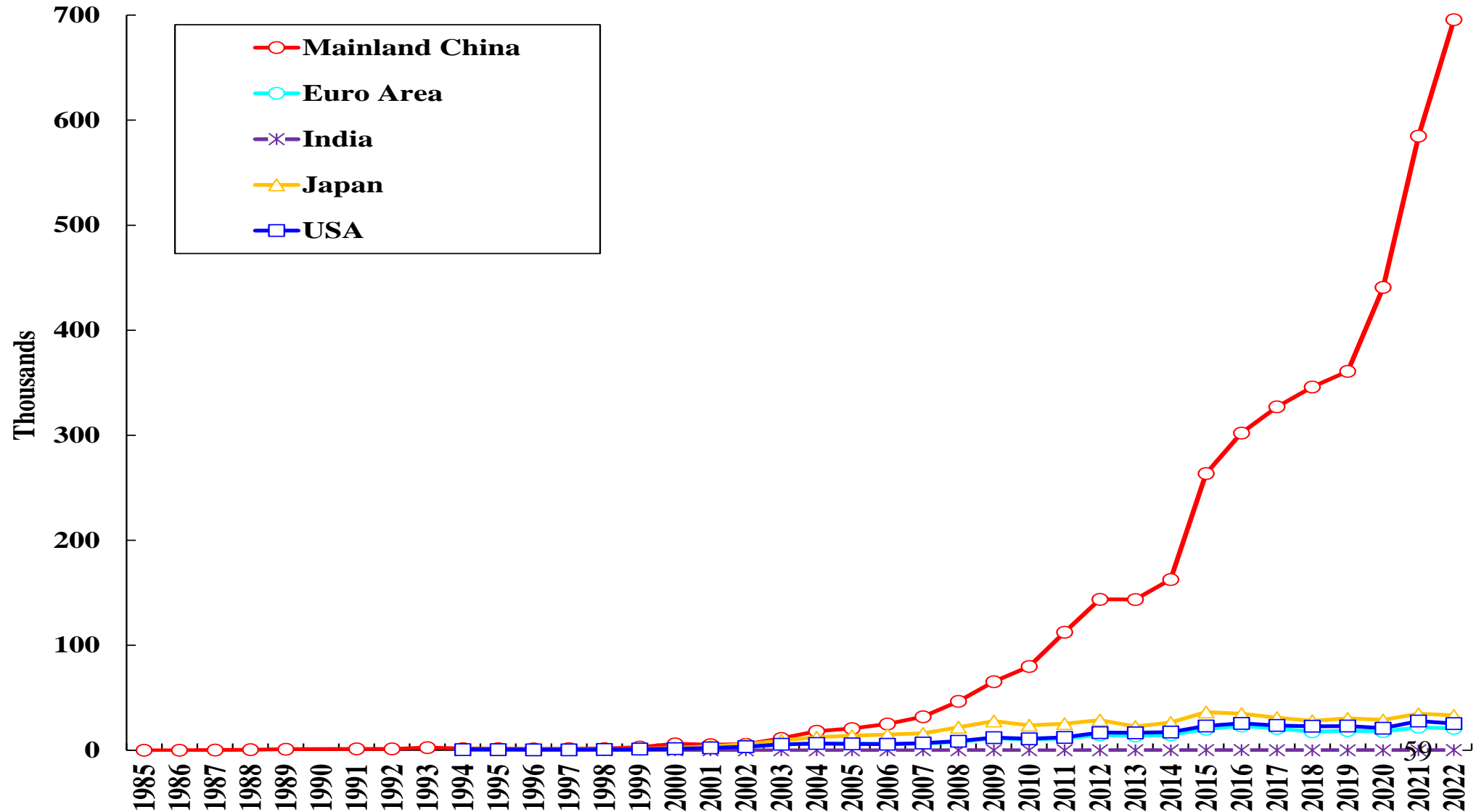
The Number of EPO Patents Received by China, the Euro Area, India, Japan and the U.S.



The Number of Japanese Patents Received by China, the Euro Area, India, Japan and the U.S.



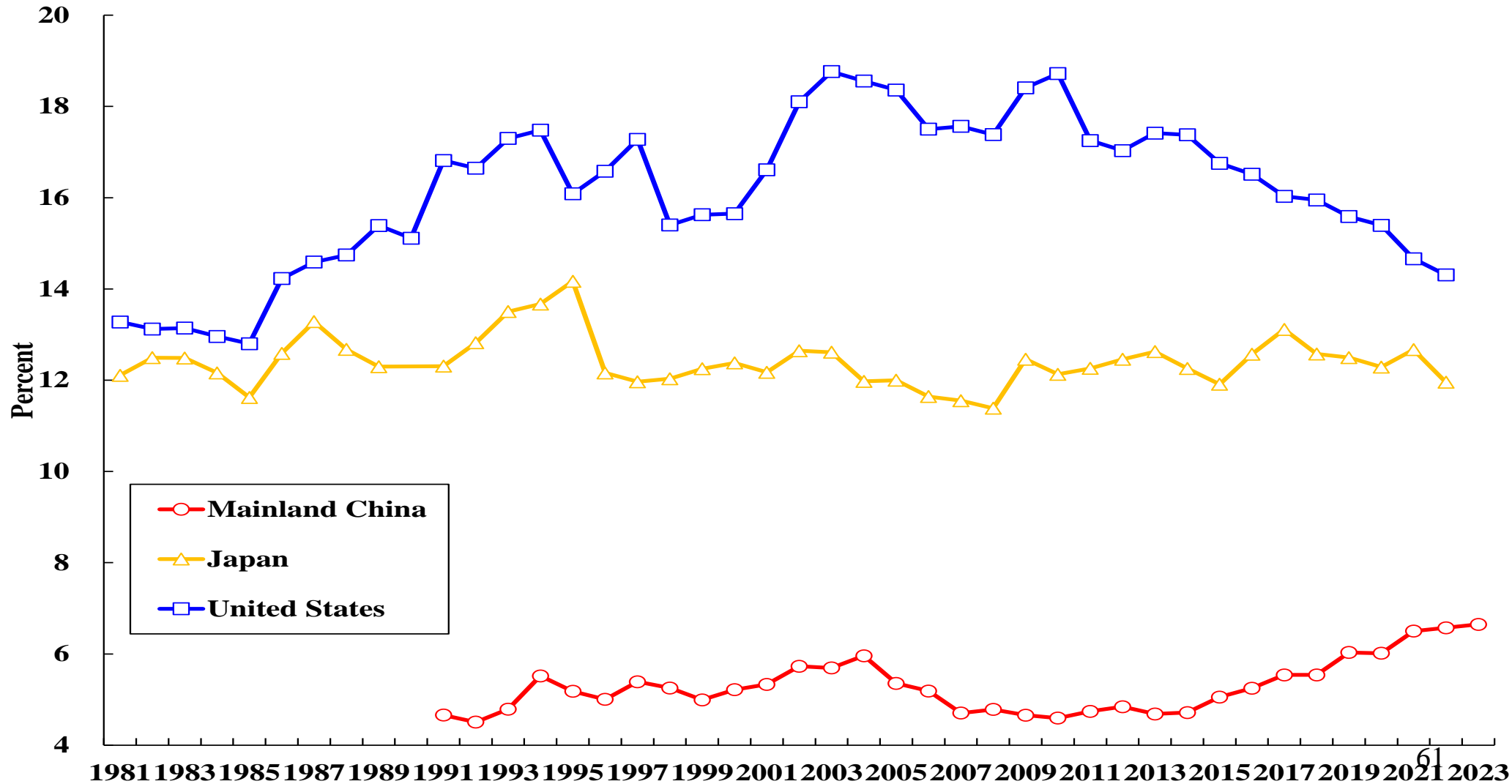
The Number of CNIPA Patents Received by China, the Euro Area, India, Japan and the U.S.



