Economic Relations between China and the U.S.

by

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Economic Relations between China and the U.S.[§]

Lawrence J. Lau[1]

December 2019

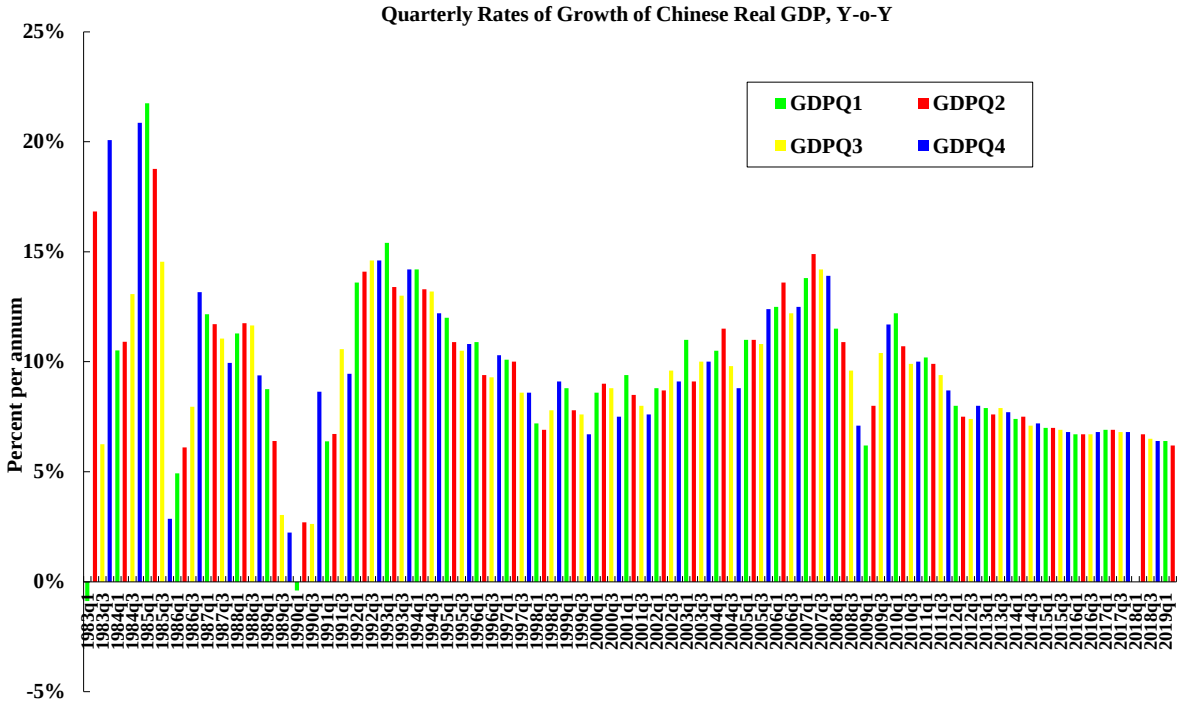
Abstract: First, we summarise the chronology of the China-U.S. trade war. We then show that the China-U.S. trade surplus, correctly measured, is not as large as it is made out to be, but is nevertheless still a large number. We go on to look at the value-added (GDP) generated directly and indirectly by the bilateral exports in the respective countries. In terms of the total domestic value-added generated by the exports of goods to each other, the China-U.S. bilateral gap is much smaller. Next, we analyse both the immediate and real impacts of the mutual tariffs on the two economies. We provide estimates of the maximum loss in GDP in China and the U.S. as a result of the mutual tariffs. Third, we discuss economic and technological competition between China and the U.S. and present long-term projections of the two economies to 2050 as well as some indicators of their innovation potentials. Fourth, we identify the economic complementarities between China and the U.S. We then discuss the possibility of coordinated expansion of trade that can be win-win for both countries and consider how mutual economic interdependence can be enhanced. Fifth, we also discuss the thorny bilateral issues in the economic relations between the two countries. Finally, some brief concluding remarks are made at the end.

[1] The author is the Ralph and Claire Landau Professor of Economics, The Chinese University of Hong Kong and the Kwoh-Ting Li Professor in Economic Development, Emeritus, Stanford University. This paper was prepared for presentation at the Chinese Economic Association (Europe/UK) Annual Conference, Stockholm, 1 September 2019. It is forthcoming in the Journal of Chinese Economic and Business Studies. The author wishes to thank Prof. K. C. Fung, Ms. Ayesha Macpherson Lau, Prof. Yanyan Xiong and Prof. Jinghai Zheng for their helpful comments and suggestions but retains sole responsibility for all remaining errors. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the Institute.

1. Introduction

The China-U.S. trade war actually started in January 2018, even though the first tariffs did not take effect until mid-2018. Thus far, the trade war does not seem to have done too much noticeable damage to either of the two economies. In 2017, the Chinese economy grew 6.8%. In 2018, the Chinese economy grew 6.6%, exceeding the Plan target of 6.5%. For 2019H1, the Chinese economy grew an annualised 6.3%, a decline of 0.5% from 2017. In Chart 1, the quarterly rates of growth of Chinese real GDP, year-on-year, are presented in colour-coded columns (light green for first quarter, red for second quarter, yellow for third quarter and blue for fourth quarter). The six quarterly year-on-year rates of growth were, from 2018Q1 through 2019Q2, respectively: 6.8%, 6.7%, 6.5%, 6.4%, 6.4% and 6.2%. The 6.2% rate of growth in 2019Q2 was the lowest rate of growth of Chinese real GDP since 2009Q1, when it also grew 6.2%. It is clear from the chart that the rate of growth of Chinese real GDP has stabilised--an L-shaped soft landing. The decline in the rate of growth over the six quarters was 0.6%.

Chart 1: Quarterly Rates of Growth of Chinese Real GDP, Y-o-Y



Source: The National Bureau of Statistics, People's Republic of China.

These results reflected the impacts of the expectation of a trade war since January 2018 and a full year of U.S. tariffs on U.S. imports of Chinese goods, as well as the rise of rates of interest globally until recently. The uncertainty and unpredictability created by the trade war also affected both investment and consumption negatively, with major decisions being put on hold, awaiting a resolution of the trade war. Moreover, the 6.3% rate of growth in 2019H1 might have also reflected the positive effects of accelerated shipments of Chinese exports of goods to the U.S. in an attempt to beat the imposition and increases of tariffs.

The U.S. economy grew 2.9% in 2018, close to its long-term average of 3%. It grew 3.1% and 2.1% in 2019Q1 and 2019Q2 respectively. The latest forecast made by the U.S. Federal Reserve Board for the rate of growth in 2019 is 2.3%, a decline of 0.6% from 2018.

The chronically large China-U.S. bilateral trade surplus is the proximate cause of the current China-U.S. trade war, but the trade war itself is also a reflection of the rise of isolationism, nationalism, populism and protectionism in the U.S., as in the rest of the world. The rapid growth of the Chinese economy also set off alarms in the U.S. In terms of aggregate GDP, China went from only one-fifth of the U.S. GDP in 2000 to two-thirds in 2017, in only 17 years. China overtook Japan in 2006 to become the second largest economy in the world, just after the U.S. It is inevitable that there will be economic, technological and geo-political competition between China and the U.S., the two largest economies in the world. Thus, even if the trade war, or at least the mutual tariffs, end, competition between China and the U.S. is likely to continue for a long time. It will become the "new normal". Moreover, the trade war itself may do damage to the longer-term relations between the two countries.

The Chinese economy is sufficiently flexible and resilient that it will be able to adopt appropriate measures, survive the negative impacts and maintain significant positive economic growth. For example, it can increase domestic aggregate demand by mandating the enhanced provision of public goods such as environmental preservation, protection and restoration, education, health care and elderly care, which are often under-provided by the free market anyway. Chinese enterprises on the U.S. "entities list" will also be able to develop alternatives to U.S. technology imports. For example, Huawei has launched the Harmony (Hongmeng) operating system to replace the Android operating system in its cell phones.

In what follows, we first summarise the chronology of the China-U.S. trade war. We then show that the two countries do not even agree on the size of the bilateral trade surplus. However, the China-U.S. trade surplus, correctly measured, is not as large as it is made out to be, but is nevertheless still a large number. We go on to show that the gross value of the bilateral trade surplus does not reflect the relative benefits of the bilateral trade to the two trading-partner countries. Instead, we should look at the value-added (GDP)[2] generated directly and indirectly by the bilateral exports in the respective countries. In terms of the total domestic value-added generated by the exports of goods to each other, the China-U.S. bilateral gap is much smaller than that measured in terms of gross value of exports, and it appears feasible to close the gap with coordinated expansion of trade between the two economies in a few years.

Next, we analyse both the immediate and real impacts of the mutual tariffs on the two economies. The immediate impacts are mostly psychological and manifest themselves in the stock and foreign exchange markets. The real impacts come later, when current and future trade flows are affected by the mutual tariffs. When two countries trade, they both benefit in the aggregate because their choice sets are enlarged and aggregate economic welfare rises in both countries. A country always loses when it restricts its own choice set, for example, by imposing tariffs or an embargo. Its aggregate welfare will decline. But its trading-partner country will also lose because its choices are also restricted. We provide estimates of the maximum loss in GDP in China and the U.S. as a result of the mutual tariffs.

Third, we discuss economic and technological competition between China and the U.S. and present long-term projections of the two economies to 2050 as well as some indicators of their innovation potentials.

Fourth, we identify the economic complementarities between China and the U.S. The potential benefits from bilateral trade are higher the more different the two economies are. China and the U.S. are as different as they come as far as the endowments of land and natural resources are concerned. We then discuss the possibility of coordinated expansion of trade that can be win-win for both countries and consider how mutual economic interdependence can be enhanced.

[2] And of course, employment and GNP too; but that will have to be the subject of another paper.

Fifth, we also discuss the thorny bilateral issues in the economic relations between the two countries. Finally, some brief concluding remarks are made at the end.

2. The Chronology of the China-U.S. Trade War

The trade war began in March 2018 with a Section 301 investigation of China by the U.S. Government, which resulted in a 25% tariff on US$50 billion worth of Chinese exports of goods to the U.S. China retaliated with a tariff on US$50 billion of U.S. exports to China in June 2018. In September 2018, the U.S. imposed 10% tariff on US$200 billion of Chinese exports of goods to the U.S. and China announced a 5%-10% tariff on US$60 billion of U.S. exports to China. On 10 May 2019, the 10% tariff rate on the US$200 billion of Chinese exports was raised to 25%. However, the marginal effect of this increase in the tariff rate from 10% to 25% is not likely to be large because the 10% tariff rate is already high enough to be almost prohibitive for most Chinese exports to the U.S. There simply is not that kind of profit margin for such exports to for the tariffs to be absorbed by the Chinese manufacturers and exporters.

Tariffs at a rate of 10% on the remaining approximately US$300 billion of Chinese exports of goods to the U.S. were ordered by U.S. President Donald Trump to take effect on 1 September 2019. This last batch of Chinese exports to the U.S. consist of products such as the Apple iPhones (worth around US$50 billion), personal computers, garments and shoes and packaged re-exports of semi-conductors. The incidence of the tariffs will be mostly borne by U.S. enterprises and households including Apple Inc.[3]

However, on 13 August, President Trump announced that these tariffs will be delayed until 15 December on goods such as cell phones, laptop computers, shoes and toys, amounting to approximately US$160 billion, so as not to affect the Christmas shopping season in the U.S. The tariff was dropped altogether on 25 types of products "based on health, safety, national security and other factors". Then, on 23 August 2019, it was announced that the 10% and 25% tariff rates would be raised by 5% to 15% and 30% respectively on 1 October 2019. Yet, as a

[3] One incidental and unintended beneficiary will be Samsung of South Korea, whose Galaxy cell phones compete with the Apple iPhones and they are not subject to the new tariffs on U.S. imports from China.

gesture of goodwill, the U.S. has postponed the 5% increase in the tariff rates to 15 October 2019.

Chinese tariffs, with rates up to 25%, have also been imposed on US$110 billion of U.S. exports of goods, with $75 billion of which subject to increased tariffs on 1 October 2019. However, on 11 September, the Chinese Government announced an exemption of Chinese tariffs on 16 types of U.S. goods including cancer drugs, lubricant oils and some specialty chemicals, for one year beginning on 17 September. Moreover, on 13 September, the Chinese Government announced an exemption from tariffs for pork,[4] soybeans and other agricultural imports from the U.S. and signalled that Chinese enterprises would be making large purchases of both pork and soybeans from U.S. producers. Subsequently there have been reports that actual purchases have been made by Chinese enterprises.

On 10-11 October, the Chinese and U.S. teams resumed their negotiations in Washington, D.C. and were close to reaching what was called a "Phase 1" agreement, which apparently provided for significant Chinese purchases of U.S. agricultural commodities of between US$40-50 billion and a delay in the implementation of new and increased tariffs scheduled for 15 October. There were also supposedly provisions for strengthening intellectual property protection and facilitating the provision of financial services by U.S. firms.

3. The Different Measurements of the Bilateral Trade Balance

In 2018, despite the trade war and the devaluation of the Renminbi with respect to the US$ by approximately 8%, Chinese exports of goods to the U.S. actually increased by 11.3% to US$478 billion, in part because of the acceleration of exports in anticipation of the imposition and increases of tariffs. U.S. exports to China actually declined by7.3% to US$121 billion, reflecting the Chinese tariffs on U.S. agricultural commodities as well as U.S. restrictions on high-technology exports to China.

The official U.S. estimate of the U.S.-China trade deficit in goods only in 2018 is US$419.6 billion, an increase from US$375.8 billion in 2017. The official Chinese estimate of the bilateral trade surplus is US$323.3 billion, an increase from US$275.8 billion. There is

[4] Pork has been in short supply in China because of a severe swine epidemic.

a difference between the Chinese and U.S. estimates of the bilateral trade balance of almost US$100 billion. However, these numbers suffer from a number of imperfections and are not directly comparable.

First, by convention and custom, exports of goods are measured by the exporting country as either f.o.b. (free on board), e.g., China, or f.a.s. (free alongside ship), e.g., the U.S., and imports of goods as c.i.f. (cost, insurance and freight), e.g., China, or customs basis, e.g., the U.S., so that the measured imports of the importing country from an exporting country is always larger than the measured exports of the exporting country to the importing country.[5] Even if the values of exports of both countries to each other are exactly the same, they will both show a bilateral trade deficit. There is thus a built-in bias for a bilateral trade deficit with the conventional measurements of exports and imports. Moreover, insurance and freight are frequently provided by firms of third countries and should not be attributed to the exporting country. It is therefore more accurate to measure the bilateral trade surplus in goods using only bilateral data on exports, f.o.b.[6] If the bilateral trade deficit is calculated based on bilateral exports data only, f.o.b., the China-U.S. bilateral trade surplus in 2018 would be US$356.4 billion, smaller than the official U.S. estimate of US$419.6 billion and larger than the official Chinese estimate of US$323.3 billion.

Second, the official trade data do not necessarily include re-exports via third countries and customs territories such as Hong Kong. This applies to both re-exports of Chinese goods to the U.S. and re-exports of U.S. goods to China through Hong Kong and other non-Chinese and non-U.S. ports. The U.S. trade statistics quite properly classify re-exports of Chinese goods through third countries and regions as imports from China. However, they do not include re-exports of U.S. goods to China through third countries and regions as U.S. exports to China. Similarly, the Chinese trade statistics do not include re-exports of Chinese goods to the U.S. through third countries or regions but appear to include re-exports of U.S. goods to China.

[5] However, f.o.b. is typically larger than f.a.s. by approximately 1%, and c.i.f. is typically larger than f.o.b. by approximately 10%. Customs basis is used primarily by the U.S. and is not significantly different from c.i.f. in recent years.

[6] The insurance and freight should be included in the imports of services to the extent that it is not provided by firms of the importing country.

