

Investment in Intangible Capital

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Introduction

- ◆ President XI Jinping has repeatedly emphasised the importance of China becoming an Education Power (教育强国), a Science and Technology Power (科技强国), and a Human Capital Power (人才强国).
- ◆ The China-U.S. strategic competition, which is the new normal, will last for at least five to ten years, perhaps even longer. The long-term focus of the competition will be on science and technology, especially if they relate to national defence. However, it is unlikely that either side will wind up with a decisive advantage. The end result is therefore likely to be a stalemate, not unlike that between the former Soviet Union and the U. S. during the Cold War era in the last Century.
- ◆ Eventually, China and the U. S. will enter into arms limitation agreements, just as the former Soviet Union and the U. S. did. This is because both sides will realise that there is no need to waste valuable resources to build and accumulate more and more weapons that both sides hope they will never have to use.
- ◆ However, this means that the competition is on investment in intangible capital, that is, human capital and R&D capital, which is crucial for innovation in science and technology.

Introduction

- ◆ Human capital may be measured as the discounted present value of the stream of future 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.
- ◆ R&D capital 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.

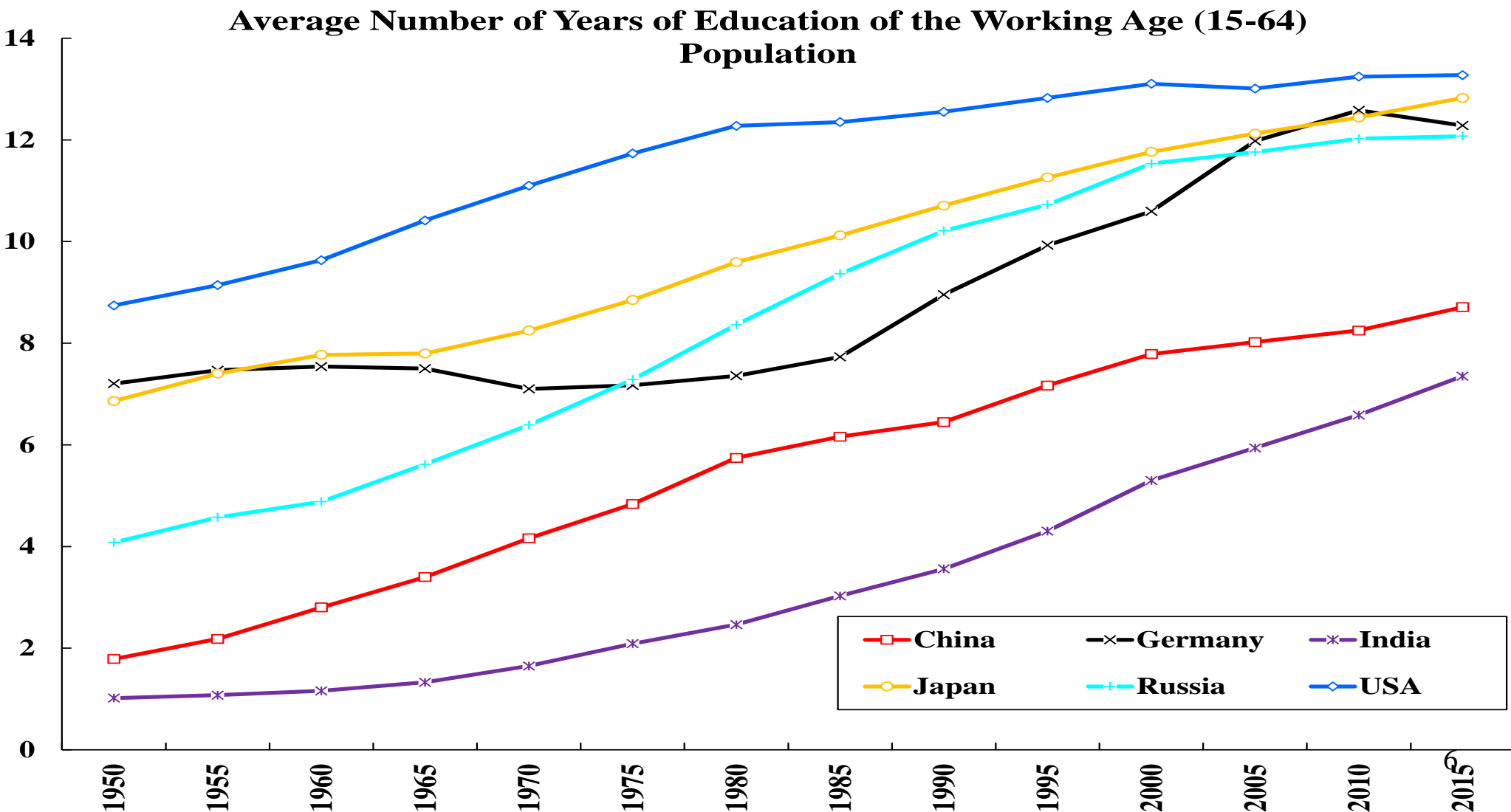
Investment in Human Capital

- ◆ While the quality of the Chinese labour force has improved a great deal since 1950, it still lags behind the other developed economies significantly (see Charts below). It is time for China to consider the extension of mandatory education from 9 years (instituted in 1986) to 12 years. Moreover, it should be viewed as a long-term investment in the future of China and will bring significant benefits in both the short and the long runs.