Self-Reliance in Science and Technology

- ◆ China today is not only subject to U.S. export controls on high-technology hardware and software, but also faced restrictions by other countries such as Japan and the Netherlands, which are also participating in U.S.-advocated sanctions against China, especially if related to advanced semiconductor manufacturing. This may slow down China's economic growth to some extent, but it will not stop it completely. China will make significant new investments in these areas in order to produce the necessary components locally. For example, Huawei has been reasonably successful in overcoming the effects of U.S. sanctions against it and its suppliers.
- ◆ The past experience of innovation catch-up is that once proven to be feasible, alternative paths to the same outcome will be discovered. It is just a matter of time.
- ◆ However, breakthrough discoveries and inventions depend on sustained long-term investment in basic research. In 2023, China devoted less than 7% of its R&D expenditures on basic research, while the United States spent nearly 15%. China should significantly increase its investment in long-term basic research.
- ◆ The most important thing to recognise is that self-reliance and independent innovation should not be equated with complete self-sufficiency.

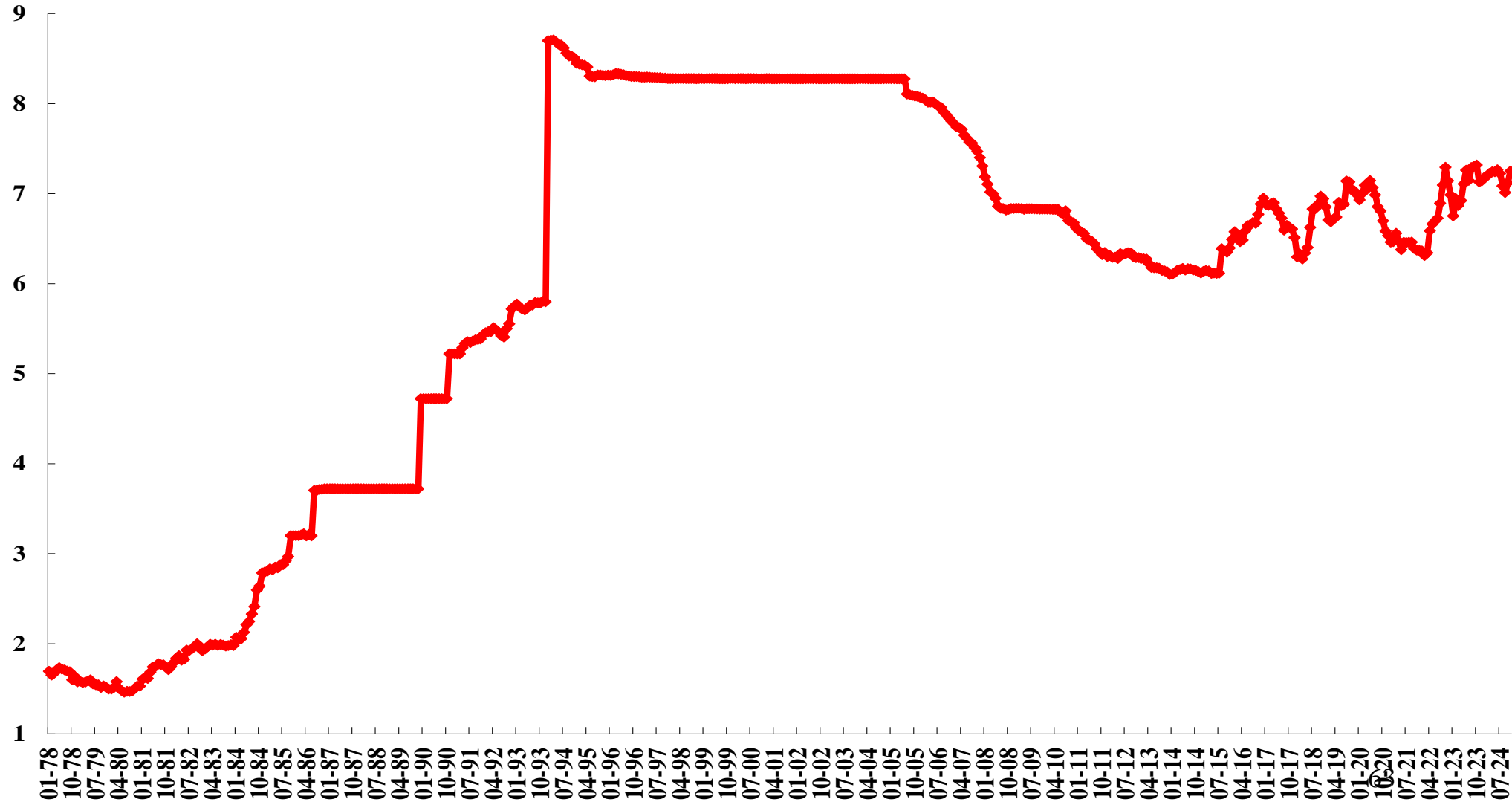
Basic Research Expenditure as a Percent of Gross Expenditure on R&D



The Use of the Renminbi in International Transactions

- ◆ One notable development is the gradual internationalisation of the Renminbi. The Renminbi has been a current-account convertible currency since 1994. Its value comes from the Renminbi's purchasing power over Chinese goods, services and assets. In fact, offshore Renminbi is fully convertible in Hong Kong. China's capital controls only apply to certain capital flows into and out of Mainland China.
- ◆ If bilateral cross-border transactions between two countries can be settled in their own national currencies rather than in a third-country currency like the U.S. Dollar, the transaction costs and the exchange rate risks are both reduced, because only one currency exchange is required and hence there is only one exchange rate risk. If the settlement is made in a third-country currency, two currency conversions are required, doubling the transaction costs, and exchange rate risks are incurred by both the exporter and the importer. Thus, own-currency settlement benefits both the exporting and the importing country.