We can estimate the extent of re-exports by comparing the imports data of each country with the exports data of the other, taking into account the value of insurance and freight. We find that in recent years, the measured imports of one country, minus an allowance for insurance and freight of 10%, almost always exceed the corresponding measured exports from the other country. Their difference provides an estimate of the gross value of re-exports.[7] (The re-exports thus estimated may be an under-estimate as there may be an incentive for importers to under-invoice imports in order to avoid or reduce tariffs, which may or may not be detected by customs officials.) These estimates are compared to the re-exports data of Hong Kong and are broadly consistent in recent years. If the estimated bilateral re-exports of goods are added to the exports on an f.o.b. basis, the bilateral trade deficit may be estimated to be US$350.9 billion compared with US$356.4 billion not including the estimated re-exports. Re-exports are no longer an important factor in China-U.S. bilateral trade as they were at one time.

Third, the bilateral trade in services, in which the U.S. has a significant surplus,[8] is frequently neglected in the discussion of the China-U.S. trade balance. U.S. exports of educational services alone was US$44.7 billion in 2018. In fact, some U.S. higher educational institutions have even purchased insurance against a decline in tuition revenue from students from China.[9] If the bilateral trade deficit is calculated for goods and services combined, the official U.S estimate of the China-U.S. bilateral trade surplus is US$380.8 billion, smaller than the official U.S. estimate of US$419.6 billion for goods only; the "official" Chinese estimate of the China-U.S. bilateral trade surplus is US$268.4 billion and smaller than the official Chinese estimate of US$323.3 billion for goods only.[10]

Trade in services is different from trade in goods in one important respect—there is no additional insurance and freight. However, even then, there exist large differences between the official Chinese and U.S. estimates of the exports of services to and imports of services from each other. Which set of numbers is more reliable? It is difficult to say. In general, imports of services data appear to be more reliable, especially for China. This is because in order to pay for these imported services, for example, educational services provided to Chinese students

[7] Note that insurance and freight apply to both the initial exports and the re-exports.
[8] Estimated to be US$38.8 billion in 2018 by the U.S. and US$54 billion by China for 2017 (Chinese data for 2018 apparently have not been released).
[9] Financial Times, 11 September 2019, p. 4.
[10] The Chinese bilateral service trade figures for 2018 are estimated by the author. They are assumed to have grown at the same rate as the official U.S. bilateral data.

by U.S. universities, the Chinese service users must apply for permission to remit the funds abroad, which under normal circumstances is almost always granted.[11] There are therefore formal records for these expenditures. In contrast, the U.S. exporters (providers) of these services do not have the formal obligations to report to the U.S. Government of the detailed sources and amounts of their service revenues. Similarly, U.S. importers of Chinese services, for example, U.S. tourists visiting China, will leave better records, through credit card charges, currency exchanges and bank remittances, than Chinese exporters of such services, for example, hotel and restaurant owners. Thus, to the extent that the measured exports of services from one country to the other is different from the measured imports of services of its trading-partner country, we should put greater reliance on the measured imports.

To be on the safe side, we make two alternative calculations involving the bilateral China-U.S. trade in services, using different assumptions. First, we use official U.S. estimates of the bilateral trade flows in services for 2018. The resulting estimate of the U.S.-China overall trade deficit in goods, including re-exports, and services combined in 2018 may be estimated to be US$312.1 billion. Second, we use the reported service imports data of the importing country, on the grounds that they are more reliable than the service exports data. The resulting U.S.-China overall trade deficit may be estimated to be US$276.0 billion for 2018. These are still large numbers, but smaller than the often-mentioned U.S. official estimate of the bilateral trade deficit in goods only of US$419.6 billion by between one-quarter and one-third, and even smaller than the Chinese official estimate of US$323.3 billion for goods only.

The results of applying different adjustments to the data on the bilateral trade in goods and services are summarised in Table 1. However, it should be recognised that even though our adjusted estimate of the China-U.S. bilateral trade surplus of US$276 billion for 2018 is much smaller than both the official U.S. and Chinese estimates, it is nevertheless still a very large absolute number, equivalent to 1.3% of U.S. GDP and 2.1% of Chinese GDP.

[11] The Renminbi has been current-account convertible since 1994.

Table 1: The Different Measurements of the Bilateral Trade Balance: A Summary

Measurement	Official Chinese Estimates	Our Estimates	Official U.S. Estimates
Goods Only, Exports FOB, Imports CIF	323.3		419.6
Goods only, Based on Bilateral Exports FOB Data		356.4	
Goods Only, Based on Bilateral Exports and Estimated Re-Exports, FOB		350.9	
Goods, Exports FOB, Imports CIF, and Services	268.4		380.8
Goods, including Estimated Re-Exports, FOB, and Services Based on U.S. Data		321.2	
Goods, including Estimated Re-Exports, FOB, and Services Based on Bilateral Imports Data		276.0	

Sources: The National Bureau of Statistics of the People's Republic of China, The Bureau of Economic Analysis, U.S. Department of Commerce, and author's estimates.

4. The Relative Benefits from the Bilateral Trade

However, the gross value of exports does not reflect accurately the real benefits of exports to the exporting country. What really matters is the GDP created by the exports, that is, the domestic value-added created by the exports, directly and indirectly. As an example, consider the Apple iPhone, an export of China since it is finally assembled by Foxconn (Hon Hai Precision Industry Co., Ltd. of Taiwan) in China. The value of an iPhone is at least US$600 whereas the Chinese domestic value-added is less than US$20, with a direct value-added content of at most 3.3%.[12] The GNP generated is even lower since Foxconn is not a Chinese company.

The average direct domestic value-added content of Chinese exports of goods to the U.S. is higher, at 24.8%,[13] so that each US$100 billion worth of Chinese exports to the U.S., f.o.b., generates directly no more than US$24.8 billion of Chinese GDP. However, the reduction of exports leads to a reduction in the demands for domestic inputs used in their

[12] The low Chinese domestic value-added in the assembly of the Apple iPhone is well known.
[13] See Chen and Wang (2016).

production and the demands for consumption goods by the workers in the exporting industry, which in turn lead to a second-round reduction in the demands for domestic inputs used in the production of the domestic inputs and final goods for domestic consumption. With the indirect, that is, second-, third-, fourth- and higher-round effects of the reduction of Chinese exports kicking in, the total domestic value-added affected will eventually increase to 66% cumulatively,[14] with the indirect value-added content being 41%.

The average direct domestic value-added content of U.S. exports of goods to China may be estimated to be 50.8%.[15] Including all the indirect, that is, second-, third-, fourth- and higher-round effects of the reduction of U.S. exports of goods, the total domestic value-added affected increases to 88.7% cumulatively,[16] with the indirect value-added content being 37.9%.

Using these estimates of the domestic value-added contents of Chinese and U.S. exports of goods to each other and the official U.S. data on the bilateral service trade, the U.S.-China trade deficit in goods and services combined, in terms of total value-added, may be estimated to be US$141.1 billion in 2018, almost only a third of the often-mentioned U.S.-China trade deficit in goods only of US$419.6 billion (see Table 2). (The value-added content of exports of services is assumed to be 100%.) This value-added trade deficit can be closed with an increase in U.S. exports of goods to China of a gross value of US$159 billion (based on an average total value-added content of 88.7%), which appears feasible with coordination between the two countries within a few years as discussed below. We further note that this figure is based on the official U.S. estimate of its exports of services to China of US$57.1 billion in 2018. An estimate of U.S. exports of services to China based on past Chinese trade data is approximately US$93.2 billion in 2018, which would further reduce the value-added gap to approximately US$105 billion from US$141 billion, implying a gross-value trade deficit of US$118 billion to be closed.

[14] See Chen and Wang (2016).
[15] See Chen and Wang (2016).
[16] See Chen and Wang (2016).

Table 2: The Relative Benefits from the Bilateral Trade in Terms of Value-Added, 2018: A Summary

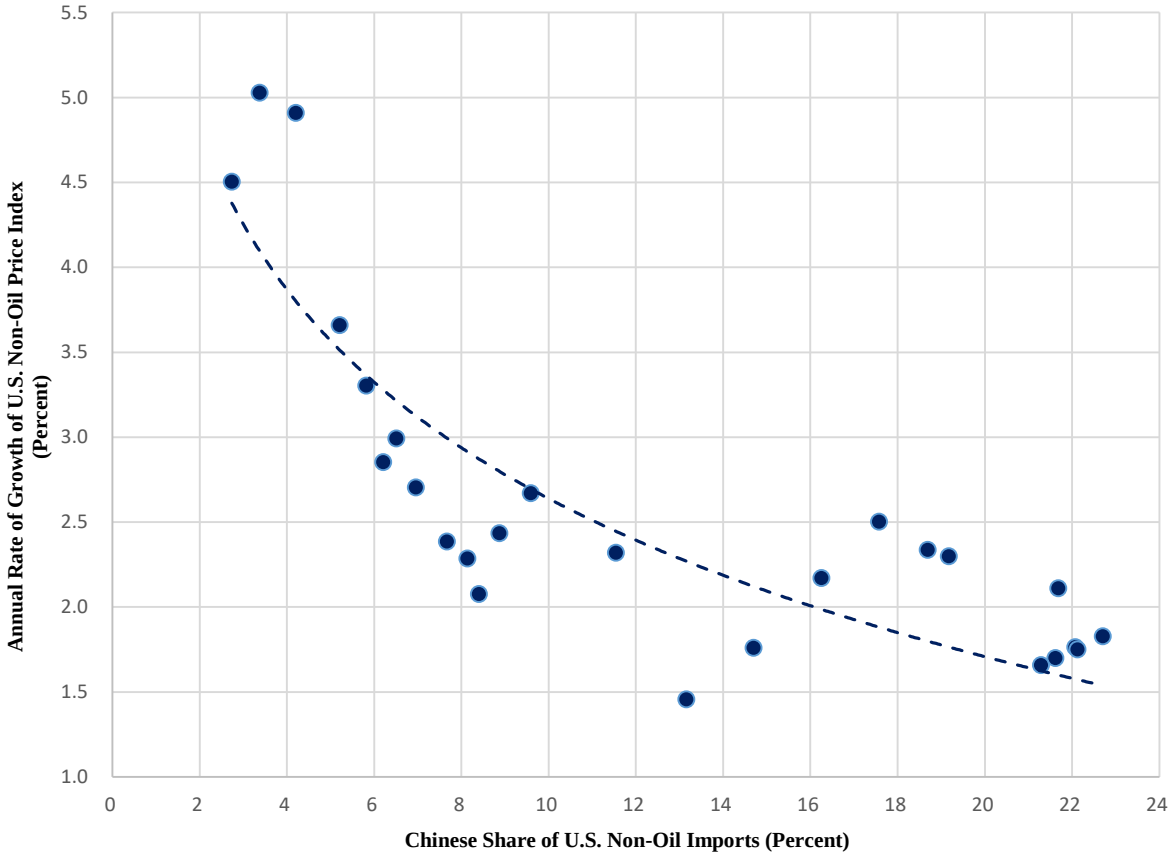
Summary of Comparisons of Relative Benefits In 2018			
Measurement	China	The U.S.	Difference
Direct Value-Added, Goods Only, Based on Bilateral Exports and Estimated Re-Exports, FOB	159.8	128.6	31.2
Indirect Value-Added, Goods Only, Based on Bilateral Exports and Estimated Re-Exports, FOB	201.9	53.3	148.6
Total Value-Added, Goods Only, Based on Bilateral Exports and Estimated Re-Exports, FOB	361.8	181.9	179.9
Value-Added from Service Exports, Based on U.S. Data	18.3	57.1	-38.8
Value Added from Service Exports, Based on Bilateral Service Imports Data	18.3	93.2	-74.9
Total Value-Added, Good and Services, Based on U.S. Service Trade Data	380.1	239.1	141.1
Total Value-Added, Good and Services, Based on Bilateral Service Imports Data	380.1	275.1	105.0

Source: Author's calculations.

It is difficult to assess which country has benefitted more from their economic relations. China has been able to lift 740 million of its citizens out of poverty, initially through the vast expansion of export-oriented jobs in China that resulted from China's opening up to international trade and direct investment in 1978 and accession to the World Trade Organisation (WTO) in 2001. However, the U.S. consumers have also benefitted from two decades of low prices for their consumer goods. Lau and Tang (2018) show that had U.S. imports from China stayed at 1994 levels, the U.S. Consumer Price Index would have been 27 percent higher in 2017, or approximately 1 percentage point higher annually (see Chart 2). Additional benefits for the U.S. include the profits of U.S. corporations earned by their operations within China, such as General Motors, Walmart and Starbucks, as well as the sales of Apple iPhones, which, since they are finally assembled within China, are not considered

U.S. exports to China. Also not included as income earned by U.S. nationals from China are Chinese royalty and license fee payments to subsidiaries of U.S. high-technology firms such as Apple Inc. and Qualcomm in third-country tax havens such as Ireland and the Netherlands. The above also does not include the benefits that the U.S. has derived from seigneurage, that is, from being the monopolist provider of the international medium of exchange for Chinese international transactions. China is among the largest foreign holders of U.S. government bonds and agency securities.

Chart 2: The Rate of Growth of US Non-Oil Price Index and the Chinese Share of U.S. Non-Oil Imports



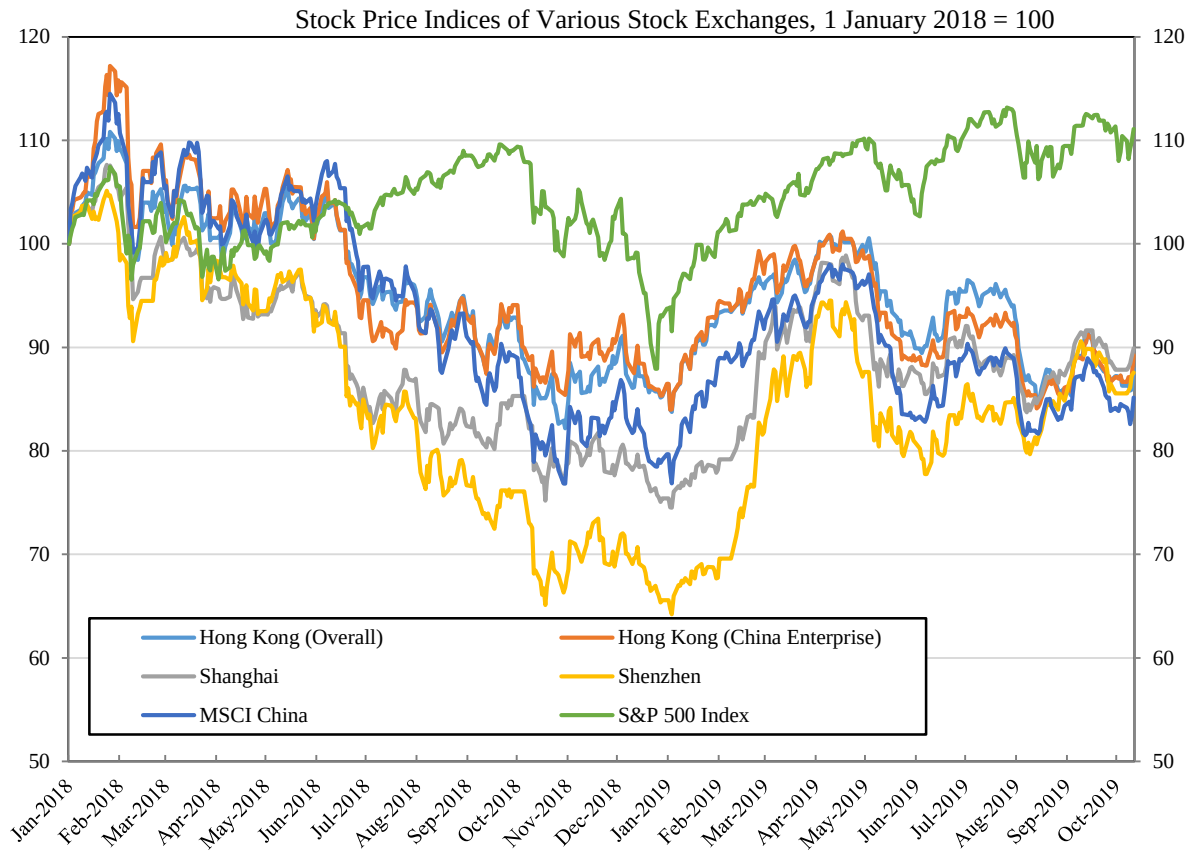
Source: Lau and Tang (2018).