- ◆ First, the establishment of new and the expansion of existing senior high schools will create a demand for a large number of new teachers and administrators, thus providing additional employment opportunities for the currently unemployed or under-employed graduates of tertiary institutions and alleviating the youth unemployment problem.
- ◆ Second, the construction of new as well as expansion of existing senior high schools and their student dormitories, followed by the derived demands for colleges, universities, and technical institutes, will revive the demands in the building materials (steel, cement and glass) sector and the construction sector and offset the decline in the demands of the residential real estate sector.
- ◆ Third, it will postpone the entrance of young people into the labour force by up to seven years and thus will ease the pressure on generating enough new jobs every year.

Investment in Human Capital

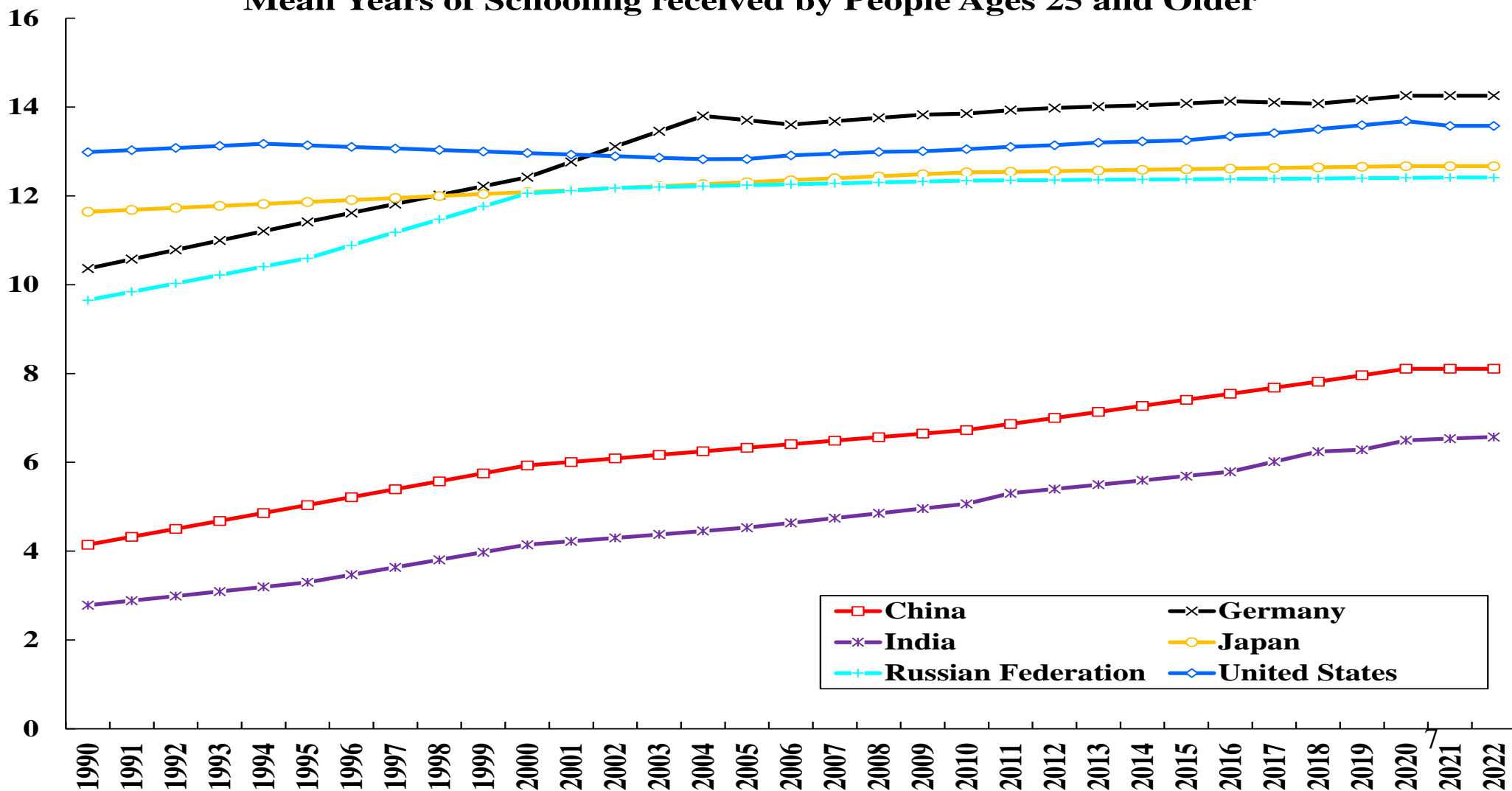
- ◆ Fourth, by making senior high school mandatory, most of the costs will be assumed by the government, and the financial burden to the households will be significantly reduced. This will in turn enable the lower-income households in China to have more free income to increase their household consumption and/or investment and perhaps on the margin to consider having more children.
- ◆ Fifth, with the rapid advance of artificial intelligence and robotics, many low-level and even higher-level jobs such as paralegals and research assistants will disappear. It is necessary to invest in the human capital of the next generation so as to enhance their future employability.
- ◆ Sixth, China aims to become a strong and powerful modernised socialist nation by 2035. For China to be a modernised nation, its citizens must be better educated and better prepared for all the future opportunities and challenges. In the long run, with a mandatory 12-year education, China will wind up with a labour force of a much higher quality and hence much higher productivity.