The Nominal Exchange Rate of the Renminbi, Yuan/US\$, 1978-present



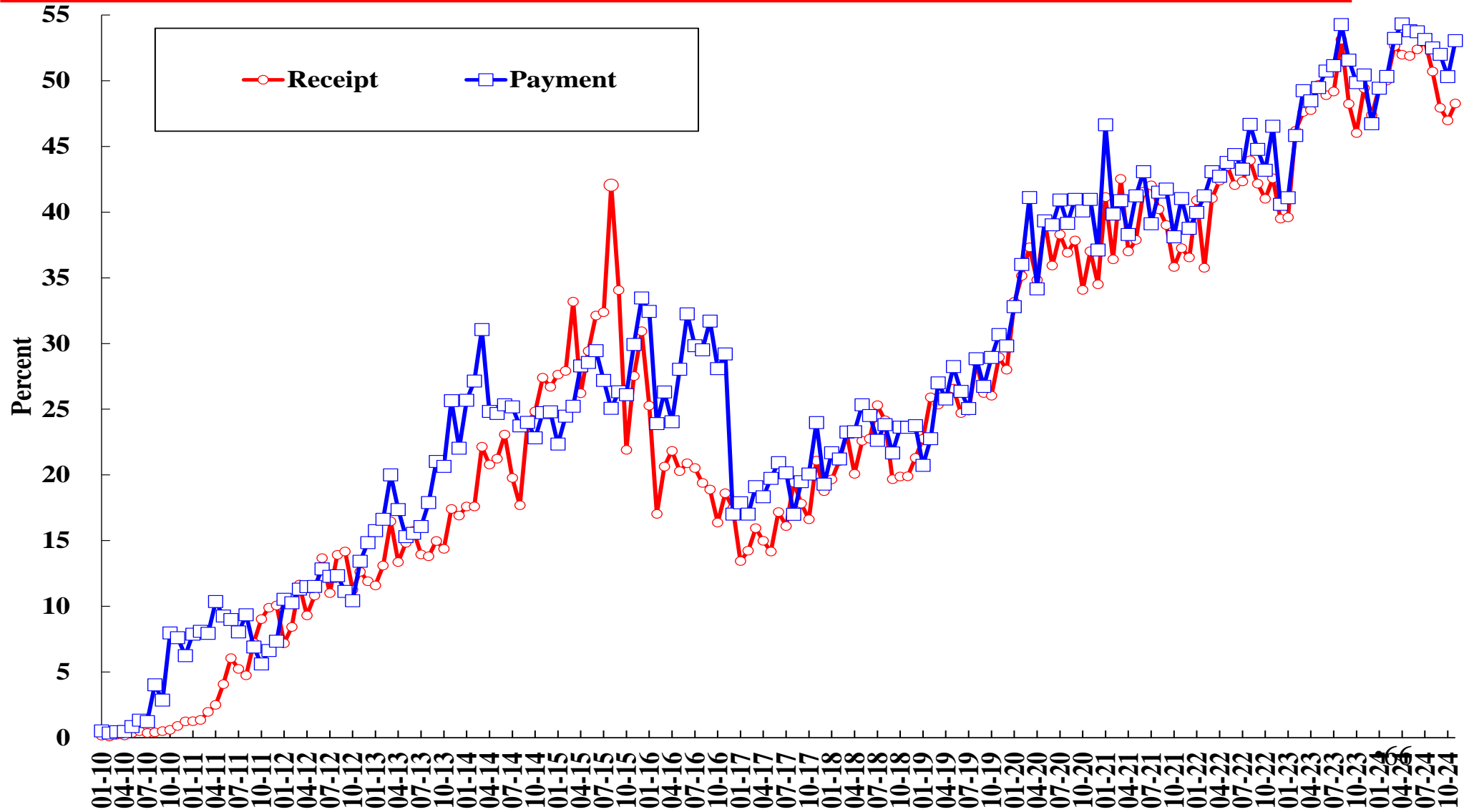
The Use of the Renminbi in International Transactions

- ◆ Since the early 1970s, the invoicing, clearing and settlement of bilateral trade between two countries has mostly been done in U.S. Dollar.
- ◆ In 2000, after the establishment of the Euro Area, the invoicing, clearing and settlement of bilateral trade between two countries in the Euro Area is done exclusively in Euro.
- ◆ Clearing and settlement of bilateral trade transactions in own currencies as opposed to a third-country currency like the U.S. Dollar reduce transaction costs and exchange rate risks to both the exporting and the importing countries, because there is only one currency exchange, and one exchange rate risk. The practice is gaining wider international acceptance.
- ◆ One principal use of the foreign exchange reserves of a country is to pay for imports. If imports can be paid for in a country's own currency, the level of foreign exchange reserves that has to be maintained for transaction purposes can be significantly reduced.

The Use of the Renminbi in International Transactions

- ◆ Before 2010, almost all of China's foreign-related transactions, including international trade and inbound and outbound foreign direct and portfolio investment, were settled in U.S. Dollar.
- ◆ The share of renminbi settlement began to rise from zero in 2010 and reached a peak of approximately 40% in mid-2015. However, a sudden and unexpected devaluation of the renminbi coupled with a large decline in the Chinese stock market led to a retreat from renminbi settlement. It took about five years for the share of renminbi settlement to recover to the level of 40%. Since then, the share of renminbi settlement has continued to rise and currently stands at around 50% (see chart).
- ◆ The main impetus for the wider use of the Renminbi in world settlement comes from the fact that international trade between China and many of its trading partner countries is increasingly settled in each other's own national currencies.

The Share of Renminbi Settlement in Mainland China's Foreign-Related Transactions



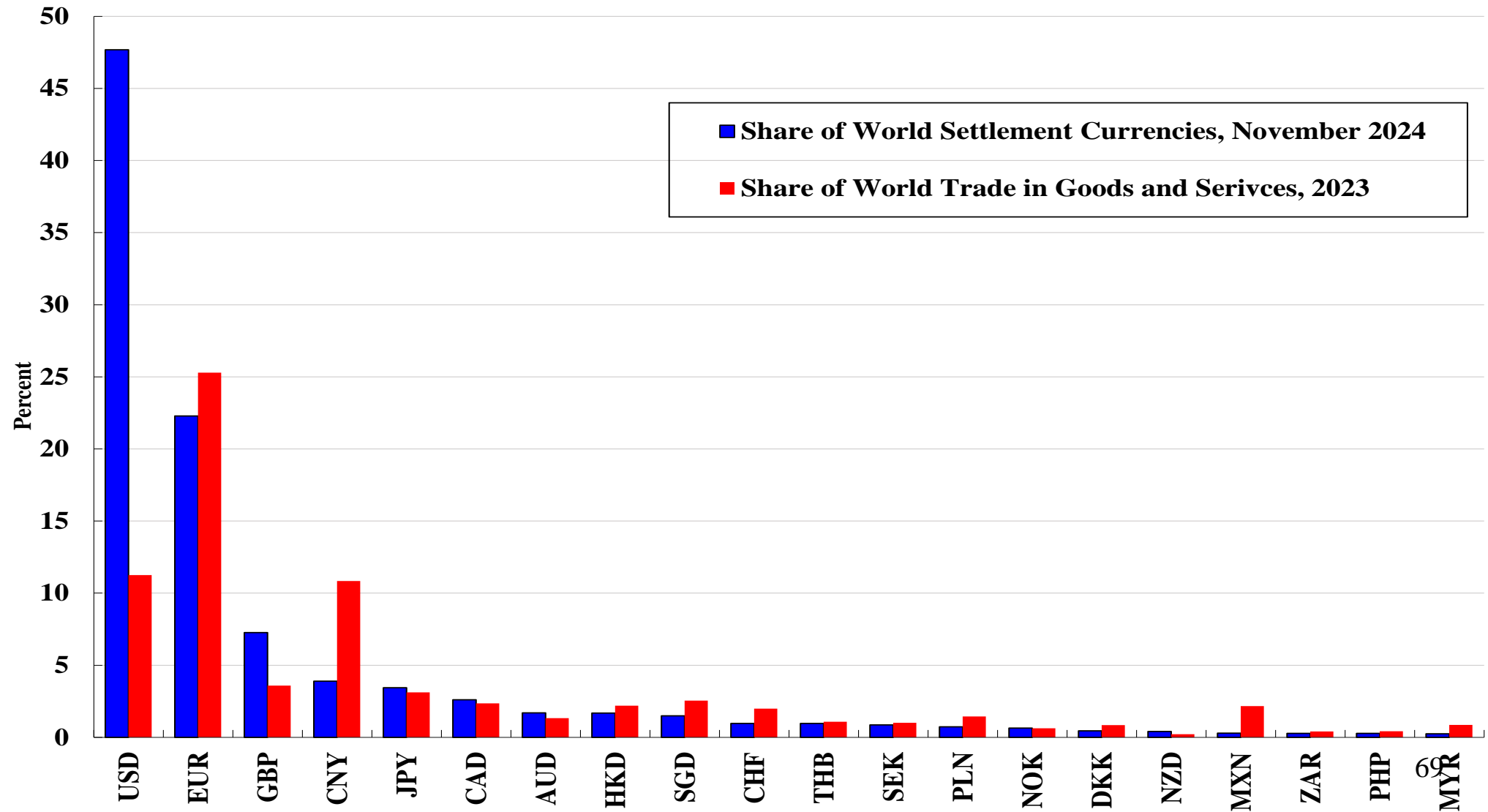
The Use of the Renminbi in International Transactions