5. The Immediate Impacts of the China-U.S. Trade War

The Chinese stock markets have already taken a hit (see Chart 3). This is an area where the psychological factor dominates. As of the end of 2018, the shares on the Shenzhen Stock Exchange had on average lost 30%, Shanghai 20%, and Hong Kong 10%. In contrast, the Standard and Poor 500 Index of U.S. stocks did not suffer any loss on a whole-year (2018) basis. It should also be borne in mind that the increase in the rates of interest in the U.S. and elsewhere in 2018 would also have affected asset prices around the world negatively, so it was not solely the effect of the China-U.S. trade war.

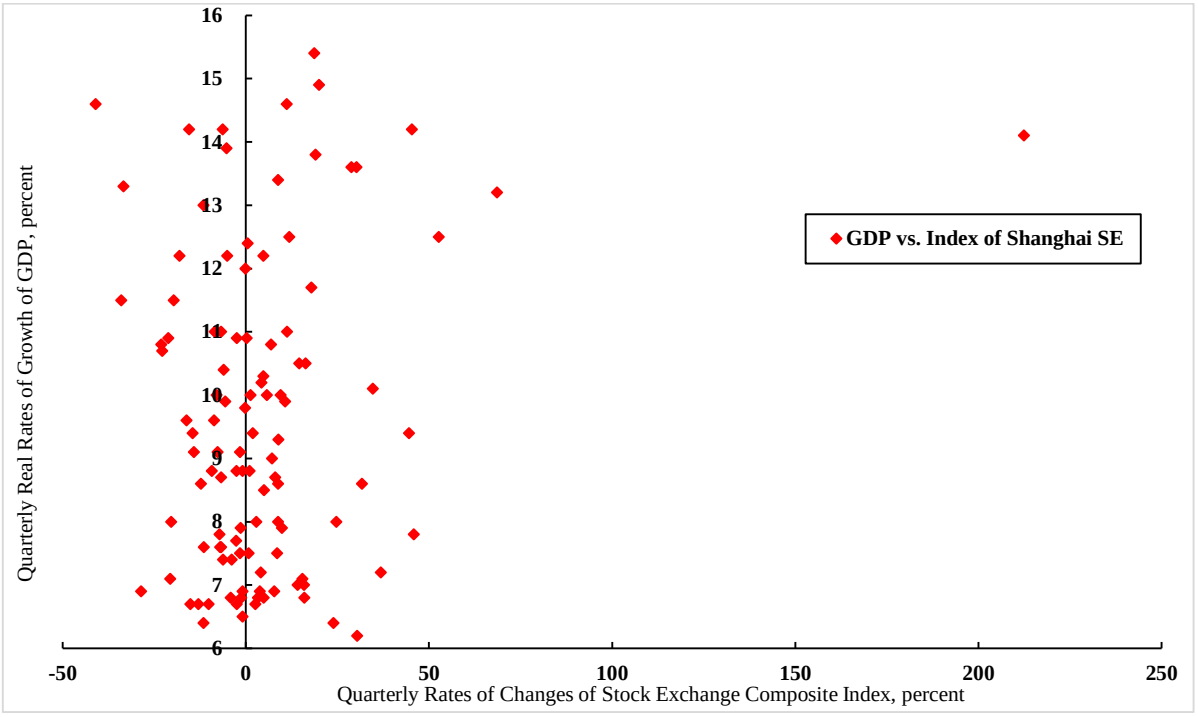
At the beginning of 2019, the Chinese stock market continued to fall, until the latter part of January, then it began to rise, buoyed by hopes of a successful conclusion of a China-U.S. trade agreement. However, since May 2019, it has become quite volatile, reflecting the progress or lack thereof of the trade negotiations, reacting to every trade-related tweet of U.S. President Donald Trump. The Standard and Poor 500 Index also fell at the beginning of 2019, but has also recovered and showed a gain of approximately 10% from the beginning of 2018. However, it has also experienced volatility similar to the Chinese stock market price indices more recently.

Chart 3: The Chinese, Hong Kong and U.S. Stock Market Indexes, 2018M1 to Date



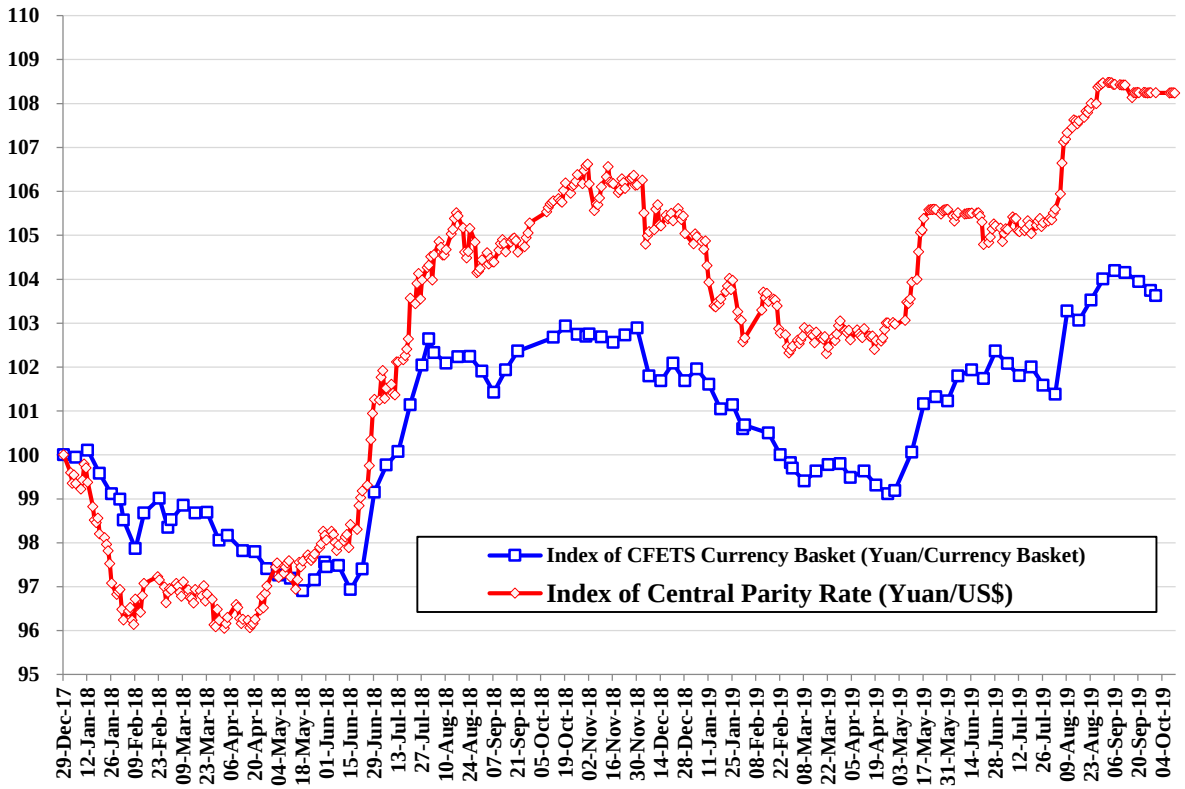
However, the Chinese stock markets are not a good barometer of the state of the Chinese real economy. There is essentially no correlation between the rate of growth of Chinese real GDP and the rate of growth of the Chinese stock market price index (see Chart 4, a scatter-diagram between the quarterly rates of growth of Chinese real GDP and the Shanghai Stock Exchange Composite Index). The majority (over 80%) of Mainland Chinese investors are individual retail investors. They are typically short-term traders who tend to leave the market at the first sign of potential trouble. The average holding period of individual Chinese investors is less than 20 trading days. The Chinese institutional investors have a slightly longer average holding period of between 30 and 40 trading days. The short holding period is due in part to the fact that Chinese publicly listed enterprises pay little or no cash dividends. Investors can make money only through frequent trading and have little incentive to hold a particular stock long term.

Chart 4: The Quarterly Rates of Growth of Chinese Real GDP versus the Chinese Stock Price Index



The Renminbi exchange rate has also been affected by the trade war (see Chart 5). Since the beginning of the trade war, the Renminbi devalued by approximately 8% relative to the US$ (at one time almost 10%). However, relative to the CFETS (China Foreign Exchange Trade System) Index, which tracks the exchange rate of a Chinese trade-weighted basket of currencies, the onshore Renminbi central parity rate has only devalued by approximately 4%. Our focus should be on the onshore central parity rate rather than the offshore rate and on its relation to the CFETS Index. The Renminbi does not follow the US$ any more because the U.S. accounts for only slightly more than 20% of Chinese international trade. For the Renminbi to follow the US$ when the US$ rises with respect to other currencies implies that China will raise its price of exports to all its other customers that account for almost 80% of its exports, which makes very little sense. Similarly, when the US$ falls with respect to other currencies, if the Renminbi follows the US$, it will imply that China will lower the price of its exports to all its other customers, which also makes little sense.

Chart 5: The RMB Central Parity Exchange Rate and the CFETS Index, 29/12/2017 (=100) to the Present



Source: The State Administration of Foreign Exchange, The People's Bank of China.

Maintaining the relative stability of the Renminbi exchange rate with respect to the exchange rate of a Chinese trade-weighted basket of currencies, tracked by the CFETS (China Foreign Exchange Trade System) Index, implies that the Renminbi exchange rate vis-a-vis the currency of an average trading-partner country of China will be relatively stable and that the international purchasing power of the Renminbi will also be relatively stable. By following the CFETS Index rather than the US$, the Renminbi exchange rate will be less volatile than the US$ exchange rate when viewed from the perspective of a third country. The Renminbi exchange rate will move, in general, in the same direction as the US$ but by a smaller amount. This means that when the US$ appreciates with respect to other currencies, the Renminbi will devalue relative to the US$, and when the US$ devalues with respect to other currencies, the Renminbi will appreciate relative to the US$. It is in China's interests to maintain a relatively stable Renminbi exchange rate. It is the only way for the internationalisation of the Renminbi to become a reality eventually. China today has an approximate overall balance between total exports and imports of goods and services and it has ample official foreign exchange reserves and no major exchange rate adjustment is necessary.

6. The Real Impacts of the Mutual Tariffs on the Two Economies

Over the past ten years, Chinese dependence on exports has been declining. The share of exports of goods and services in Chinese GDP has fallen from a peak of 35.3% in 2006 to 19.5% in 2018. The share of exports of goods to the U.S. in Chinese GDP has also fallen by half, from a peak of 7.2% in 2006 to 3.6% in 2018. This sets a ceiling to the total amount of potential damages to the Chinese economy as a result of the U.S. tariffs (see Charts 6 and 7). The 3.6% in 2018 represented an increase from the 3.4% in 2017. However, the increase reflected the acceleration of exports of goods to the U.S. from China in anticipation of the imposition and increases of tariffs. The trend of Chinese exports of goods to the U.S. as a percent of Chinese GDP is downwards.

During this same period, the growth of Chinese exports to the world and to the U.S. has also slowed significantly. Chinese exports to the world grew at an average annual rate of 23.5% in the decade 1998-2007, but slowed to only 5.9% in the following decade, 2008-2018. Similarly, exports to the U.S. grew at 23.7% per annum in the decade 1998-2008, but slowed to less than 6.6% per annum in the most recent decade. Exports is no longer the engine of Chinese economic growth.

Chart 6: Chinese Exports of Goods and Services and Goods Only as a Percent of Chinese GDP

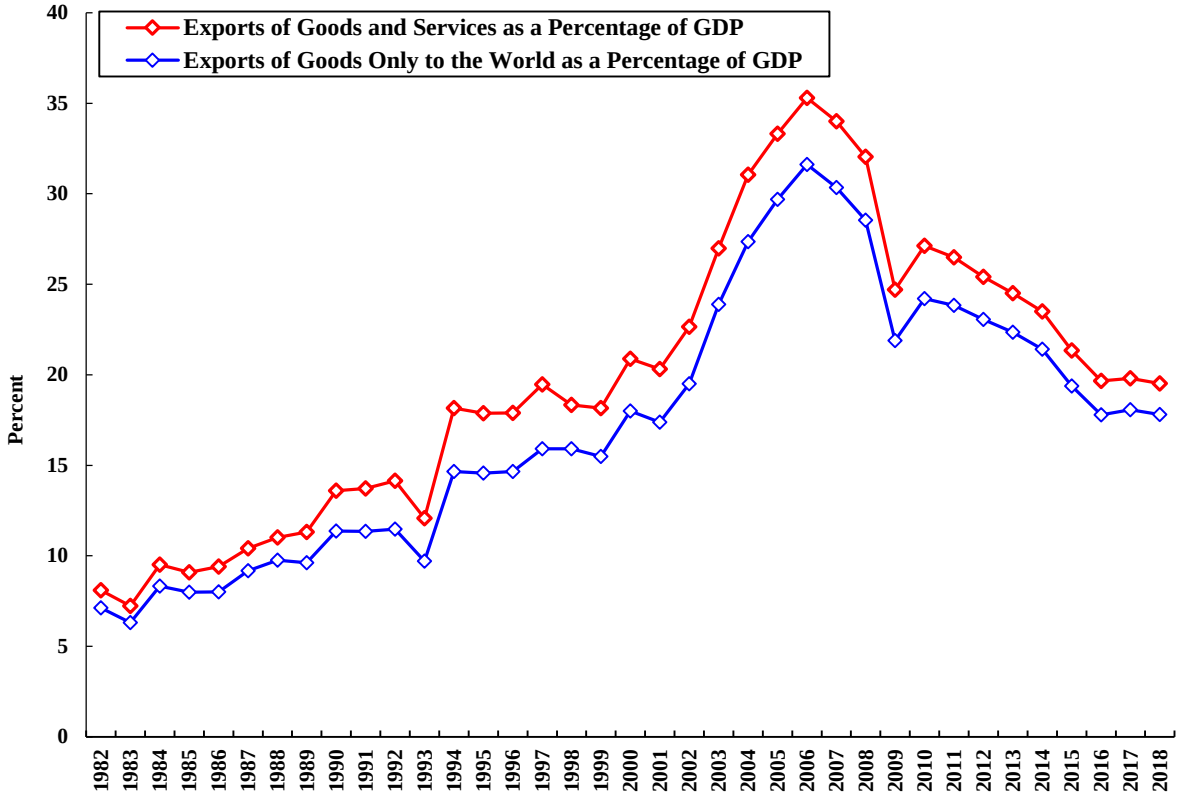
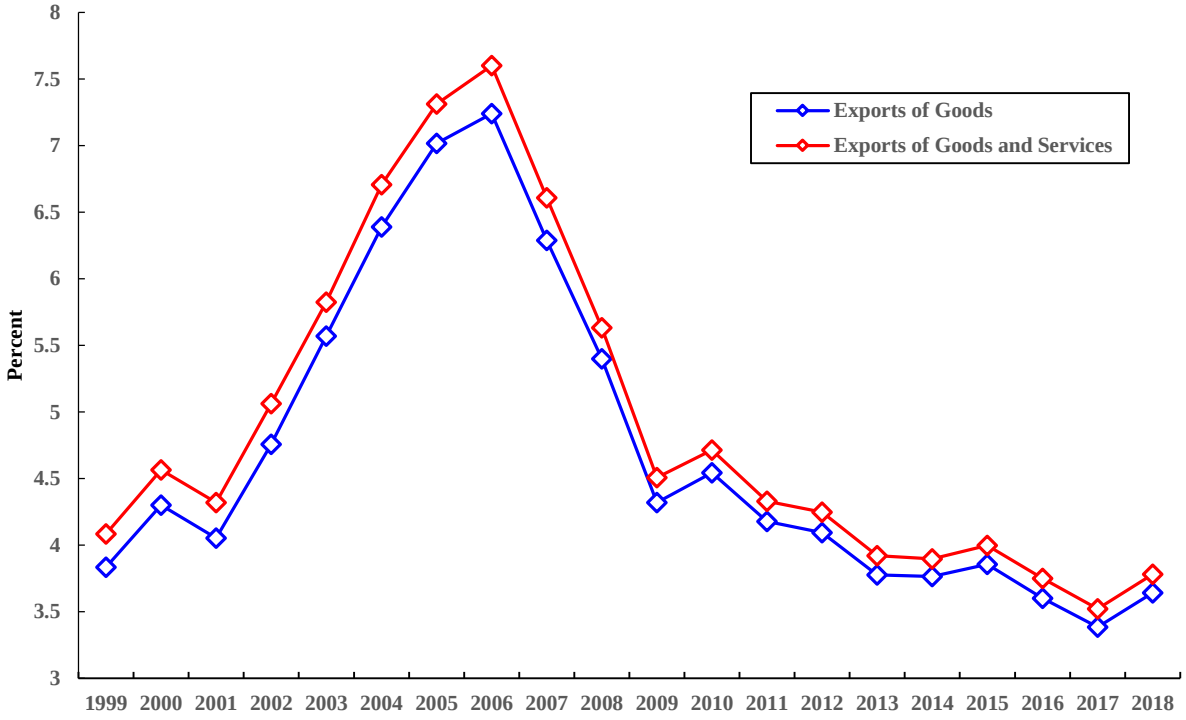


Chart 7: Chinese Exports of Goods and Services and Goods to the U.S. as Percent of Chinese GDP



Since mid-2018, U.S. tariffs ranging between 10% and 25 % have been imposed on US$250 billion of U.S. imports of goods from China (arrival value, approximately equal to US$227 (250 x 10/11) billion of Chinese exports of goods to the U.S., f.o.b. or departure value). This is slightly less than half of Chinese exports of goods to the U.S. in 2018. (Chinese exports of goods to the U.S. in 2018 amounted to US$540 billion according to U.S. data based on arrival value, which is approximately equivalent to US$500 billion at f.o.b. or departure value.) Thus, Chinese exports of goods amounting to slightly less than 1.8% (3.6%/2) of Chinese GDP were affected in the first instance.