Average Number of Years of Education of the Working Age (16-64) Population (Barro-Lee)



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

Mean Years of Schooling received by People Ages 25 and Older

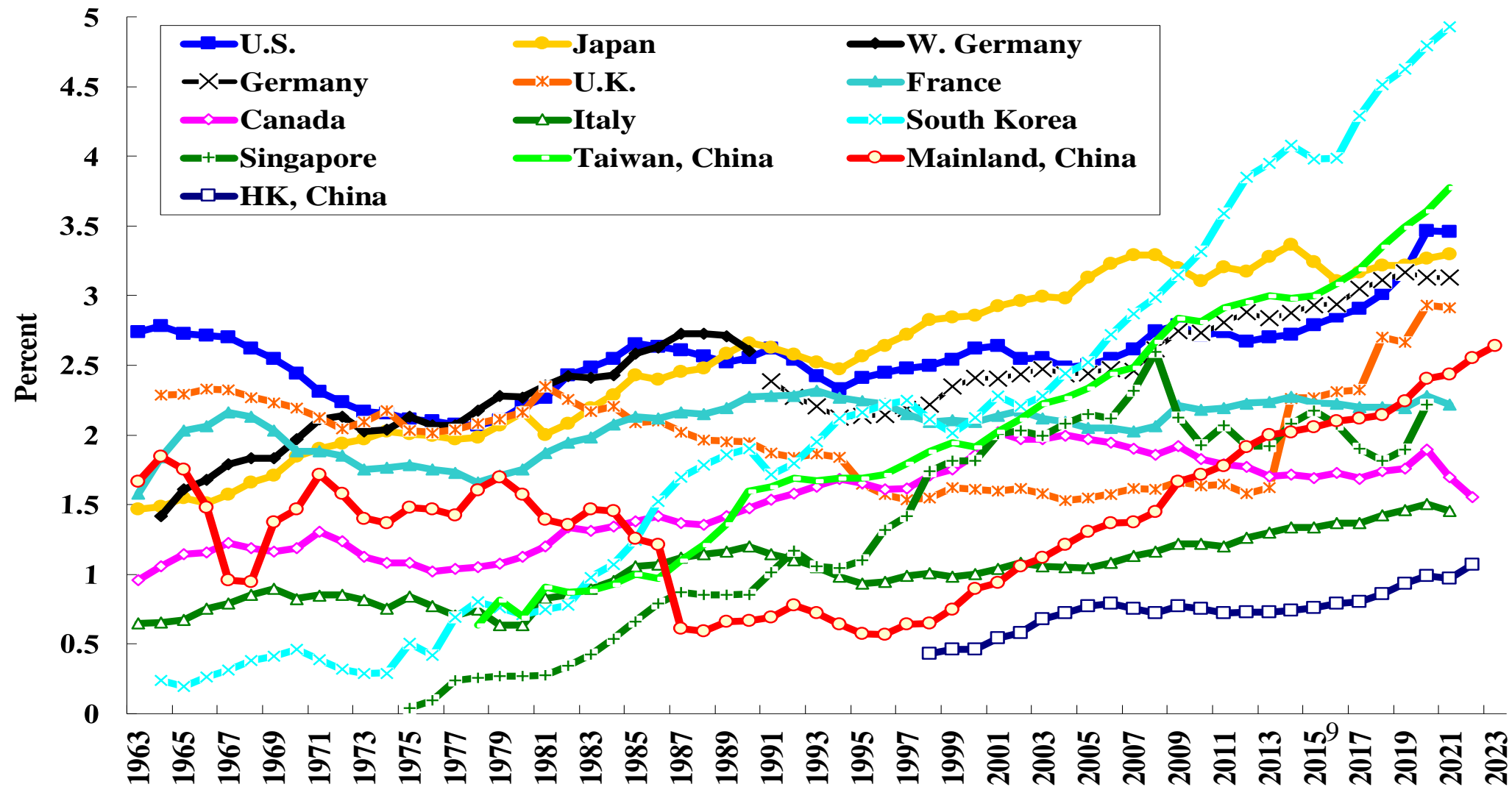


Investment in Research and Development (R&D)