- ◆ More and more countries have signed own-currency settlement agreements with China. For example, in trade with China, both Indonesia and Russia use their own respective national currencies, the rupee or the ruble, together with the Chinese yuan, to settle. More recently, countries such as Argentina, Brazil and Saudi Arabia have also agreed with China to settle their bilateral trade with China in their own respective national currencies and the Yuan.
- ◆ With more and more settlement done in own currencies, the need for the maintenance of a large foreign exchange reserves consisting of U.S. Dollar-denominated assets, is reduced.
- ◆ The Society for Worldwide Interbank Financial Telecommunication (SWIFT) international payment system for the U.S. Dollar is increasingly weaponised under U.S. pressure, forcing many countries, such as Iran and Russia, to look for alternatives. The use of the United States dollar as an international medium of exchange or store of value by third countries is likely to decline gradually over time.
- ◆ An alternative system, the Cross-border Interbank Payment System (CIPS), has been developed by the People's Bank of China to provide clearing and settlement services for its financial institution participants in cross-border transactions in different currencies. As of December 2024, CIPS has 168 Direct Participants and 1461 Indirect Participants.

Share of World Settlement versus Share of World Trade

- ◆ In the following chart, we compare the share of world settlement of the currency of a country or region (blue column) in November 2024, with the share of world trade in goods and services of that country or region (red column) in 2023 (this is because the 2024 world trade data are not yet complete).
- ◆ In 2023, the Euro Area accounted for the largest share of world trade in goods and services, 25.3%, followed by the U.S, with 11.2%, and the Mainland China, with 10.8%. (We note that these shares are sensitive to changes in exchange rates.)
- ◆ In November 2024, the U.S. Dollar accounted for the largest share of world settlement, at 47.7%, the Euro accounted for 22.3%, and the British Pound accounted for 7.3%. The renminbi share in world settlement had been increasing gradually, from 2.3% in March 2023, to 3.1% in July 2023, 4.1% in December 2023, 4.5% in January 2024 and 3.9% in November 2024, to become the fourth most frequently used settlement currency. The Japanese Yen was in fifth place, accounting for 3.4%. (These percentages are also sensitive to relative exchange rate changes and to the time of the year.)
- ◆ We note that for the U.S. Dollar, the British Pound and the Japanese Yen, their shares of settlement were all higher than the respective shares of these countries in world trade. The share of renminbi in world settlement is likely to continue to grow but is not expected to catch up to that of the U.S. Dollar, which currently stands at 47.7%, any time soon.

Share of World Settlement versus 2023 Share of World Trade, November 2024



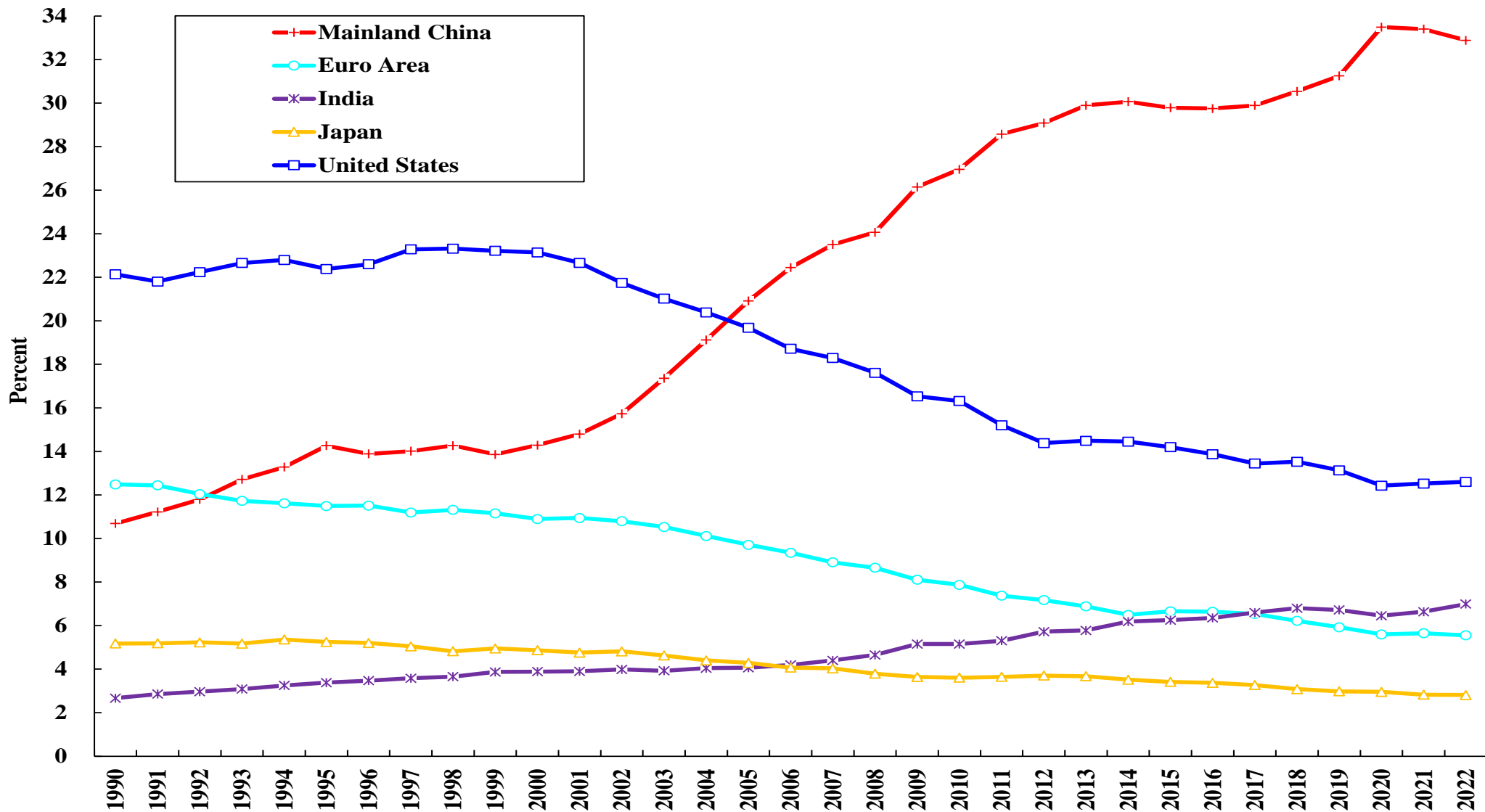
Share of World Settlement versus Share of World Trade