The U.S. tariff rate on this first batch of Chinese exports of goods to the U.S. has recently been raised to 25% (and will be raised further to 30% on 15 October). Even at 25%, it is prohibitive for most of the Chinese exports of goods to the U.S., as neither the Chinese exporters nor the U.S. importers have the kind of profit margins that can absorb these tariffs. There is no evidence that the Chinese producers or exporters will pay for the U.S. tariffs. The cost of the tariffs will be mostly borne by U.S. consumers and users of Chinese imports. Moreover, U.S. tariffs ranging between 10% and 25% have also been imposed on the remaining approximately US$300 billion of Chinese exports of goods to the U.S., to begin on 1 September 2019. However, approximately US$160 billion worth of Chinese exports have been exempted until 15 December so as not to disrupt the Christmas shopping season in the U.S. These tariff rates were subsequently increased by 5 percentage points, originally to take effect on 1 October. The increases have since been postponed to 15 October.

The direct domestic value-added content of Chinese exports to the U.S. is 24.8%. Thus, the maximum loss in Chinese GDP, assuming that half of the exports to the U.S. is completely halted, in the first instance, may be estimated at 0.45% (3.6%/2 x 0.248), a manageable level. However, the reduction of exports leads to a reduction in the demands for domestic inputs used in their production and the demands for consumption goods by the workers in the exporting industry, which in turn lead to a second-round reduction in the demands for domestic inputs used in the production of the domestic inputs and demands for domestic final consumption. With the indirect, that is, second-, third-, fourth- and higher-round effects of the reduction of Chinese exports kicking in, the total domestic value-added affected will eventually increase to 66 percent cumulatively. This implies ultimately a maximum total loss in Chinese GDP of 1.2% (3.6%/2 x 0.66), assuming half of Chinese exports of goods to the U.S. are halted. In absolute terms, this amounts to US$156 billion in 2018 prices, a manageable level, especially

for an economy growing at an average annual real rate of 6.6 percent and with a per capita GDP of US$9,415 in 2018. If all of Chinese exports of goods to the U.S. are halted because of the prohibitive tariffs, the maximum total loss in Chinese GDP would be doubled, to 2.4% (3.6% x 0.66) of GDP, which is significant but not intolerable.

These losses are all estimated assuming that nothing is done in response to the imposition and increases of U.S. tariffs. It is instructive to recall what transpired during the Global Financial Crisis of 2008-2009, which was triggered by the collapse of Lehman Brothers in the U.S. in September 2008. Chinese exports of goods to the world and to the U.S. declined by 16.0% and 12.5% respectively in 2009, with a total decrease of Chinese exports of US$230 billion (in 2009 prices), approximately the same magnitude as half of Chinese exports of goods to the U.S. in 2019. Yet the Chinese real GDP still managed to grow 9.7% and 9.4% in 2008 and 2009 respectively. What this shows is that a decline in Chinese exports of goods of this magnitude is still quite manageable for the Chinese economy.

The direct non-agricultural employment generated from Chinese exports of goods to the U.S. is 0.0133 person per US$1,000. Thus, the reduction in direct non-agricultural employment, assuming that half of the exports to the U.S. is completely halted, in the first instance, may be estimated at 3.325 million (0.0133 x 250,000,000), a manageable level, especially for an economy creating new employment of more than 10 million a year.[17] However, the reduction of exports leads to a reduction in the demands for domestic inputs used in their production, which in turn lead to a second-round reduction in the employment. With the indirect, that is, second-, third-, fourth- and higher-round effects of the reduction of Chinese exports kicking in, the total employment affected will eventually increase cumulatively to 0.0304 person per US$1,000. This implies ultimately a reduction in Chinese employment of 7.6 million (0.0304 x 250,000,000). This is significant, but constitutes only 1.75% of the total non-agricultural employment of 434.19 million in 2018, which can be absorbed in a couple of years.

Bear in mind, however, that our calculation of the loss in real GDP and other similar calculations do not take into account the effects of any possible economic stimulus measures

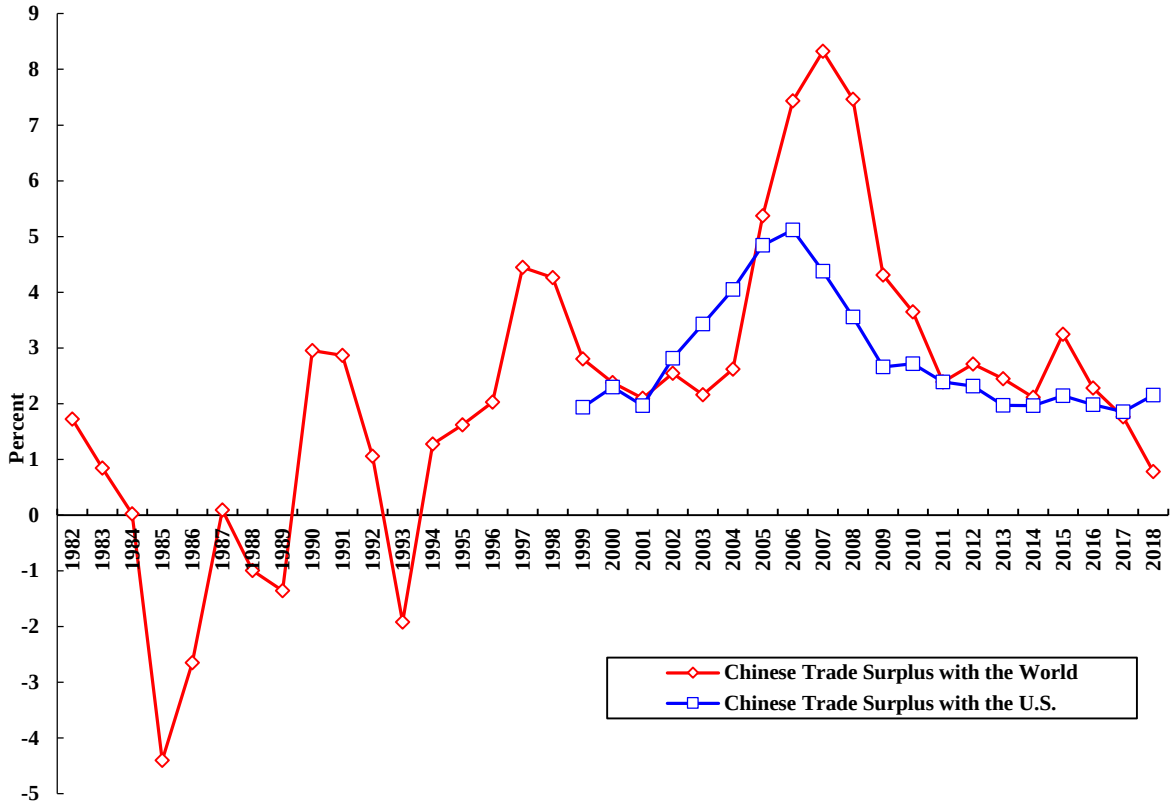
[17] Actually, 13.61 million of new employment opportunities were created in 2018 (http://www.stats.gov.cn/tjsj/zxfb/201902/t20190228_1651265.html).

that may be undertaken by the Chinese government. They also do not take into account the possibility of substitution of Chinese exports of goods from factories located elsewhere. For example, instead of shipping from a factory in China, the factory owner can ship goods to the U.S. from another factory it owns in Vietnam and instead ship goods to Japan from its factory in China. This would result in no decrease in its total Chinese export of goods despite the U.S. tariffs. More generally, exports of goods originally destined for the U.S. can be sold elsewhere in the world. And global supply chains can be reconstituted with the final finishing stage located outside of China. (This must satisfy the "rules of origin" regulations.) The same can apply to Chinese imports of goods. For example, instead of importing soybeans from the U.S., the Chinese importers can import from Brazil, and the U.S. exporters can sell to the original customers for the Brazilian soybeans.

What is the impact of the trade war on the Chinese trade balance in goods and services with the world? With a possible reduction of half of the total Chinese exports of goods to the U.S., amounting to 1.8% of Chinese GDP, as a result of the trade war, a corresponding reduction in Chinese imports of goods from the U.S. is to be expected. Chinese imports of goods from the U.S. amounted to US$156 billion, or 1.2% of Chinese GDP in 2018. Assuming that half of such imports are halted because of the prohibitive Chinese tariff (for example on liquefied natural gas and soybeans) and the U.S. restrictions on Chinese high-technology enterprises such as Huawei, Dajiang Industries and HikVision, it would be 0.6% (=1.2%/2) of Chinese GDP. The net effect on the Chinese trade balance with the world would be a negative 1.2% (1.8%-0.6%) of GDP.

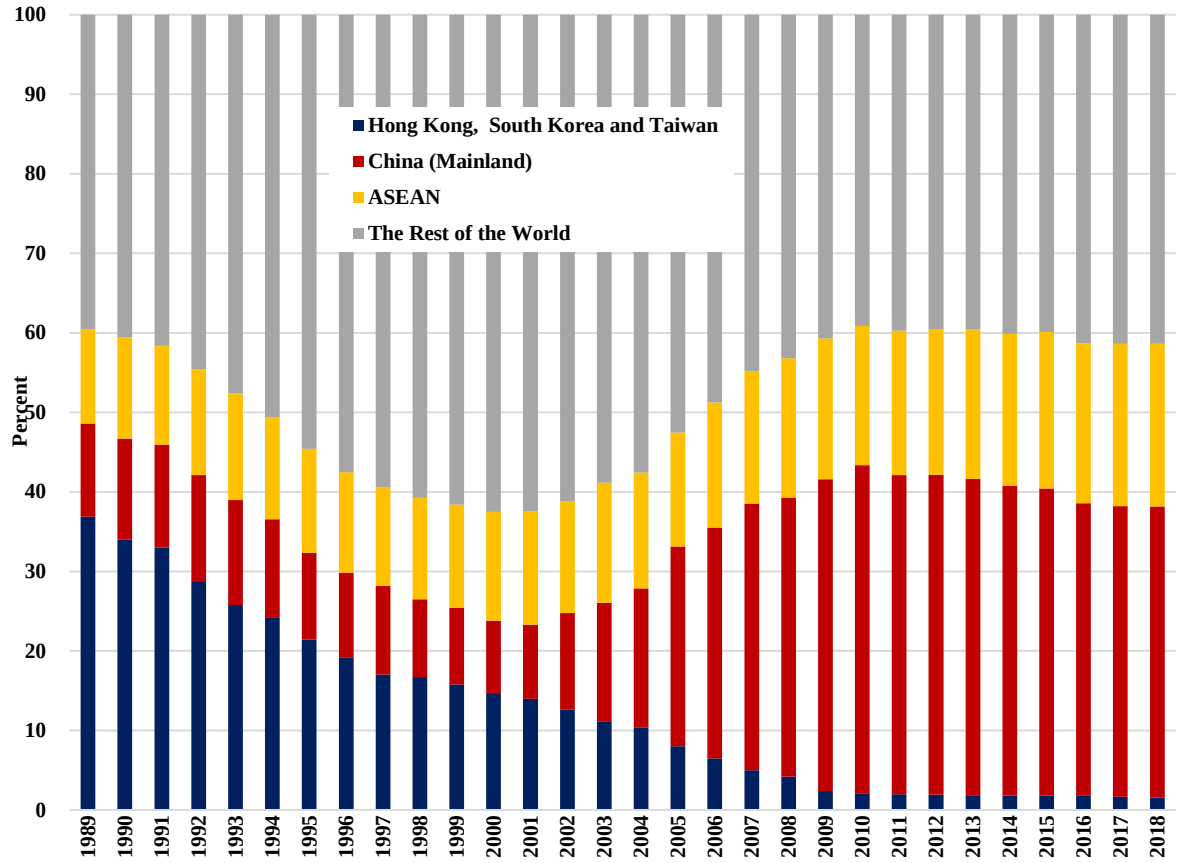
This analysis does not take into account the possible diversion of Chinese exports of goods to other countries or the substitution of U.S. exports of goods to China by third country exports. It also does not take into account the possible reduction of the U.S. net trade surplus with China in services. The Chinese trade in goods and services with the world had a surplus of 0.8% of GDP in 2018 (see Chart 8). It is likely to have a net deficit equal to 0.4% (0.8%-1.2%) of its GDP, or approximately US$54 billion, in 2019. This is a relatively small amount that can be easily absorbed by the Chinese official foreign exchange reserves of US$3 trillion. Thus, there should be little pressure for the Renminbi to devalue.

Chart 8: Chinese Trade Surplus in Goods and Services with the World and the U.S. as Percent of GDP



In the longer run, if tariffs continue on both sides, the U.S. importers will begin to replace Chinese imports by imports from other Asian countries such as Vietnam, Cambodia and Bangladesh, and eventually perhaps even North Korea if an agreement can be struck between it and the U.S. But the shift in the sourcing of imports away from China has already been occurring since 2010, because of the rise in labour costs in China and the appreciation of the Renminbi. This is similar to the earlier shift of the sources of U.S. imports of apparel from Hong Kong, South Korea and Taiwan to Mainland China (see Chart 9). In 1989, the Chinese share of U.S. imports of apparel was 11.7 %, compared with a share of 35.9% from Hong Kong, South Korea and Taiwan combined, with the ASEAN accounting for 11.9%. In 2018, the Chinese share has declined from its peak of 41.2% in 2010 to 36.6% and the Hong Kong, South Korea and Taiwan share has declined to 1.6%, whereas the ASEAN share has risen to 20.5%. The new U.S. tariffs will accelerate this process. The ASEAN and South Asian countries may benefit, but it is really hard to predict by how much because the supply chains today are so internationalised. However, it is unlikely, in most cases, that the tariffs will stimulate new domestic production in the U.S.