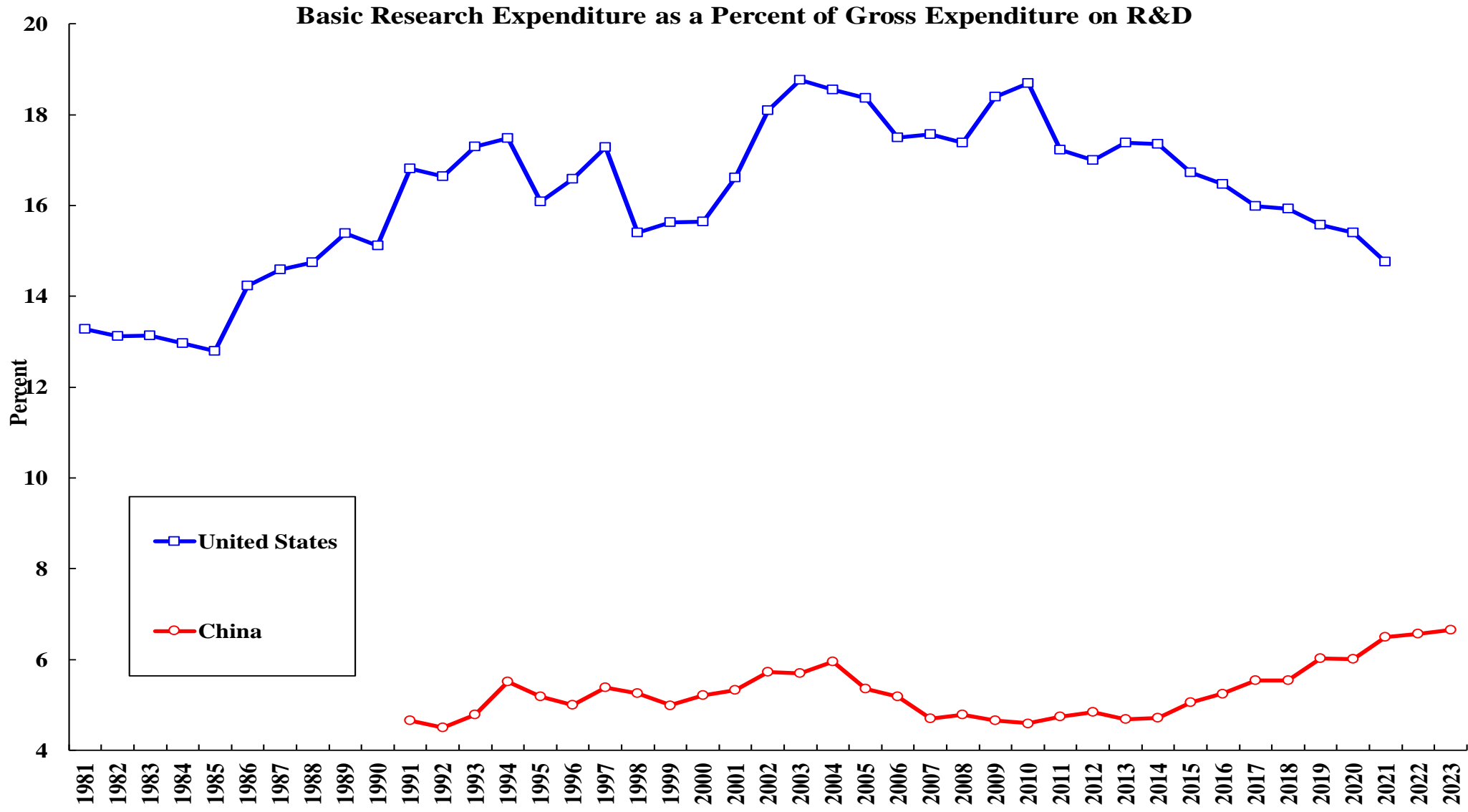
- ◆ Chinese investment in R&D has reached 2.64% of its GDP in 2023, an increase from 2.56% in 2022. However, it is still below quite a few countries including Japan and the U.S.
- ◆ However, in order for break-through discoveries and inventions to be made, there must be more investment in basic research. China still lags behind the U.S. and some other countries in terms of the proportion of its R&D investment devoted to basic research.