- ◆ In world settlement, the Japanese Yen's share was 3.4%, which was higher than Japan's share in world trade of 3.1%, while the renminbi share in world settlement was only 3.9% even though China's share in world trade was 10.8%.
- ◆ If the share of renminbi settlement could eventually reach China's share of world trade, it would become 10.8%, surpassing the share of the British pound to become the third most widely used settlement currency. There is a great deal of room for the renminbi share of world settlement to continue to grow.
- ◆ However, replacing the US Dollar with the renminbi as a medium of international exchange between other countries may not be in China's own best national interests. Instead, China should promote the settlement between bilateral trading-partner countries in their own respective national currencies, as they did under the Bretton Woods system before 1971.

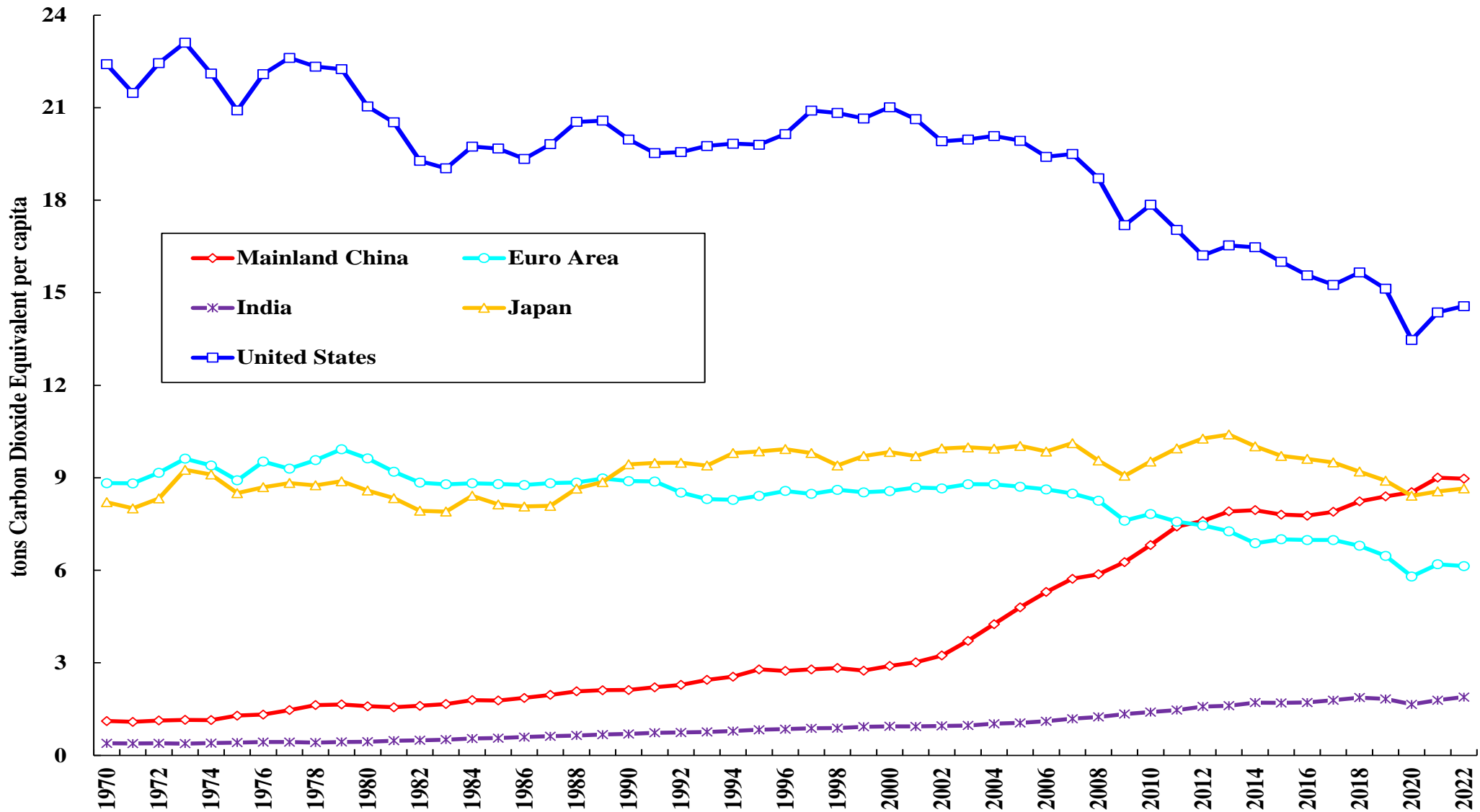
Mitigation of Global Climate Change: The Shares of World Carbon Dioxide Emissions

- ◆ Since 2005, China has been the largest carbon emitter in the World, overtaking the United States. They are followed by the Euro Area, India and Japan, in that order (see the following chart). In order to prevent further climate change, China has the responsibility of reducing its carbon emissions significantly. Chinese total emission has begun to decline (Source: The World Development Indicators (WDI) Database.)
- ◆ The emissions of the developed economies, the United States, the Euro Area and Japan, have all been declining over time, in part because of the rising share of the service sector in their GDPs. The emissions of China and India, driven by their growing GDPs, have been rising.
- ◆ However, on a per capita basis, the U.S. still has the highest, albeit declining, carbon emission in the world, followed by China and Japan (see chart).
- ◆ On an efficiency basis, that is, carbon emissions per unit real GDP, India is the worst emitter, followed by China, which has made a great deal of progress. The developed economies of the U.S., the Euro Area and Japan have significantly lower emissions per unit GDP because of the dominance of the service sector in their economies (see chart).