Chart 9: The Distribution of U.S. Apparel Imports by Countries and Regions of Origin



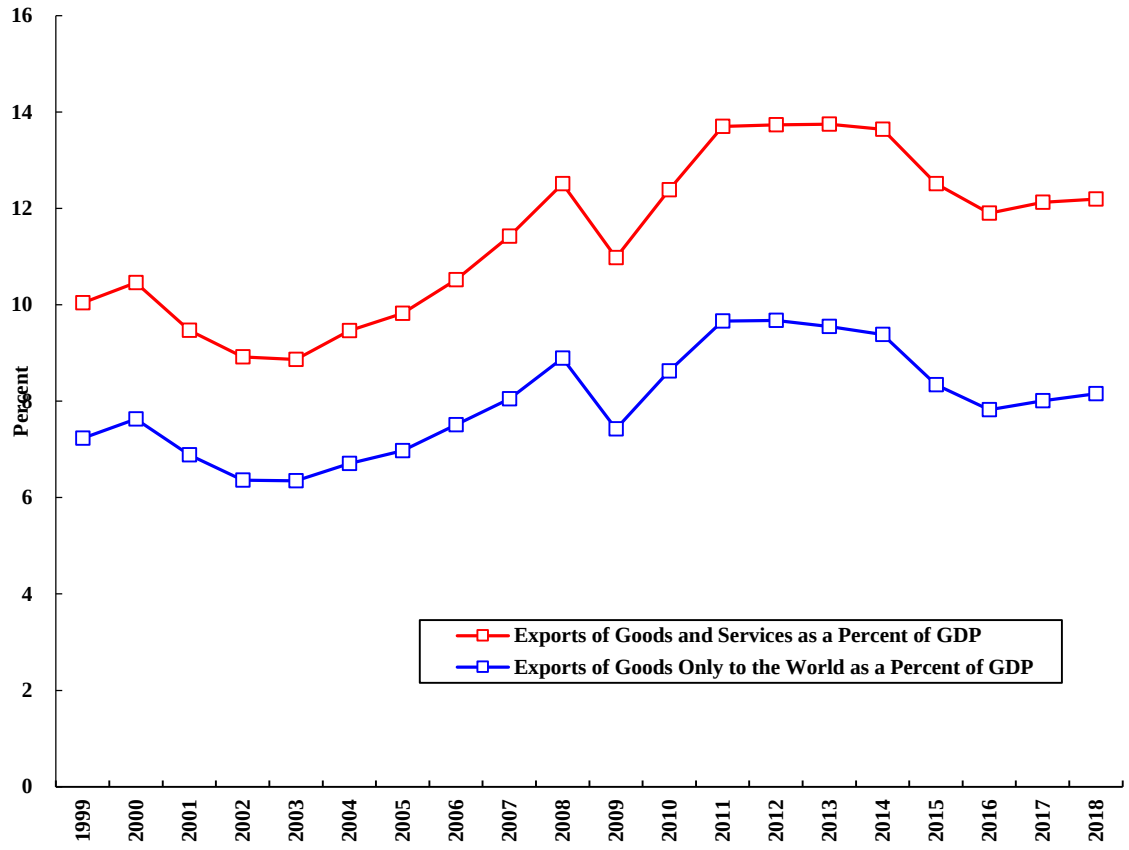
While the impacts on the Chinese economy of the U.S. tariffs have certainly been significant and negative, they are still relatively small in real terms and quite manageable for China. There is no need to panic. The sky is not falling! However, the uncertainty created by the trade war has affected both fixed investment and consumption negatively, with major decisions being put on hold, especially in the Chinese economy.

The Real Impacts on the U. S. Economy

The degree of dependence of the U.S., a large continental economy, on exports is even lower than that of China's. U.S. exports of goods and services combined as a share of GDP was 12.2% in 2018 (see Chart 10). The exports of goods alone as a share of GDP was only 8.2%. In 2018, the shares of U.S. exports of goods and services and goods alone to China in U.S. GDP declined from 0.97% to 0.88% and 0.67% to 0.58% respectively, reflecting the effects of the trade war (all of which were borne by the exports of goods). In absolute value, the exports were respectively US$180 billion and US$121 billion in 2018, much lower than those of Chinese exports to the U.S. However, the shares of U.S. exports of both goods and

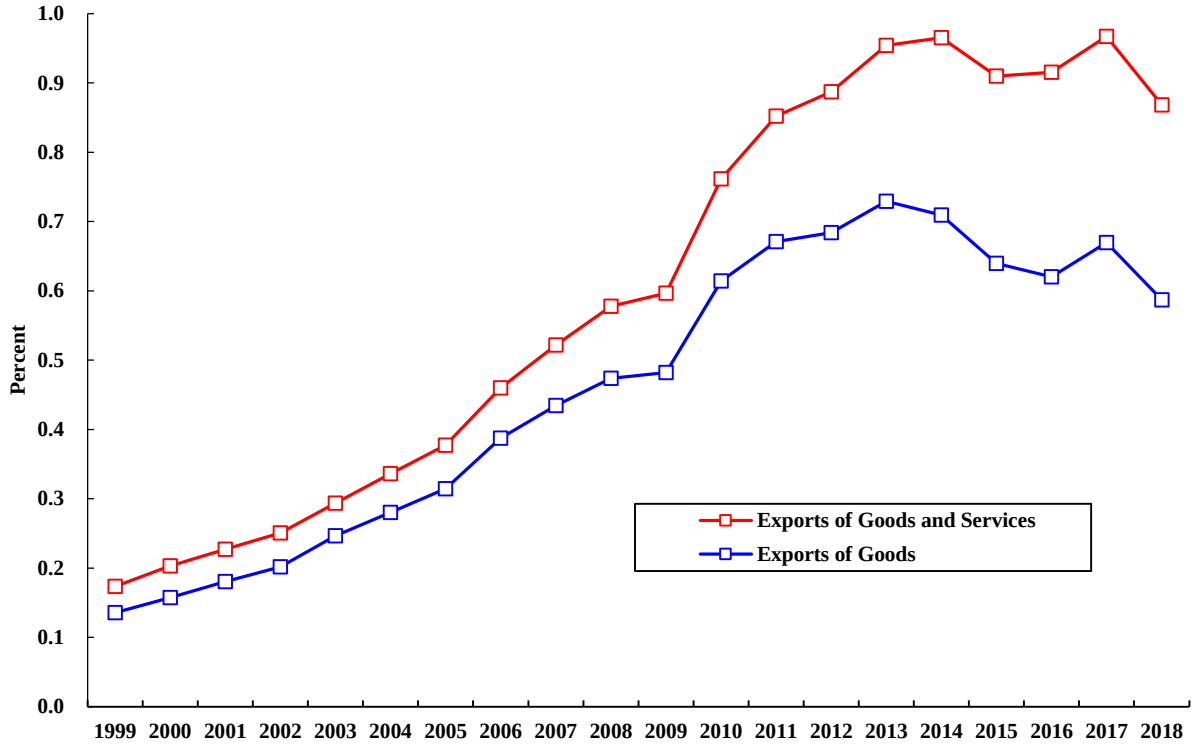
services and goods only to China have been rising over time until more recently. At the present time, Chinese tariffs have been imposed on US$110 billion of U.S. exports of goods, with rates up to 25%. The tariff rates have recently been adjusted upwards on approximately US$75 billion worth of U.S. exports to China.

Chart 10: U.S. Exports of Goods and Services and Goods Only as Percent of U.S. GDP



Source: Bureau of Economic Analysis, U.S. Department of Commerce.

Chart 11: U.S. Exports of Goods and Services and Goods Only to China as Percent of U.S. GDP



Source: Bureau of Economic Analysis, U.S. Department of Commerce.

The direct domestic value-added content of U.S. exports of goods to China may be estimated to be 50.8%. Thus, the maximum loss in the U.S., assuming that all of its exports to China is completely halted by the tariffs, may be estimated in the first instance at 0.29% (0.58% x 0.508), less than the initial impact on Chinese GDP of 0.45%, based on the assumption that half of Chinese exports of goods to the U.S. will be halted. the maximum negative impact to the U.S. economy, assuming that half of U.S. exports to China are halted, would be 0.145% of GDP in the first instance, and eventually cumulatively 0.26% of U.S. GDP if all the indirect effects are included. If all of U.S. exports of goods to China are halted, the eventual total damage would be 0.51% of U.S. GDP.

However, these estimates do not include U.S. losses of royalties and license fees through the restrictions on Chinese high-technology enterprises from such as Huawei from using U.S. products such as the Android operating system of Google. Moreover, it is unlikely that all of the U.S. exports of goods will be halted; for example, computer chips will continue to be imported by China in large quantities in the medium term. (The price elasticity is low.) Suppose only half of U.S. exports of goods to China is halted, it would amount to a loss of U.S. GDP of 0.145% (0.29%/2). This is not significant for the U.S. economy, which grew 2.9% in

2018 and is expected to grow at 2.6% in 2019. U.S. GDP per capita is approximately US$62,609. The U.S. economy can easily weather a reduction of 0.145% in its rate of growth.

With the indirect, that is, second-, third-, fourth- and higher-round effects of the reduction of U.S. exports of goods kicking in, the total domestic value-added affected increases to 88.7% cumulatively. This implies ultimately a total loss in U.S. GDP of 0.51% (0.58% x 0.887), assuming that all of U.S. exports to China will be halted. In absolute terms, this amounts to US$104.6 billion (0.51 x 20.5 trillion) in 2018 prices, much less than the estimated potential Chinese loss in terms of GDP of US$312 billion assuming all Chinese exports are halted. Thus, in both absolute and relative terms, the Chinese losses in real GDP will be much higher than those of the U.S. However, the U.S. has a significant trade surplus in services with China, estimated to be US$38.8 billion in 2018 by the U.S. and US$54 billion by China for 2017. This surplus may be in jeopardy if China-U.S. relations deteriorate further.

7. Economic and Technological Competition

Even though the proximate cause of the current trade war between China and the United States is the large trade imbalance in China's favour, but it is actually a manifestation of the potential competition between China and the U.S. for economic and technological dominance in the world. This competition, whether explicit or implicit, and whether intentional or not, will not go away soon. It did not begin with President Trump. Both the "pivot to Asia" and the "Trans-Pacific Partnership" were initiated by U.S. President Barack Obama as strategies aimed in part at containing China. It will not go away even after President Trump leaves office.

However, competition can potentially lead to constructive and positive as well as destructive and negative outcomes. For example, the competition on creating the fastest super-computer has already resulted in both countries producing better and faster super-computers. The champion in 2018 is the IBM Summit, a U.S. super-computer, which beat the Sunway TaihuLight, the champion in 2016 and 2017, a Chinese super-computer that was built entirely with indigenously designed chips. In terms of the number of nuclear-armed warheads, according to the New York Times, the U.S. is estimated to have more than 6,000 such warheads, compared to less than 300 for China. The difference is even more striking in per capita terms. This is not a competition that China should wish to join. However, a race to find

an effective cure for cancer or Alzheimer's disease would be worthwhile for both countries and in fact for the entire mankind.

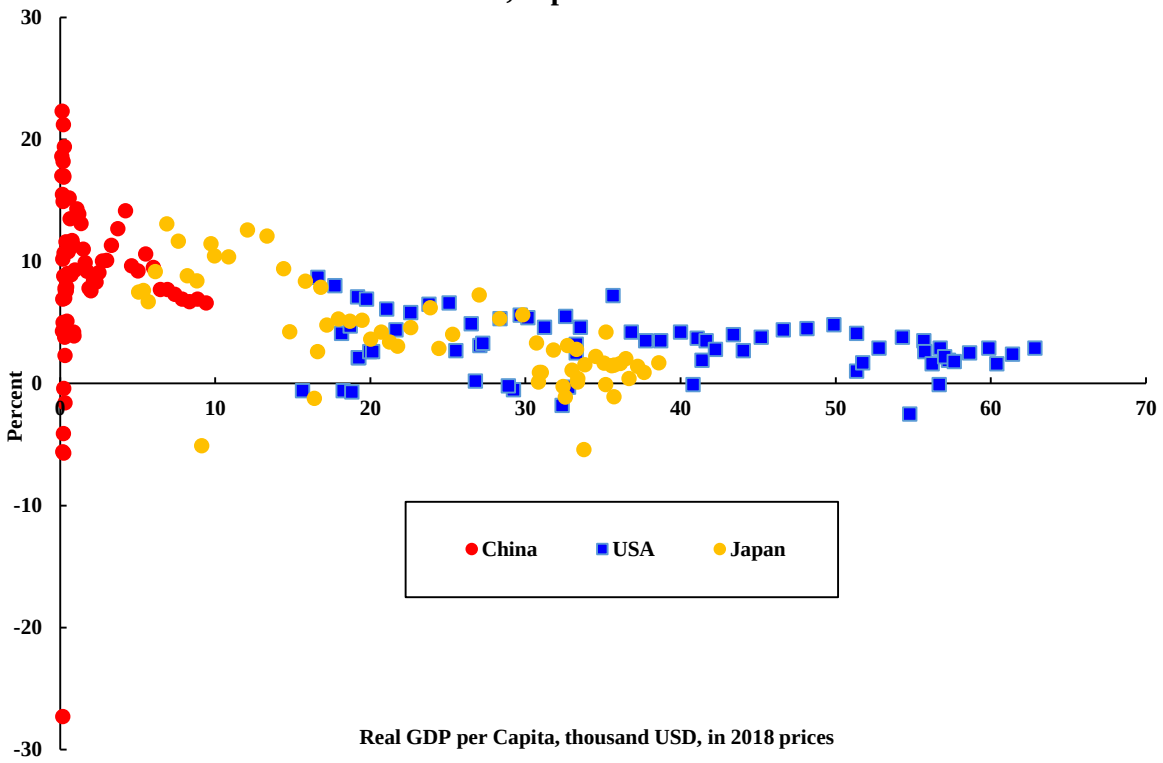
It is only a matter of time that the Chinese GDP will catch up with the U.S. GDP, probably in the early 2030s. However, in terms of GDP per capita, China is still way behind, with US$9,415 (less than S$10,000, thus technically still a developing economy), compared to US$62,609 for the U.S. in 2018. My own projections suggest that it will probably take until the end of the 21st Century before Chinese GDP per capita can approach the U.S. level, if ever. (Because of the difference in natural endowments between China and the U.S., China may not be able to catch up with the U.S. in terms of GDP per capita.)

Long-Term Forecasts of the Chinese and the U.S. Economies

In 2018, the Chinese economy grew 6.6%. In 2019H1, Chinese real GDP grew at an annualised rate of 6.3%. The target range of the Chinese rate of growth for 2019 is between 6% and 6.5%. The Chinese economy is on course. In 2018, the U.S. economy grew 2.9%, close to its long-run average of 3%. The rates of growth of 2019Q1 and 2019Q2 were respectively 3.1% and 2.1%. Both the U.S. Federal Reserve Board and the U.S. Congressional Budget Office expect 2.3% growth for 2019. It is assumed that the Chinese economy will continue to grow around 6% per annum for a few more years, declining gradually to between 5% and 6%, and that the U.S. economy will grow at an average rate of 3% per annum between now and 2050.

It may be thought that the Chinese economy will be unable to sustain an average annual rate of growth of between 5% and 6% for such a long time. Past experience shows that the rate of growth of an economy declines as its real GDP per capita rises. But given the still relatively low level of real GDP per capita in China, below US$10,000) and the low level of its capital per unit labour, such a rate of growth should still be possible for at least several decades (see the following charts in which the experiences of China, Japan and the U.S. are compared.)

Chart 12: Growth Rate (Percent) vs. Level of Real GDP per Capita (2018 thousand US$): China, Japan and the U.S.



The Chinese national savings rate is very high, exceeding 45 percent in recent years, which enables a very high investment rate (see Chart 13). The capital-labour ratio of the Chinese economy is still very low compared to the U.S. and Japan (see Chart 14). There is a great deal of room to grow. In addition, there is still significant surplus labour in the Chinese economy compared to the experiences of the other East Asia economies—Japan, South Korea and Taiwan. The share of employment in the primary sector is around 30% whereas the share of GDP originating from the primary sector is below 10% (see Chart 15). The manpower problem can also be partially solved by increasing the mandatory retirement ages from their current 55 for women and 60 for men by five to ten years (Chinese life expectancy at birth was 75 for men and 78 for women in 2017). China has significantly increased its investment in human capital and research and development (R&D). It already has the largest number of internet users in the world. Moreover, the application of the internet still has significant room to grow.