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



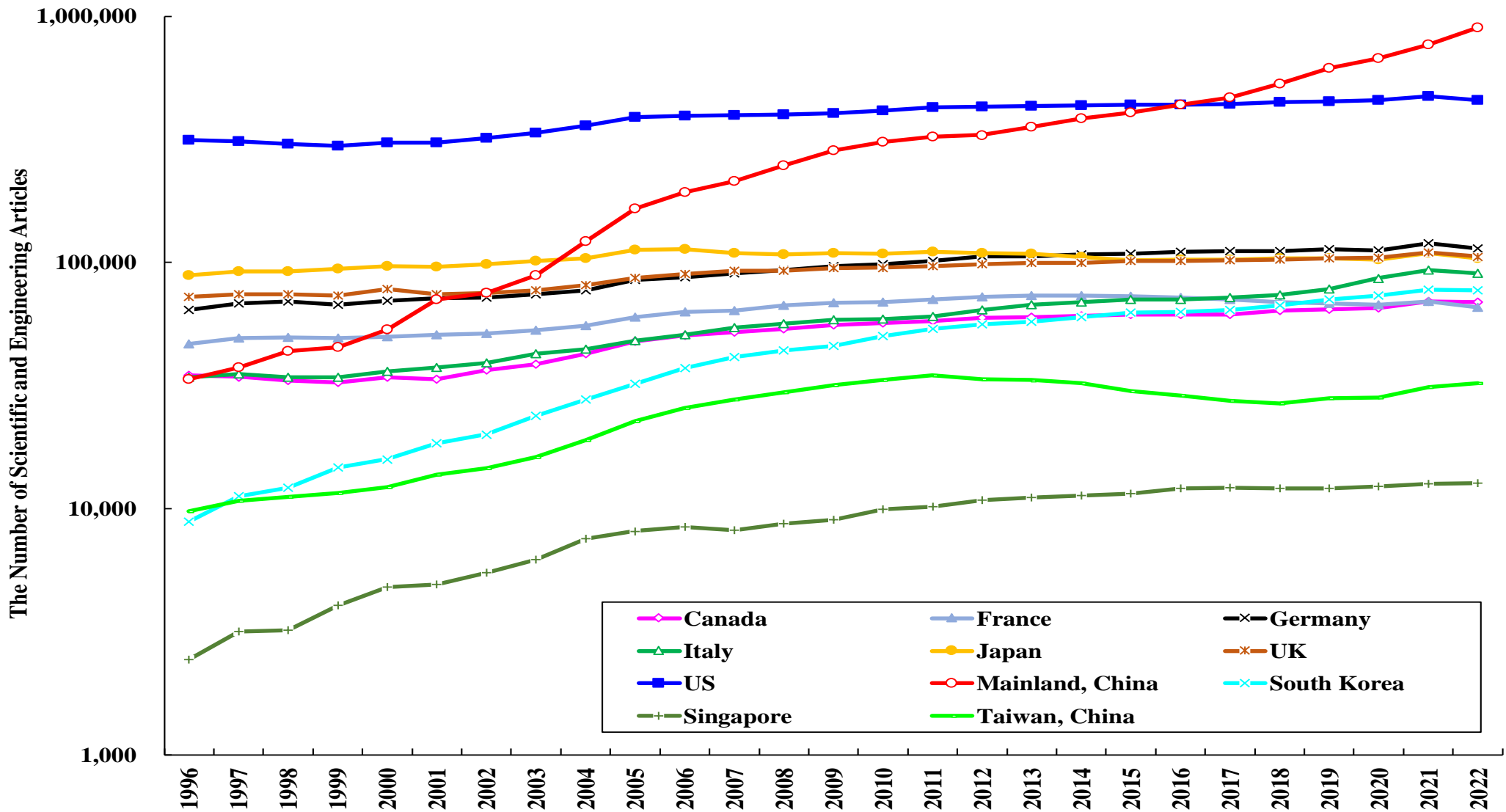
Basic Research Expenditure as a Percent of Gross Expenditure on R&D