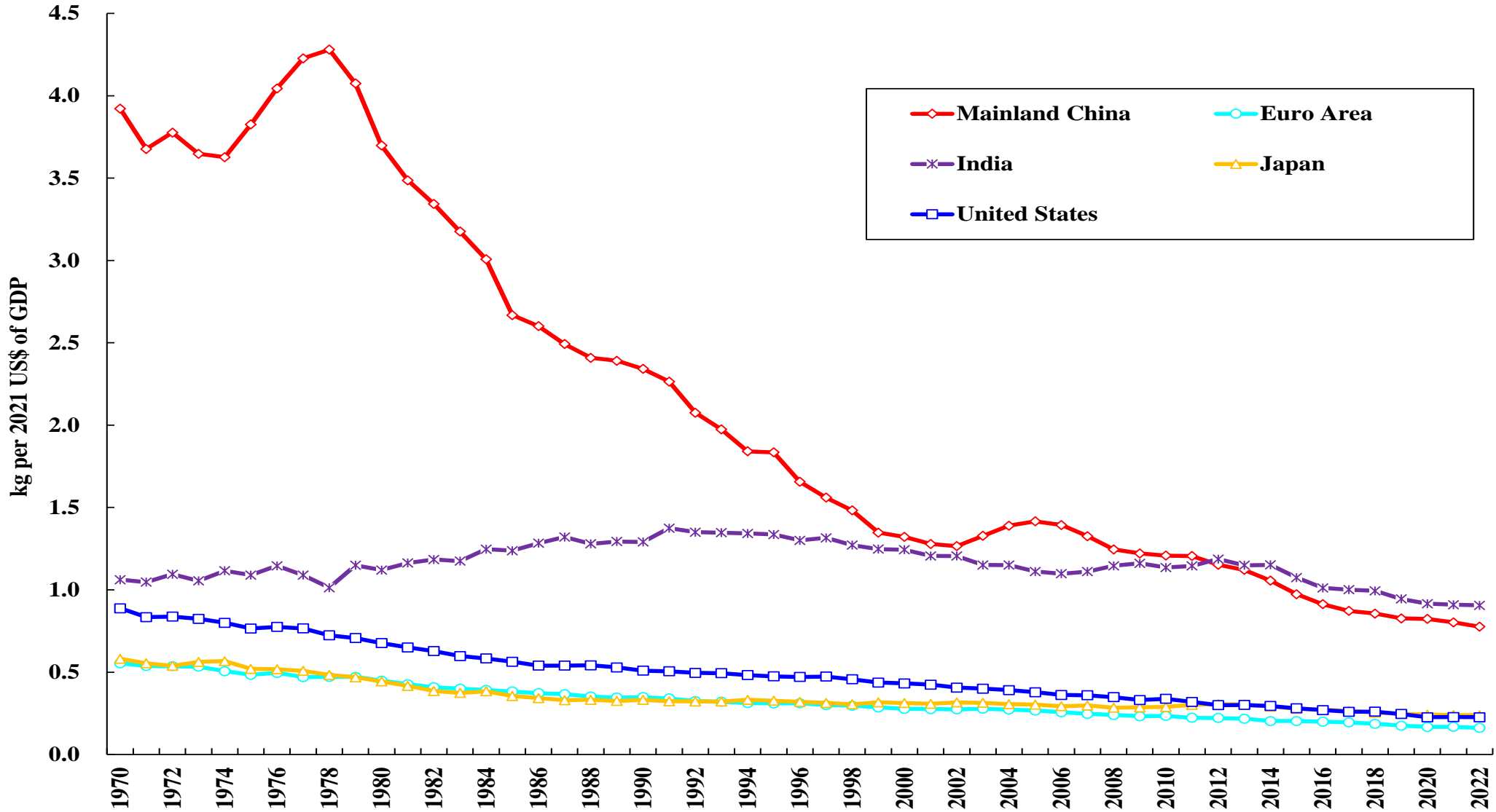
The Shares of World Carbon Dioxide Emissions, Selected Economies



Carbon Dioxide Emissions per Capita, metric tons, Selected Economies



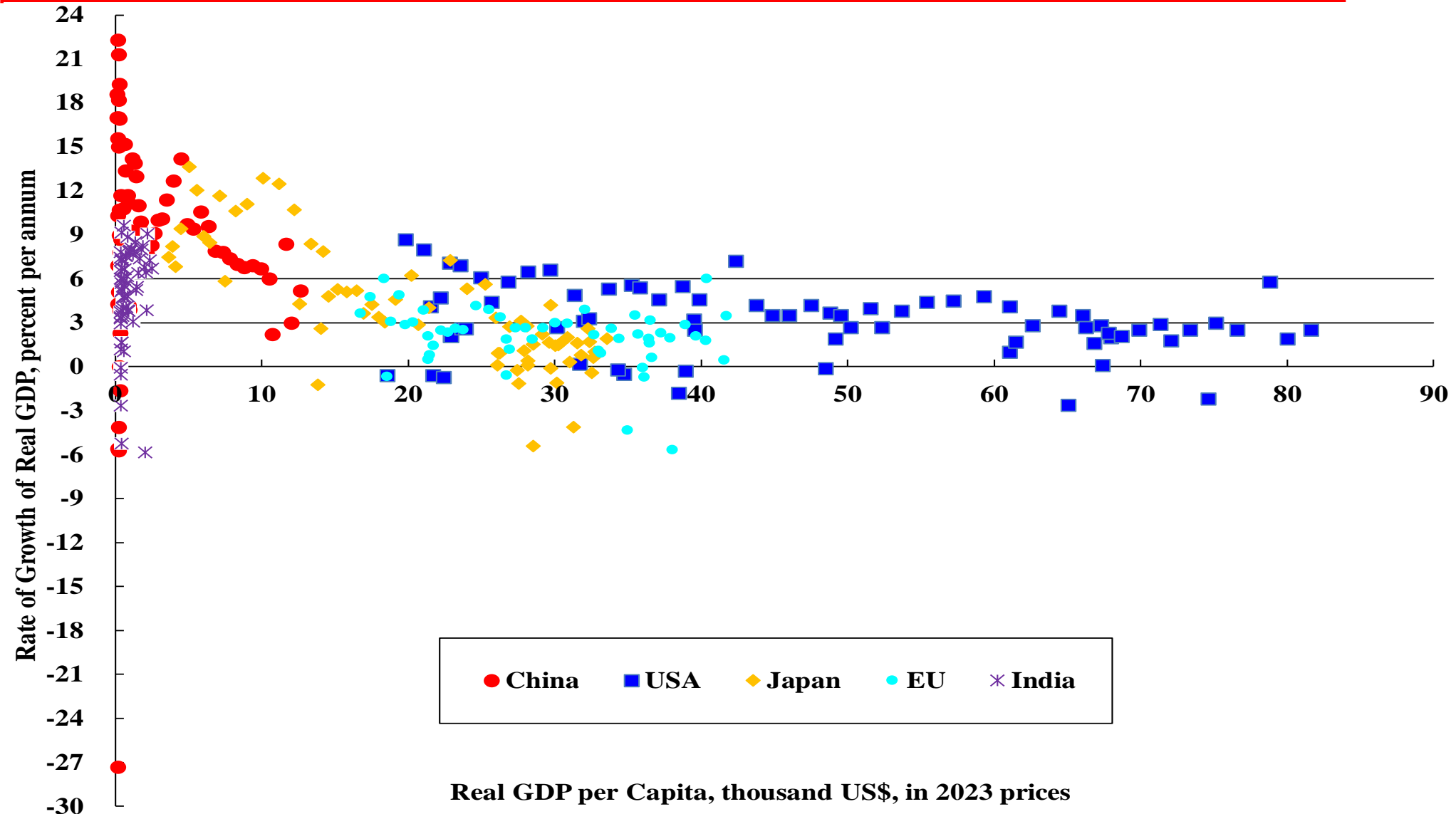
Carbon Dioxide Emissions per Unit Real GDP, Kg. per 2021 US\$ GDP, Selected Economies