Chart 13: Comparison of National Savings Rates: China, Japan and the U.S.

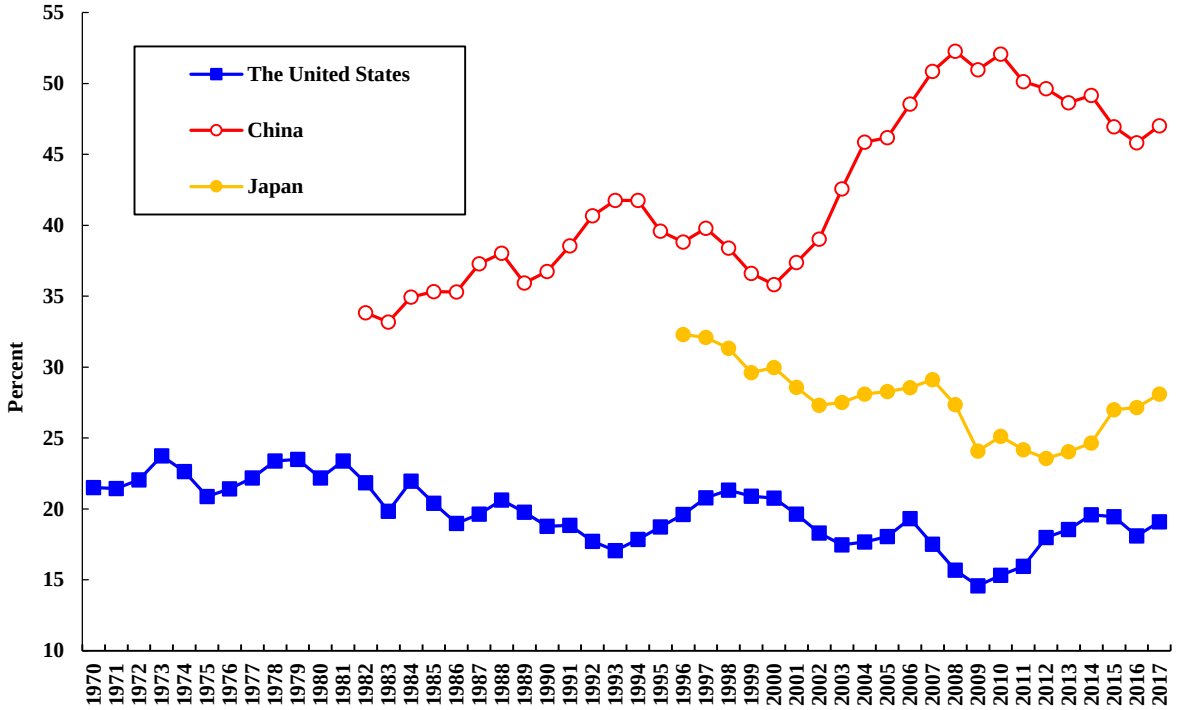


Chart 14: Comparison of Capital-Labour Ratios: China, Japan and the U.S.

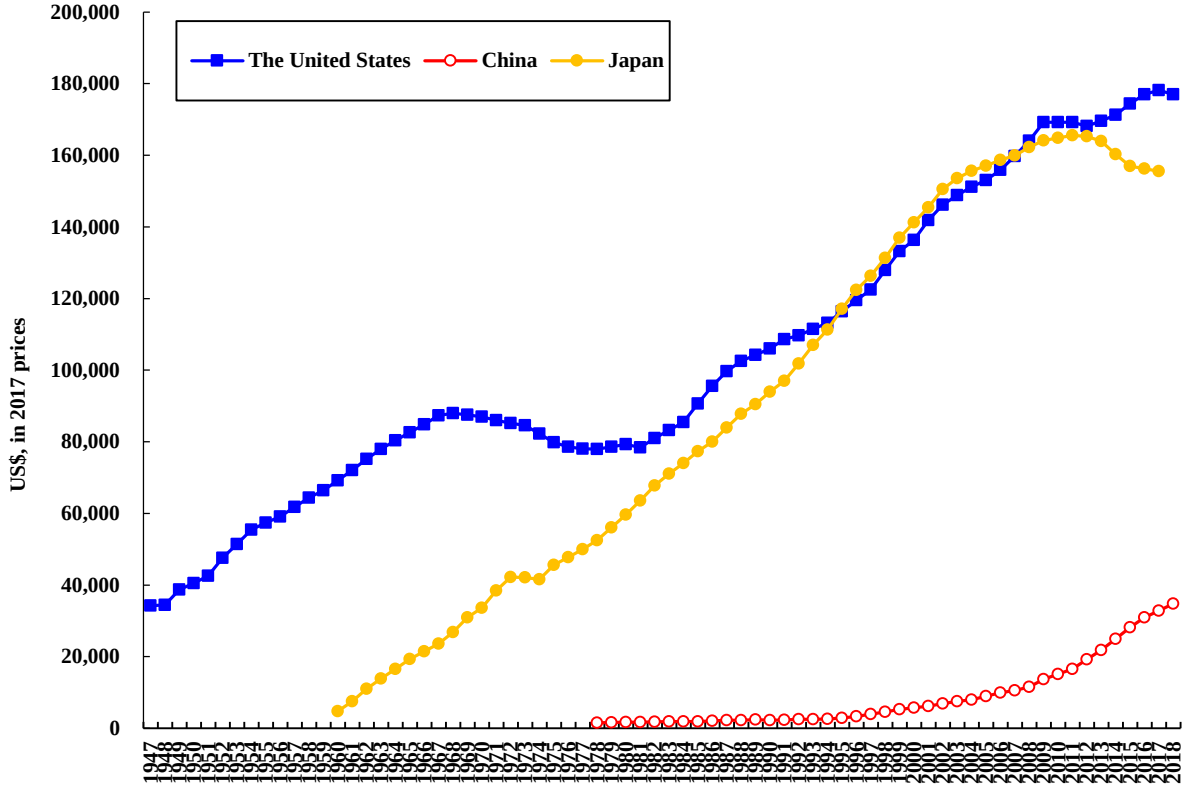
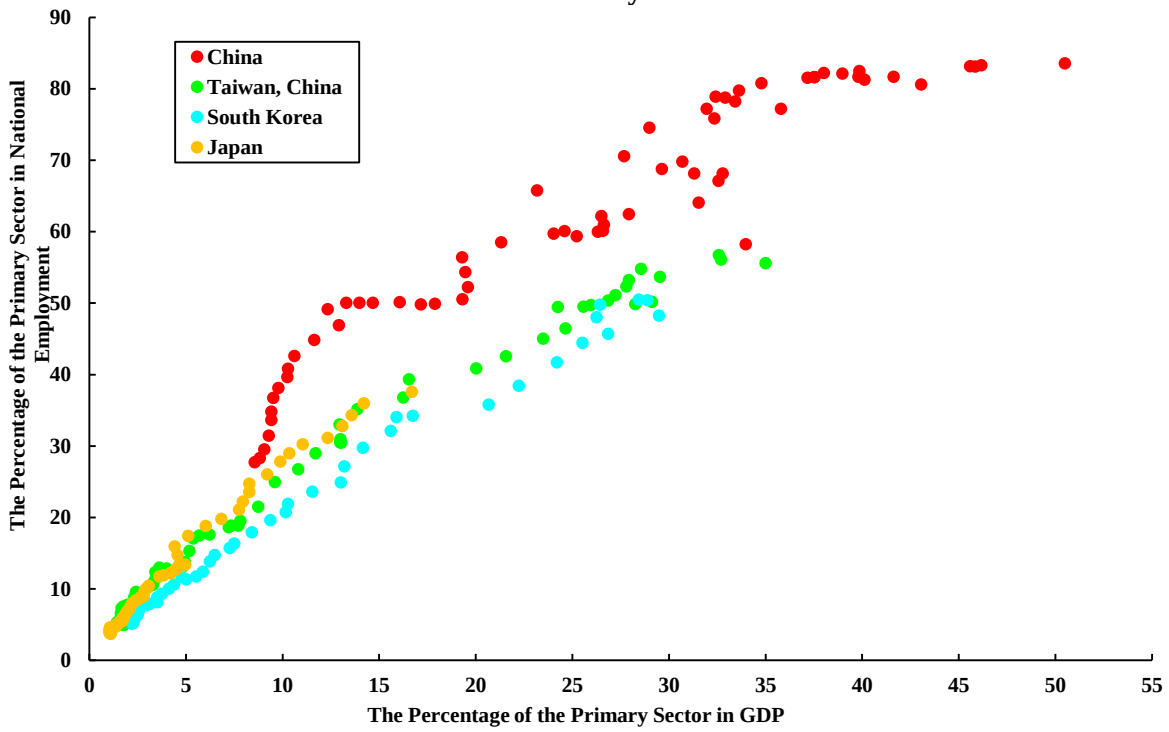


Chart 15: Scatter Diagram between the Shares of Employment and GDP of the Primary Sector



In addition, regardless of the outcome of the China-U.S. trade war, China will continue its reform and opening to the world. There is a risk that China may be isolated from the world. China must do its best to avoid it from happening. While the Chinese state-owned enterprises are here to stay, the market will be allowed to play a determining role in the Chinese economy.

Projections of the Chinese and the U.S. Economies

The projections of Chinses and U.S. real GDP and real GDP per capita between now and 2050 are presented in the following charts. In his work report to the Nineteenth National Congress of the Communist Party of China, General Secretary and Chinese President XI Jinping identified several milestones in his speech at the Nineteenth Party Congress at 2020, 2035 and 2050. The first milestone is to become a moderately well-off society by 2020. Our projections show that by 2020, Chinese real GDP per capita (in 2018 prices) will reach US$10,582 (compared to US$65,541 for the U.S.).

Our projections also show that by 2033 (plus or minus a couple of years), Chinese real GDP will surpass U.S. real GDP (US$32.7 trillion versus US$31.9 trillion), making China the largest economy in the world. However, in terms of real GDP per capita, China will still lag

behind significantly, with US$22,088 compared to US$89,363 for the U.S. By 2050, Chinese real GDP will reach US$83 trillion compared to US$53 trillion for the U.S. In terms of real GDP per capita, China will reach US$53,408, still below the current (2018) level of U.S real GDP per capita of US$62,609, compared to US$138,693 for the U.S. It will not be until towards the end of the 21st Century for the Chinese real GDP per capita to catch up with the U.S. real GDP per capita, if it is ever able to do so.

Chart 16: Actual and Projected Levels and Growth Rates of Chinese and U.S. Real GDP (trillion 2018 US$ and Percent)

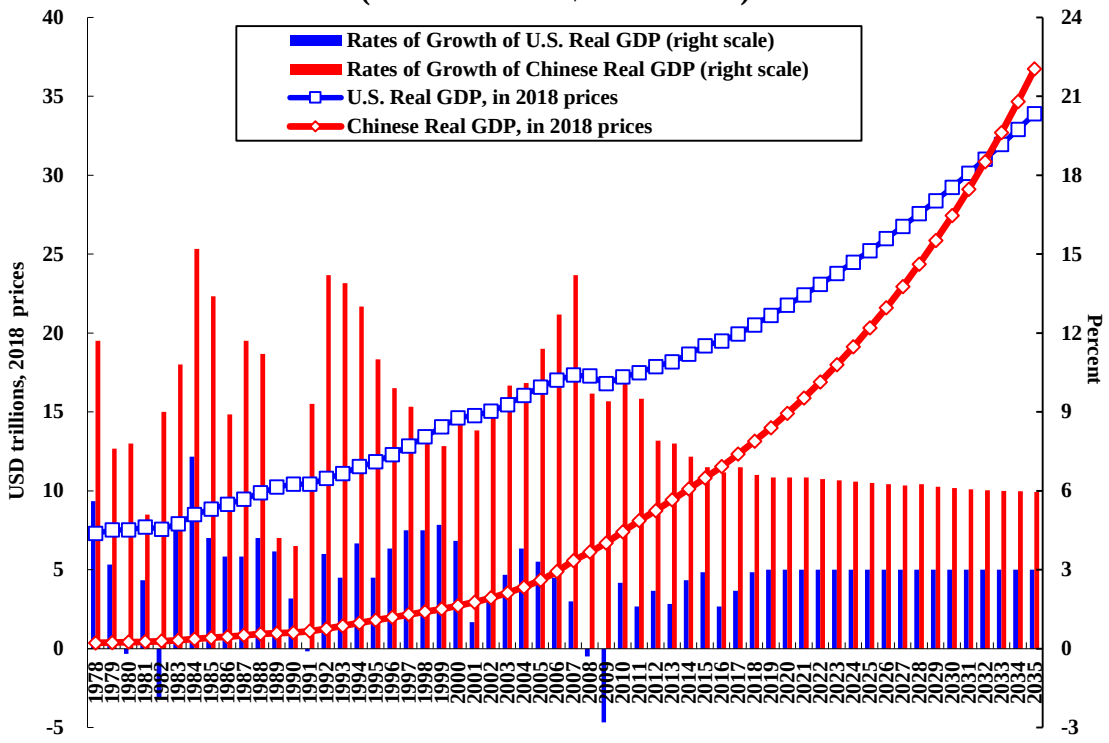


Chart 17: Actual and Projected Chinese and U.S. Real GDP per Capita and Their Annual Rates of Growth (1,000 2018 US$ and Percent)

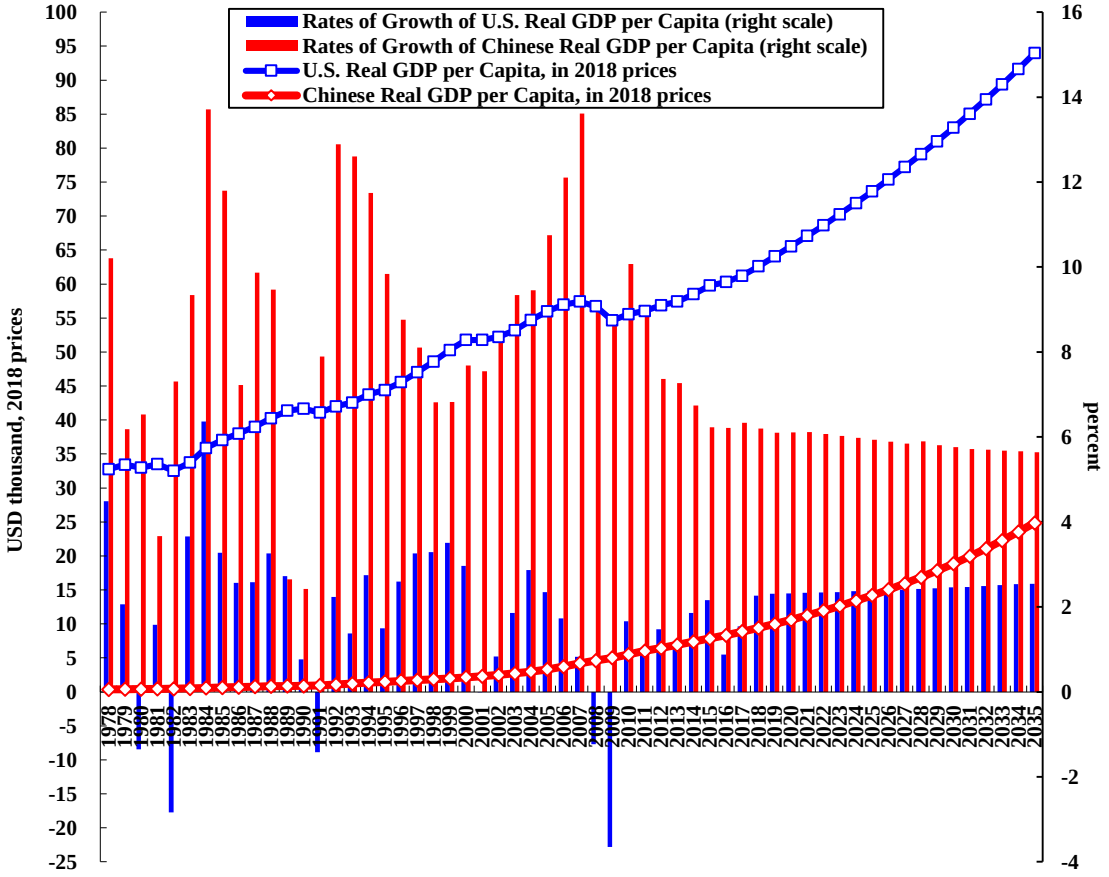


Chart 18: Actual and Projected Levels and Growth Rates of Chinese and U.S. Real GDP (trillion 2018 US$ and Percent)