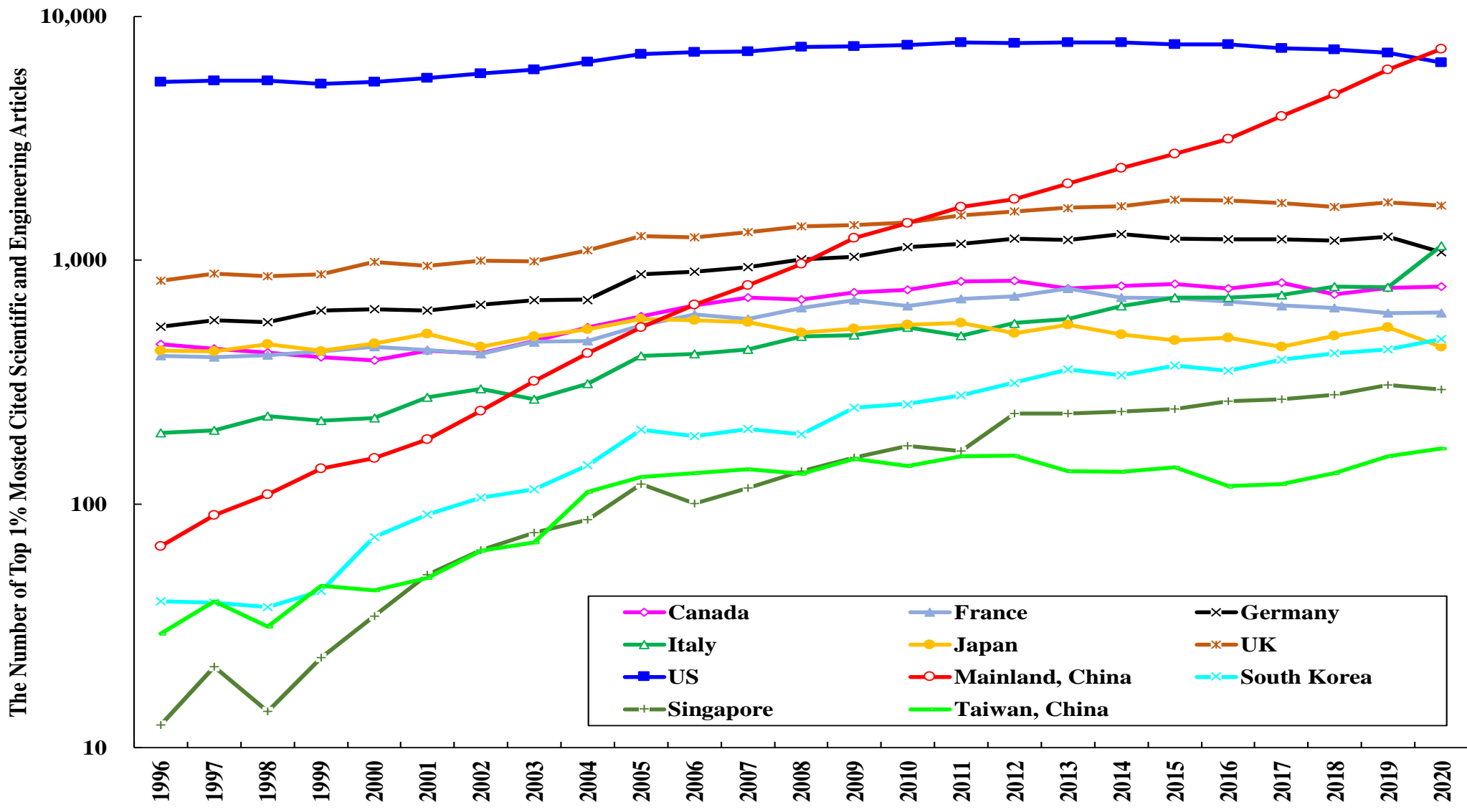
Publications and Patents

- ◆ One of the outputs of R&D is the number of publications. Chinese authors have published the highest number of scientific and engineering articles in the world since 2017, and the highest number of top 1% most cited articles since 2020, catching up with the U.S. and other developed countries.
- ◆ 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.
- ◆ There is a positive relationship between the number of patents granted to the nationals of a country, by the United States Patents and Trademarks Office (USPTO) for example, and the real R&D capital stock of that country—the higher the quantity of real R&D capital, the greater the number of USPTO patents granted. (See Lawrence J. Lau and Yanyan Xiong, **Are There Laws of Innovation?**, Singapore, World Scientific Publishing Company, 2022.)