The Long-Term Prospects of the Chinese Economy

- ◆ We conclude with some long-term projections of the Chinese economy to 2050.
- ◆ It is an empirical regularity that as the real GDP per capita of an economy rises, the real rate of growth of the economy will fall. There are many different reasons why this is the case, but we do not have the time to discuss them here.
- ◆ This is demonstrated in the following chart in which the real rates of economic growth of China (red), the Euro Area (turquoise), India (purple), Japan (yellow) and the U.S. (blue) are plotted against their respective real GDPs per capita's (all measured in 2023 US\$). As expected, there is a negative relationship between the rate of growth of real GDP and the level of real GDP per capita. (Data for the Euro Area as a whole only go back to 1970 and miss the earlier, truly high-growth years of the 1950s and 1960s.)

Rate of Growth of Real GDP vs Real GDP per Capita: Selected Economies



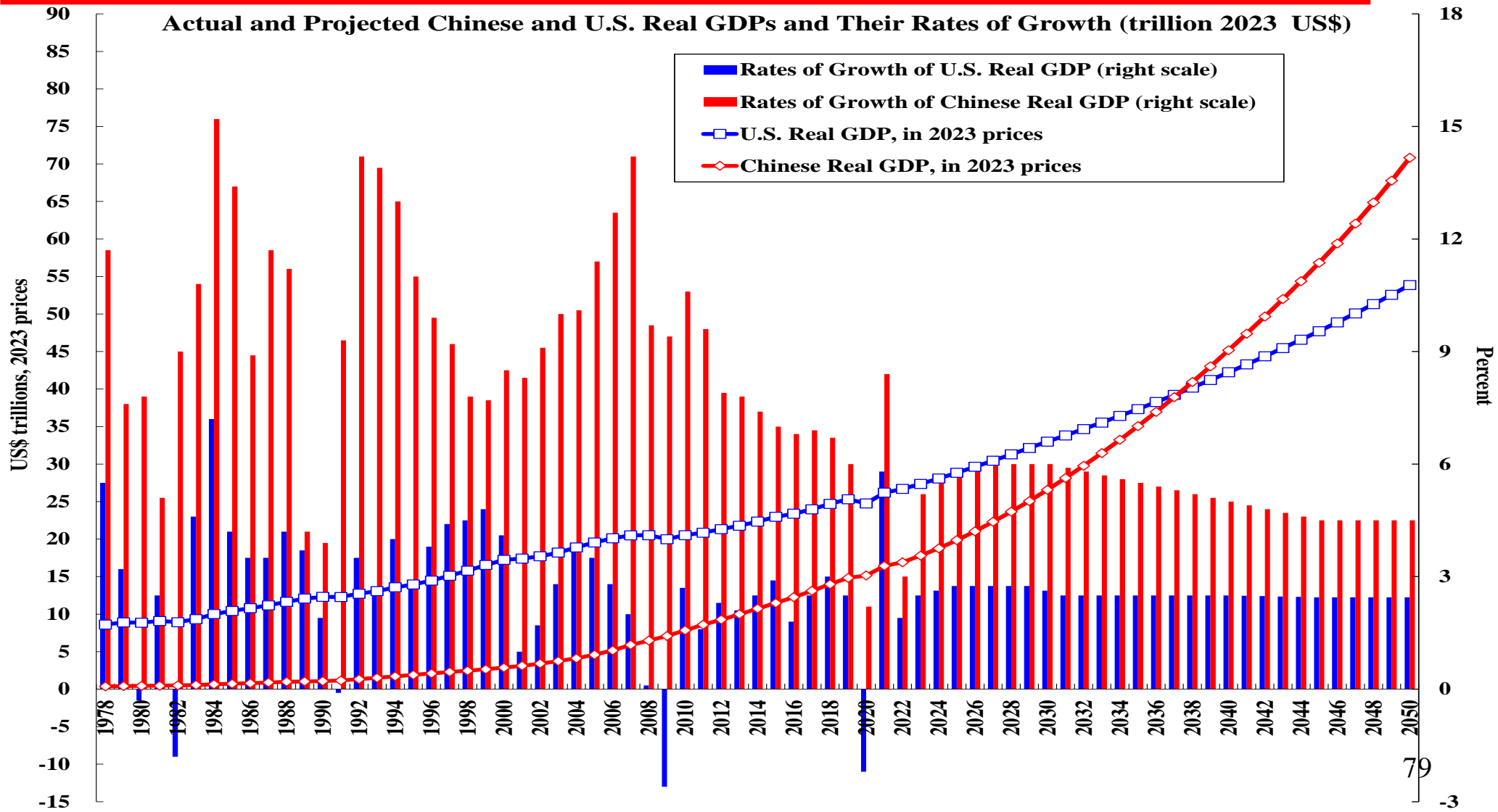
The Long-Term Prospects of the Chinese Economy

- ◆ However, we note that China, with a GDP per capita of US\$12,626 in 2023, is currently still operating in the range that permitted average annual rates of growth much higher than 6% for the Euro Area, Japan and the U.S. in earlier periods. The real GDP per capita of the U.S. was US\$81,610 in 2023, with its economy operating within a range below 3% average annual rate of growth. India, with a per capita real GDP of less than US\$2,500 in 2023, still operates in the high-growth range.
- ◆ Perhaps when Chinese real GDP per capita reaches US\$30,000 in 2023 prices, projected to occur around 2040, the Chinese average annual real rate of economic growth will begin to decline to 5% or below.