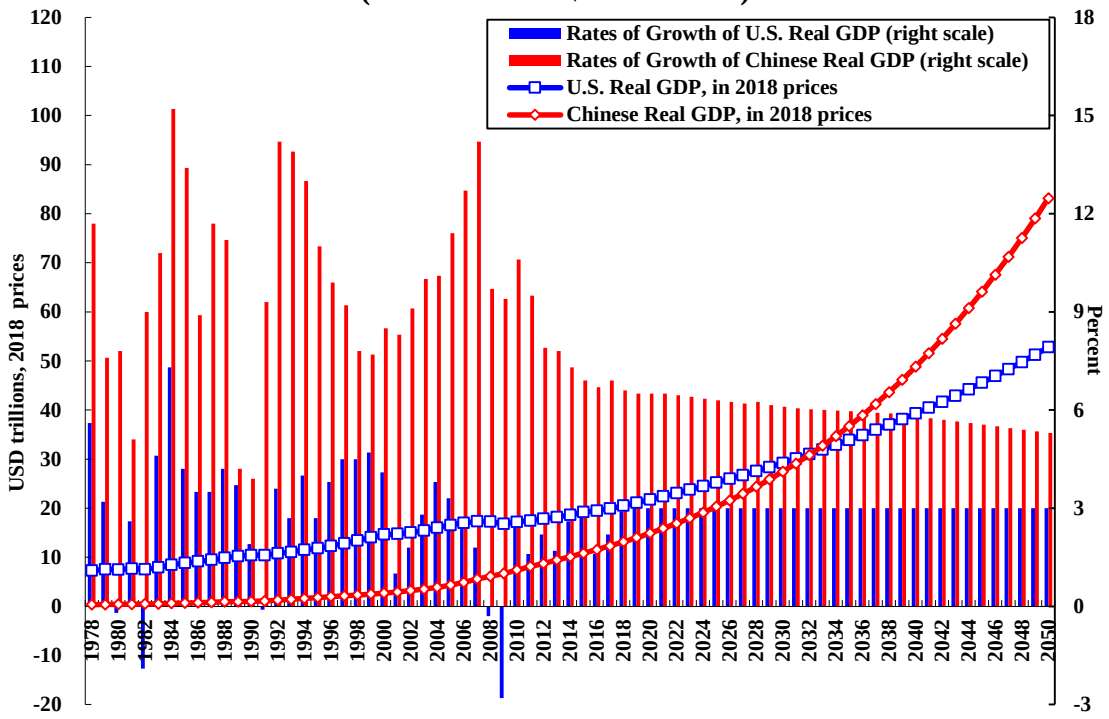
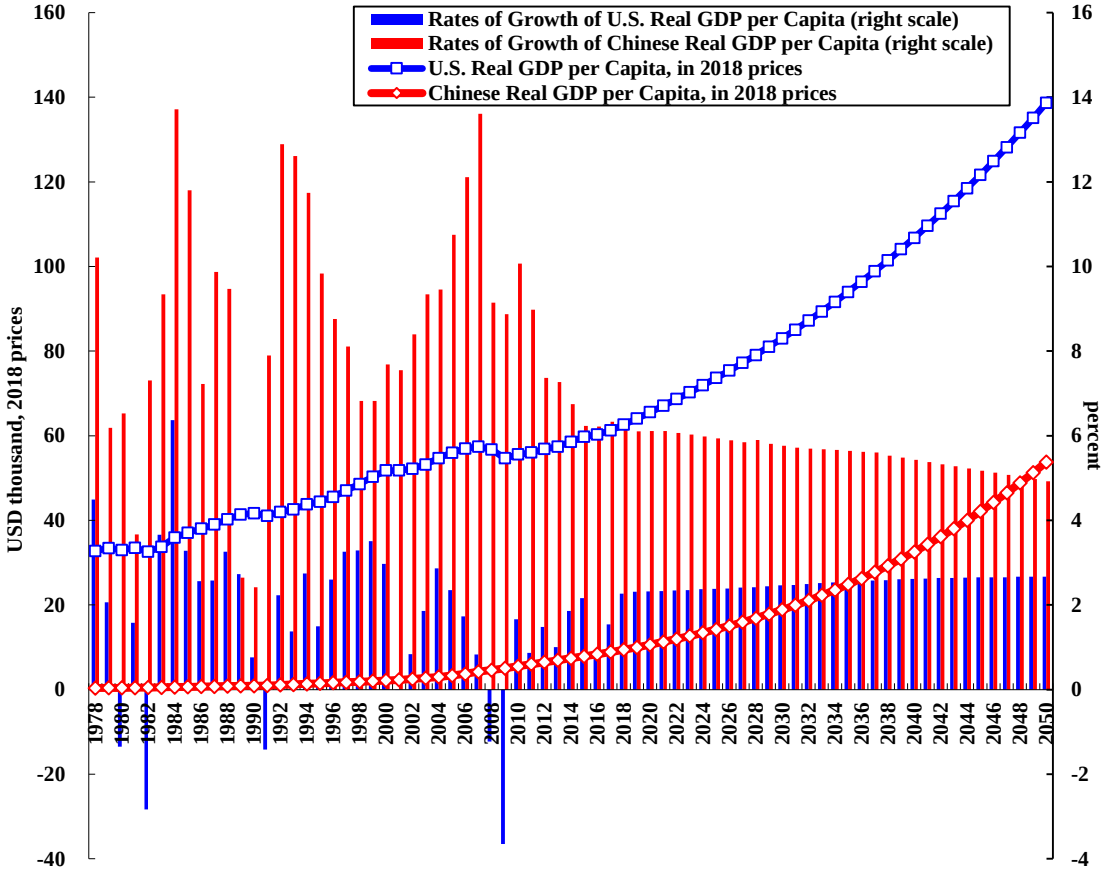


Chart 19: Actual and Projected Chinese and U.S. Real GDP per Capita and Their Rates of Growth (1,000 2018 US$ and Percent)



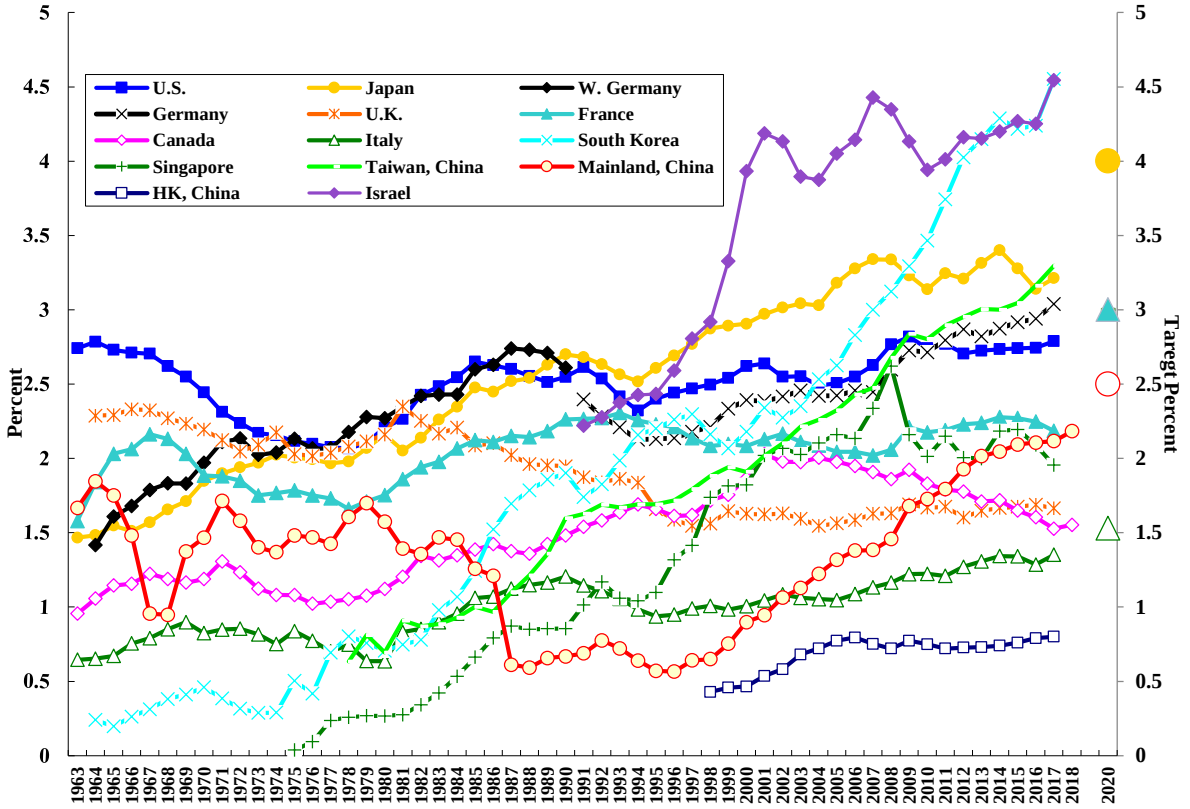
Technological Competition

Technological competition is motivated by national security considerations as well as commercial considerations. No individual or firm will want to give away or sell its core competence. In old China, masters typically do not teach their apprentices everything, unless they are male lineal descendants. It should therefore not be surprising that nations will protect their core competences. In the case of the atomic bomb—the former Soviet Union developed it independently; China developed it independently, without any foreign assistance; the U.K., France, India, Pakistan and even North Korea developed their nuclear bombs independently. China will have to continue to develop its own advanced semiconductor, artificial intelligence, and aircraft industries as it may not be able to import the best available from other countries.

Investment in Intangible Capital (R&D Capital)

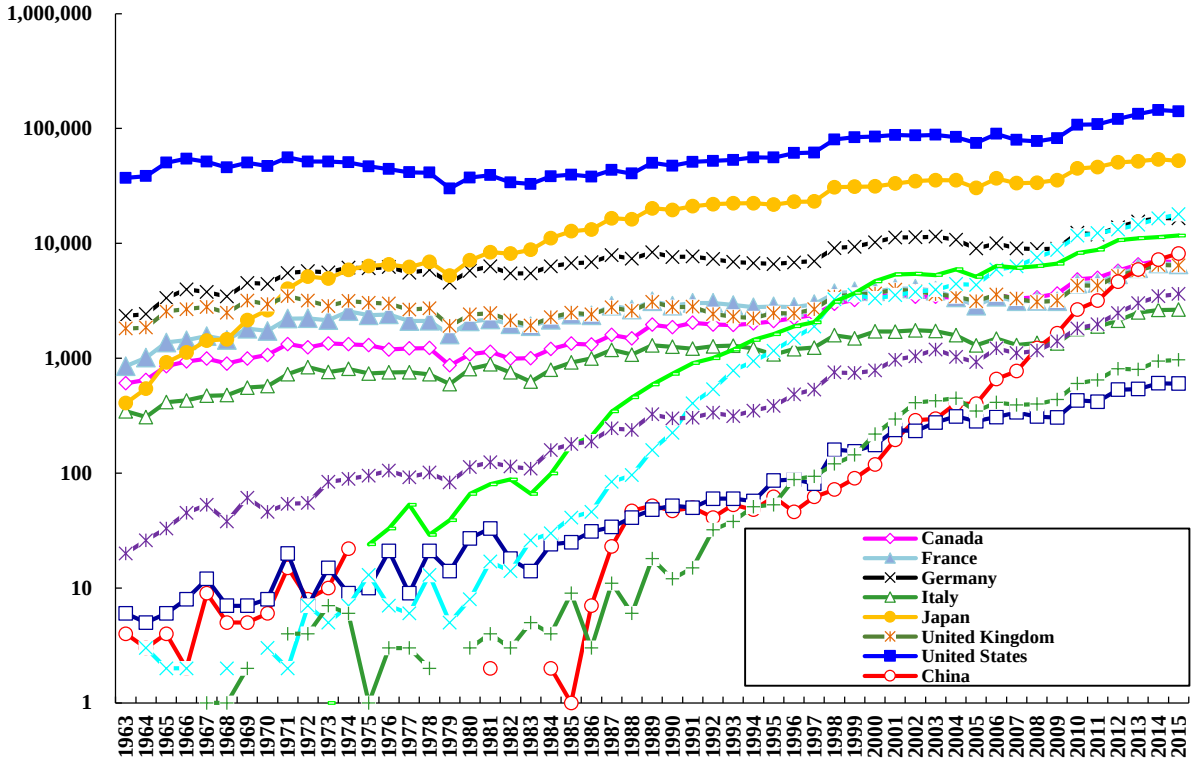
Investment in intangible capital (human capital and Research and Development (R&D) capital) is indispensable for innovation. The annual expenditure on R&D as percentages of GDP are presented for selected economies in Chart 20. Chart 20 shows that the U.S. has consistently invested a relatively high percentage of its GDP in R&D, averaging 2.5% since 1963. The East Asian economies, including Mainland China, with the exception of Hong Kong, have been catching up fast. China is expected to reach its target of 2.5% of GDP in 2020, approximately the same as the average U.S. share over the past more than fifty years. However, it will still be below the expected or targeted levels of the European countries (France, Germany and the U.K.), Japan and South Korea.

Chart 20: R&D Expenditures as a Share of GDP and Their Target Levels at 2020: G-7 Countries, 4 East Asian NIEs, China and Israel



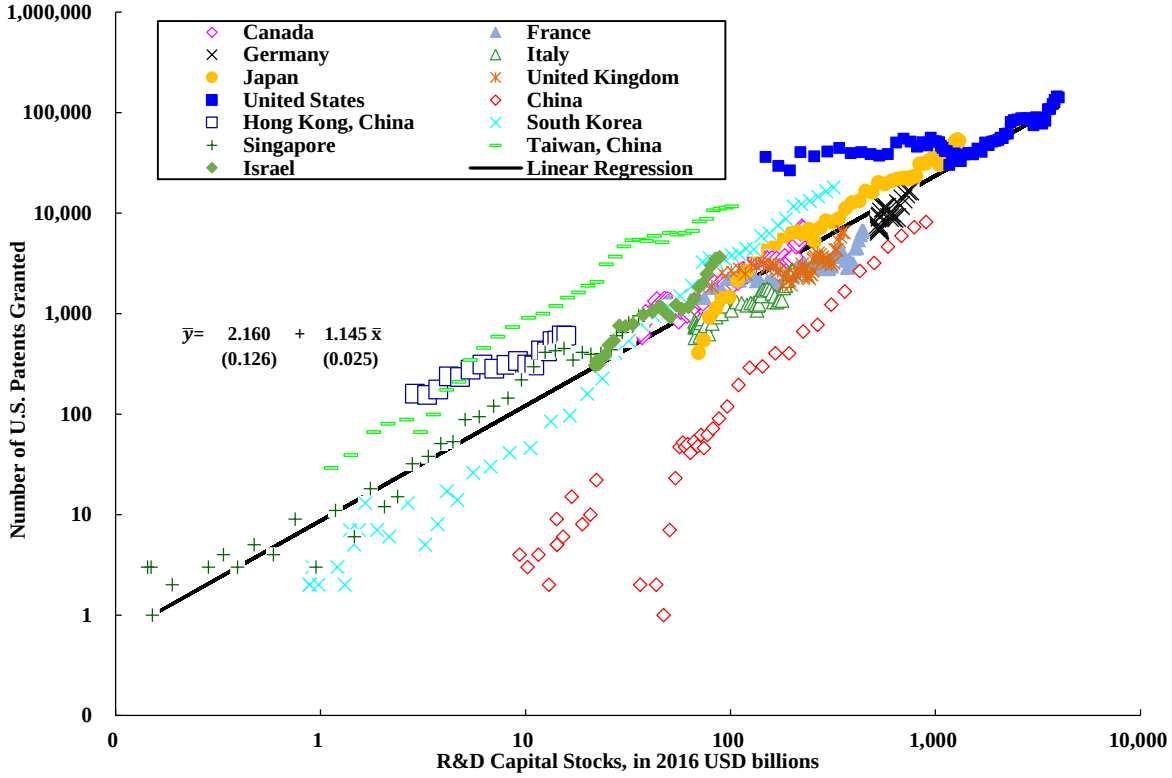
One indicator of the potential for technical progress is the number of patents created each year. In Chart 21, the number of patents granted in the United States each year to the nationals of different countries, including the U.S. itself, over time is presented. The U.S. is the undisputed champion over the past forty years, with 140,969 patents granted in 2015, followed by Japan, with 52,409. (Since these are patents granted in the U.S., the U.S. may have a home advantage; however, for all the other countries and regions, the comparison across them should be fair.) The number of patents granted to Mainland Chinese applicants each year has increased from the single-digit levels prior to the mid-1980s to 8,166 in 2015. The economies of South Korea and Taiwan, granted 17,924 and 11,690 U.S. patents respectively in 2015, were far ahead of Mainland China.