Scientific and Engineering Articles Published

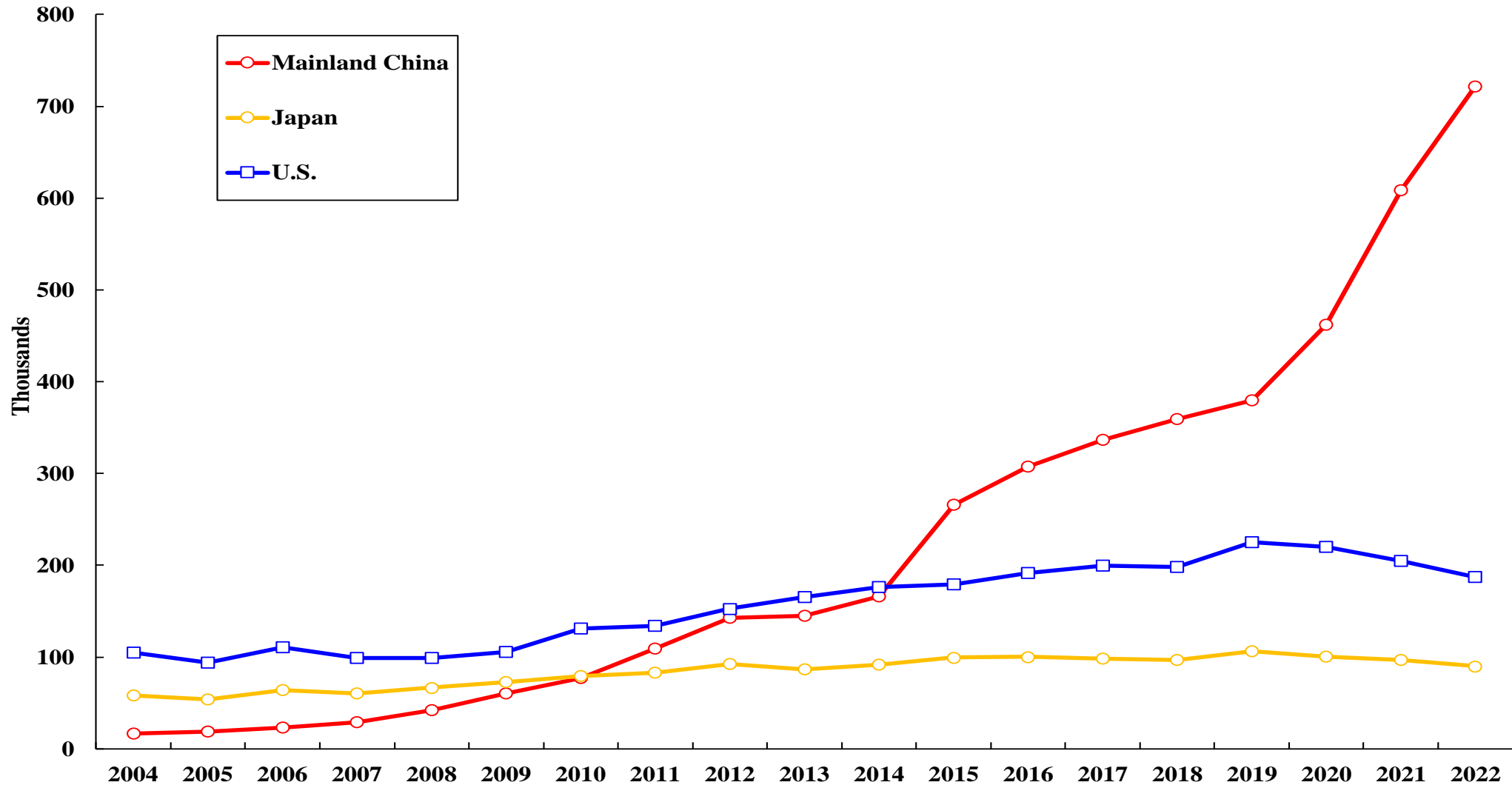


The Number of Top 1% Most Cited Articles

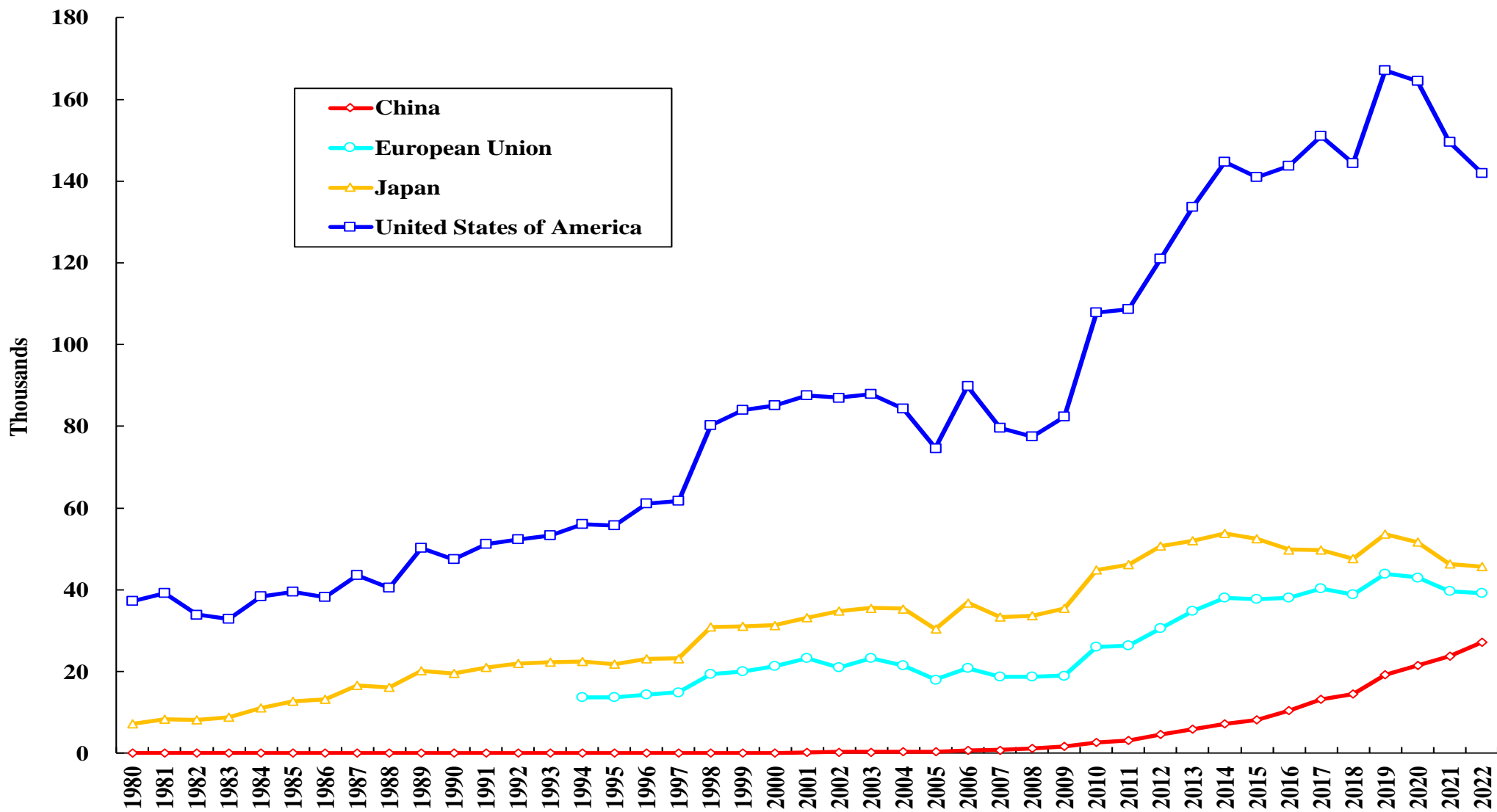


Total Patent Grants Awarded by USPTO, EPO and CNIPA: Mainland China, Japan & the U.S.