The Long-Term Prospects of the Chinese Economy

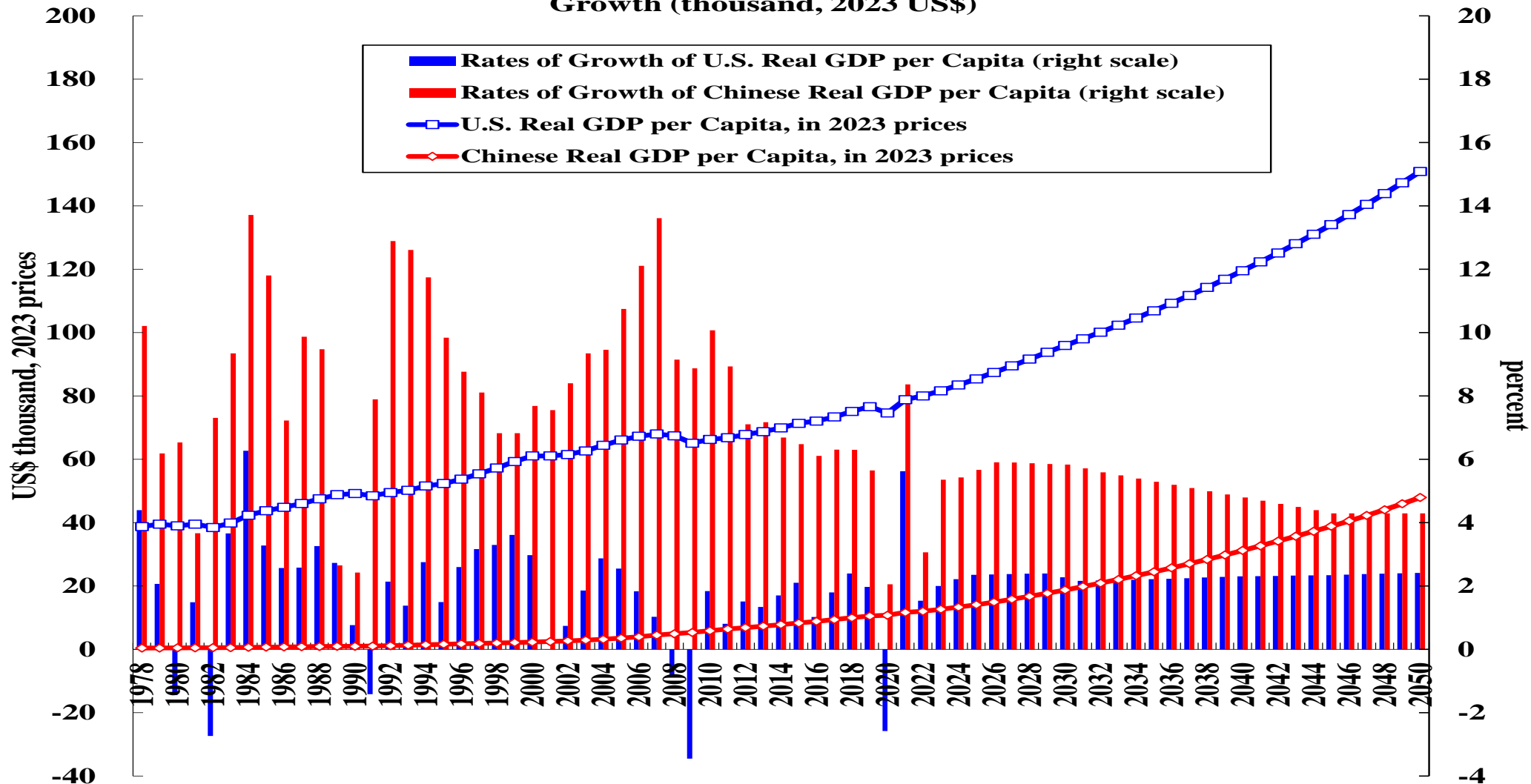
- ◆ Over the next decade, China's economy will continue to grow faster than North America and Europe, although growth will slow in all three. My personal forecast is that by 2038, real GDP on the Chinese Mainland will reach US\$40.9 trillion at 2023 prices, slightly higher than the US\$40.2 trillion of the United States. Even so, the projected Chinese real GDP per capita, US\$28,367, would still be not quite one quarter of the real GDP per capita of the United States, US\$114,232, at that time.
- ◆ In fact, in which year Chinese real GDP will catch up with the U.S. real GDP is very much related to the exchange rate of the Renminbi against the US\$. In March 2023, the exchange rate of the Renminbi against the US\$ was 6.32 Yuan per US\$. At yearend 2023, the exchange rate of the Renminbi against the US\$ was 7.08 Yuan per US\$, a difference of 12%. Thus, at 2023 prices and exchange rate, the Chinese GDP is projected to catch up with U.S. GDP in 2038, much later than my previous forecasts.
- ◆ Of course, in Purchasing-Power-Parity (PPP) terms, Chinese GDP already reached parity with U.S. GDP in 2014, a finding supported by both the International Monetary Fund and the World Bank.
- ◆ China's natural resources per capita, such as arable land, clean water, mineral deposits, etc., are far less than that of the United States, so it is not easy for its real GDP per capita to surpass that of the United States. If it can be done at all, it will likely be at the very end of this century.⁷⁸

Actual and Projected Chinese and U.S. Real GDPs and Their Rates of Growth (2023 US\$)



Actual and Projected Chinese and U.S. Real GDPs per Capita and Rates of Growth

Actual and Projected Chinese and U.S. Real GDP per Capita and Their Rates of Growth (thousand, 2023 US\$)



Concluding Remarks

- ◆ The major economies have all recovered from the COVID-19 pandemic to varying degrees. However, the ongoing war in Ukraine has prevented the return to normalcy for the European Union, Russia and Ukraine. A ceasefire in Ukraine will be positive for them and for the World.
- ◆ As the China-U.S. strategic competition is likely to be the new normal in the next five to ten years, some degree of economic de-globalisation, de-coupling and de-risking is inevitable. In the short term, it will lower economic welfare in every economy. However, in the long term, when all is done and settled, the net result is likely to be greater resilience for the world economy, and perhaps even greater welfare for all.
- ◆ Of course, the world economy will do better if China, U.S. and all the other countries can cooperate to promote a global economic recovery, as they did in the aftermath of the Global Financial Crisis of 2008. Collectively, they can also make much more progress in the prevention of climate change.
- ◆ My personal forecast is that the growth of Chinese real GDP in 2024 will exceed 5%. For 2025, my personal forecast is a rate of growth between 5% and 5.5%, even given the many uncertainties. The truth is that the Chinese economy, like the U.S. economy, is no longer dependent on its export surplus. If achieved, it is a very respectable real rate of growth for a major economy. For the decade beyond 2025, an average rate of growth between 5% and 6% for the Chinese economy is feasible.
- ◆ While the development of new-quality productivity is important for long-term growth, the key to maintaining an adequate growth in the short and medium term is the expansion of aggregate demand.

Concluding Remarks

- ◆ However, despite the continuing geo-political tensions, China should maintain the policy of openness not only with respect to its economy, but also in the fields of science and technology, insofar as possible.
- ◆ Without economic globalisation and Chinese accession to the World Trade Organization (WTO) in 2001, the Chinese economy would not be where it is today. Self-reliance and independent innovation should not be equated with complete self-sufficiency. We should always keep in mind that China is implementing a dual-circulation rather than a mono-circulation development strategy.
- ◆ Past successes of Chinese scientific and technological breakthroughs have benefitted from the contributions of scientists and engineers who studied and/or worked overseas, such as Deng Jiaxian, Qian Sanqiang, Qian Xuesen, Sun Jiadong, Wang Ganchang, Zhou Guangzhao and Zhu Guangya. Without them, the efforts to develop the "two bombs and one satellite" might have taken much longer.
- ◆ The China-U.S. strategic competition will eventually end with both countries accepting each other under the principles of peaceful coexistence, mutual respect, and win-win cooperation, and the relationship will be sustained by⁸² "economic interdependence."