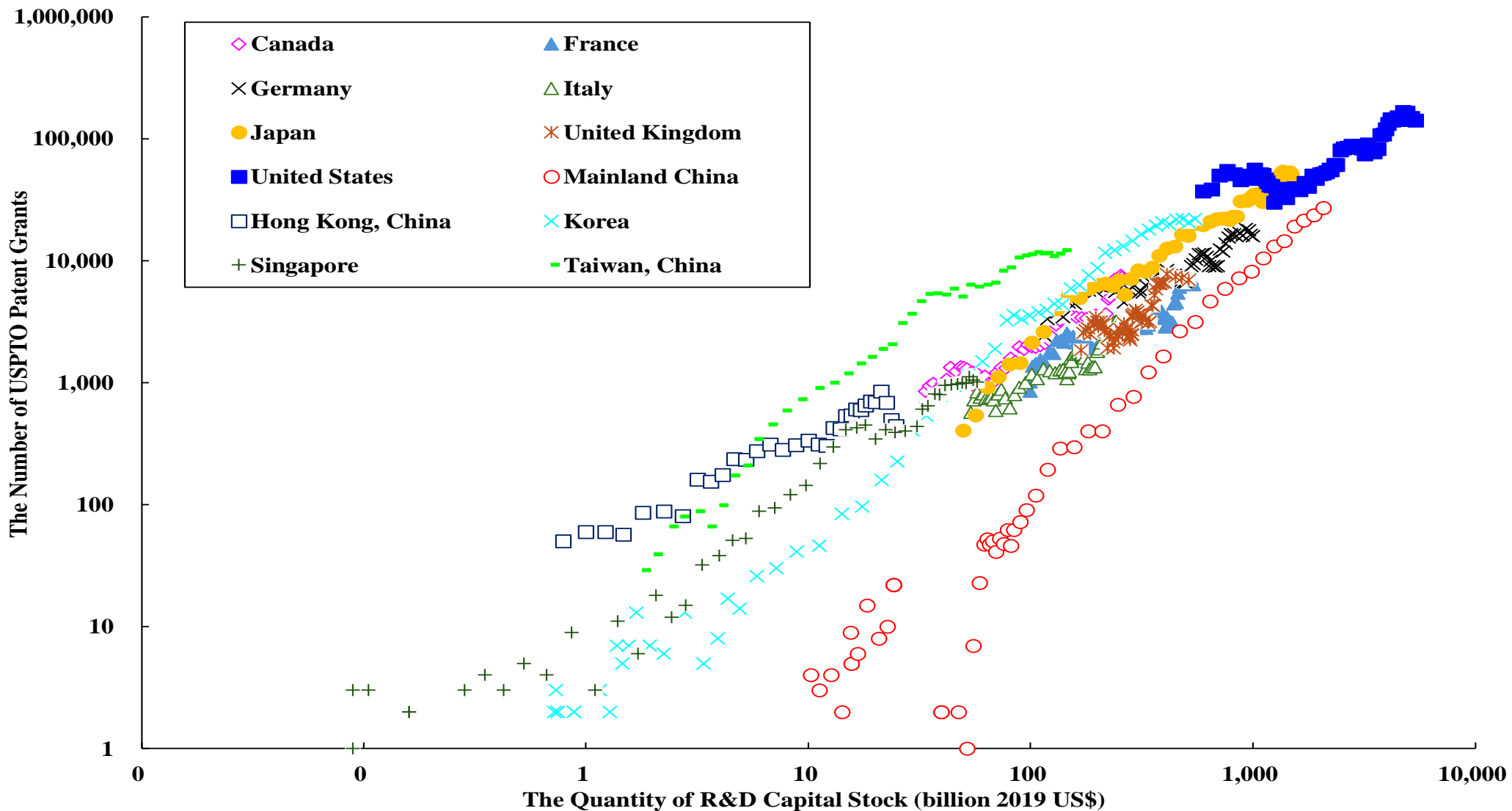
Patent Grants Awarded by USPTO, EPO and CNIPA Combined: China, Japan and the U.S.



The Number of USPTO Patents Received by China, EU, Japan and the U.S.



The Number of USPTO Patent Grants Received vs. the Real R&D Capital Stock



Concluding Remarks

- ◆ Past successes of Chinese scientific and technological breakthroughs have benefitted from the contributions of scientists and engineers trained overseas, such as Deng Jiaxian, Qian Sanqiang, Qian Xuesen, Sun Jiadong and Zhu Guangya.
- ◆ 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.