Chart 21: Patents Granted in the United States:
G-7 Countries, 4 East Asian NIEs, China and Israel



The R&D capital stock, defined as the cumulative past real expenditure on R&D less depreciation of 10% per year, is a useful indicator of innovative capacity. R&D expenditure should quite properly be treated as investment since R&D efforts generally take years to yield any results. The R&D capital stock can be shown to have a direct causal relationship to the number of patents granted (see Chart 22, in which the annual number of U.S. patents granted is plotted against the R&D capital stock of that year for each economy). The chart shows clearly that the higher the stock of R&D capital of an economy, the higher is the number of patents granted to it by the U.S.

Chart 22: U.S. Patents Granted and R&D Capital Stocks: G-7 Countries, 4 East Asian NIEs, China and Israel



The long-term determinant of the outcome of technological competition is the capacity for innovation. China has the same advantages as the U.S. in terms of the economies of scale, learning-by-doing and larger number of persons in the upper tail of the ability distributions due to their large populations. However, in order for break-through discovery or invention to be made, there must be significant investment in basic research. Basic research is by definition patient and long-term research. The rate of return, at any reasonable discount rate, will be low. It must therefore be financed by the government or non-profit institutions and not by for-profit firms. The atomic and hydrogen bombs, the nuclear reactors, the internet, the packets transmission technology and the browser are all outcomes of basic research done many years ago.

However, Chinese investment in basic research has remained low relative to the other major countries (see Chart 23). China devoted only 5 percent of its R&D expenditures to basic research, compared to the more than 15 percent of the U.S. The U.S. has a commanding lead in many basic scientific disciplines, reflected in, for example, the cumulative number of Nobel Laureates (see Chart 24). Of course, China is ahead in selected fields. For example, Huawei is a global leader in 5G technology.

Chart 23: Basic Research Expenditure as a Share of Total R&D Expenditure: China, Japan and the U.S.

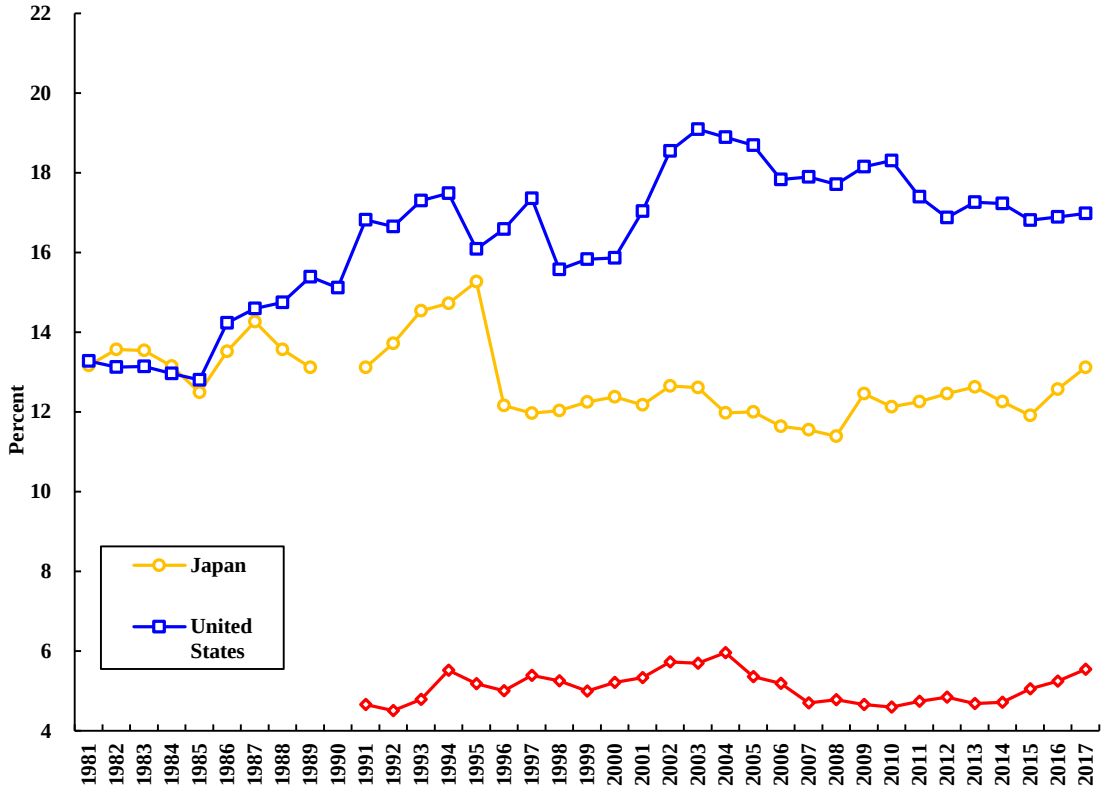
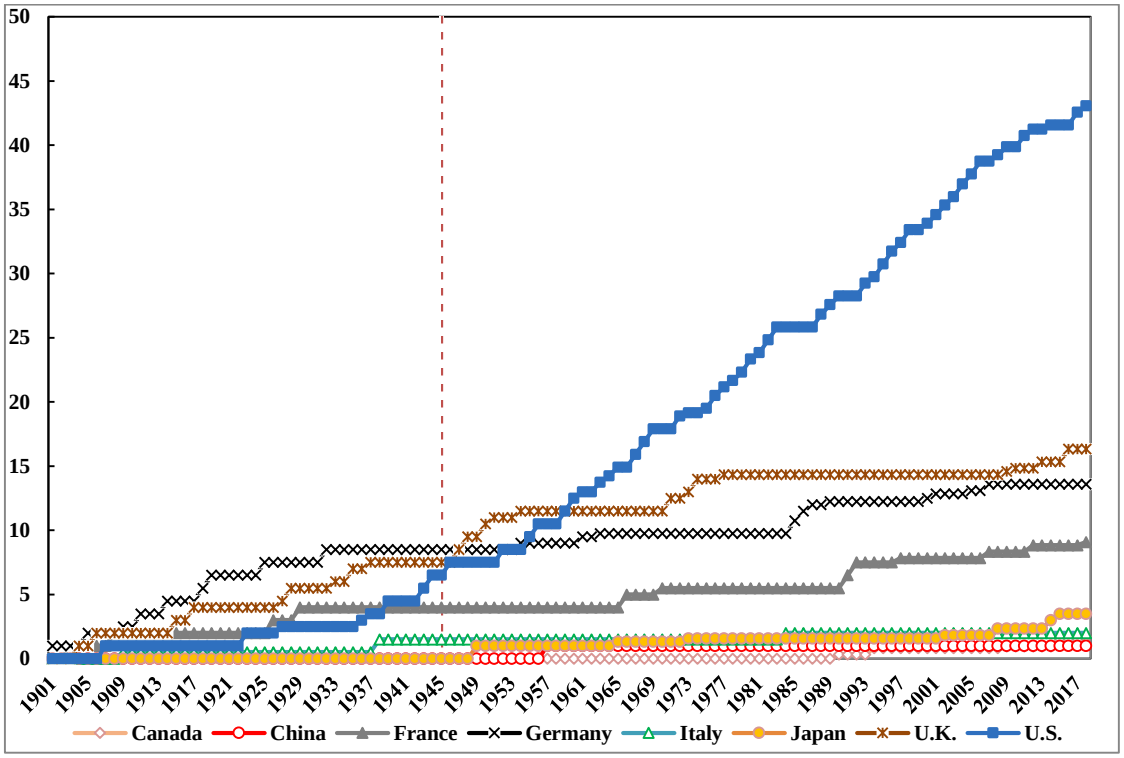


Chart 24: Cumulative Number of Nobel Laureates in Physics, Selected Countries



Another problem with Chinese technological development is the frequent duplication of research and development (R&D) efforts. This wastes valuable resources and may even delay significantly the achievement of the R&D objectives. An example is the development of an advanced semiconductor manufacturing capability in China. The basic bottleneck in China is not funding, but the scarcity of qualified engineers and scientists. If there are too many such parallel projects going on simultaneously, none of them will have sufficient qualified manpower to make it a success. It will also amount to a huge waste of resources as the establishment of a new manufacturing facility will typically require a minimum of several billion U.S. dollars.

8. Economic Complementarities between China and the U.S.

China and the U.S. have very different economic endowments. China has a large population that is more than four times that of the U.S. The U.S. has more arable land, more tangible capital stock, almost four times more R&D capital stock than China, and much more natural resources (for example, oil and gas deposits) than China (see Table 3).

Table 3: A Comparison of the Quantities of Primary Inputs between China and the U.S.

	China			U.S.		
	2015	2016	2017	2015	2016	2017
Population, thousand persons	1,374,620	1,382,710	1,390,080	321,323	323,668	325,983
Arable land, thousand hectare	134,999	134,921	134,863	152,263	152,263	
Tangible capital stock, 2016 prices, US$ billions	21,268	23,405	25,351	26,953	27,657	28,061
Real R&D capital stock, 2016 prices, US$ billions	898	1,015	1,139	4,005	4,106	4,205
Working age population (age 15-64), persons	996,030,376	995,072,896	993,792,919	212,357,568	213,254,816	213,911,387

Sources:
Population, year end for China, from National Bureau of Statics of China (NBSC) and mid year for the U.S. the U.S. Bureau of Economic Analysis (BEA).
Arable land, for China, from the National Bureau of Statics of China, and for the U.S. from the Food and Agriculture Organisation of the United Nations.
Tangible capital stock, estimated by Lawrence J. Lau from national income and product accounts data.
Real R&D capital stock, estimated by Lawrence J. Lau and Yanyan Xiong (2018).
Working age population, from the World Bank, World Development Indicators (WDI) Database.

On a per capita basis, the difference is even more pronounced (see Table 4). In addition, China has a high savings rate and the U.S. has a low savings rate. Chinese savings exceed Chinese domestic investment and U.S. savings are less than U.S. domestic investment. China is a net capital exporter and the U.S. a net capital importer. Economic theory tells us that the more different two economies are, the greater they potentially benefit from trading with and investing in each other.

Table 4: A Comparison of the Quantities of Primary Inputs per Capita between China and the U.S.

	China			U.S.		
	2015	2016	2017	2015	2016	2017
Arable land per capita, hectare	0.098	0.098	0.097	0.474	0.470	
Real capital stock per capita, 2016 prices, US$	15,472	16,927	18,237	83,880	85,448	86,080
Real R&D capital stock per capita, 2016 prices, US$	654	734	819	12,463	12,685	12,900
Working age population per capita	0.725	0.720	0.715	0.661	0.659	0.656

9. Opportunities for Coordinated Expansion of Trade

A bilateral trade gap can be closed by either the deficit country increasing its exports to the surplus country, or by the surplus country reducing its exports to the deficit country. (If two countries stop trading, the bilateral trade balance is by definition zero.) It is much better to close a bilateral trade gap by increasing the exports from the deficit country to the surplus country than for the surplus country to reduce its exports to the deficit country. In the former case, both countries benefit; in the latter case, both countries lose. It is conventional economic wisdom that reducing a bilateral trade surplus per se, for example, by increasing exports from the deficit country to the surplus country, cannot change the aggregate trade deficit with the world of the deficit country, nor increase the GDP of the deficit country. However, this is not necessarily true if the increased exports can come from new domestic production, which increases both domestic GDP and employment, rather than the diversion of existing exports from another trading-partner country.

One may raise the question: if such a profitable opportunity for trade exists, why has the trade not occurred already? The answer lies in the fact that the creation of genuinely new export supply requires significant investment, and significant investment can be justified only if the production and export activities can be sustained over time. That is why a new committed long-term demand for the good to be exported is necessary in order that there is new production. However, new long-term demand can arise only if there is new long-term supply and vice versa. There is therefore the need for the coordination of both the supply and the demand sides. But markets, especially futures markets, are incomplete. There is no long-term futures market that extend beyond a couple of years. The insurance markets are also not complete--there are many risks that cannot be insured in an economically viable way. For example, it is impossible, or prohibitively expensive, to either sell or buy beef or wheat on the futures market for delivery twenty years from the present (actually even three years from the present). Thus one cannot rely on the free markets alone for such long-term trade arrangements involving new supply and demand to occur.

Non-market coordination becomes necessary because of the incompleteness of markets. The market, left to its own, may not bring about some otherwise productive economic activities. Thus, coordination (or some would say managed trade or planning) can enable certain beneficial economic activities to take place that otherwise may not occur. An example is the

possible development of the natural gas reserves in Alaska to be sold to Chinese customers. Significant long-term investments will have to be made. Without committed buyers, the project cannot be financed (future markets for natural gas does not extend beyond a couple of years). Without committed and well-capitalised developers with a track record, the potential buyers will not commit either. Moreover, there is always the concern that the trade may be interrupted for political reasons by either government. Thus, coordination by both state and non-state actors are necessary.

Two sources of potential U.S. exports to China that can be huge and are relatively uncontroversial are agricultural commodities and energy. China has a huge demand for agricultural commodities, and, in addition, there is also great potential for the U.S. to increase the value-added content of U.S. agricultural exports, for example, by producing and exporting meat (beef, pork and poultry) instead of feed grains (corn and soybeans) to China. In 2017, China imported more than US$115 billion of agricultural commodities, but only 20 percent of the imports came from the U.S. Moreover, Chinese imports of agricultural commodities has been increasing by more than 10 percent per year. Thus, there is the potential of U.S. exports of agricultural commodities to China rising from the current US$20 billion plus a year to US$50 billion a year in three to five years, on the basis of new as well as higher value-added U.S. production. The U.S. has significant surplus production capacity (for example, it has an abundance of land, water and pastures) for agricultural commodities if there is assured long-term demand.

There is also a huge and growing Chinese demand for energy, especially relatively clean energy, which can be met by exports of liquefied natural gas (for example, from Alaska) and shale oil, which are again new production, from the U.S. In 2016, China imported a total of US$117 billion of crude oil and US$9 billion of natural gas. Chinese imports of oil and gas from the U.S. was minuscule, at US$0.2 billion and US$0.08 billion respectively. Given China's huge and growing demand for energy, and especially for non-polluting energy such as natural gas, and the U.S. being transformed into a net energy exporter because of its rising shale oil and gas production, it is entirely possible for the U.S. to become a top energy exporter to China, gradually increasing to US$50 billion a year or more, again based on new production and not the diversion of existing production, thus increasing both U.S. GDP and employment.

It is therefore possible to envisage that additional exports in the agriculture and energy areas alone can amount to more than US$100 billion a year, with almost 100 percent U.S. value-added content. Moreover, these increased exports are likely to persist for a long time. The advantage of this type of arrangements is that no one is hurt economically. In the U. S., the new exports consists of new domestic supply that already has its committed export demand, so that it will not drive up or drive down prices or otherwise affect the markets. In China, not only are the imports likely to be less expensive than the cost of domestic production on the margin, they serve the important purpose of meeting the expanded and expanding domestic demand, without affecting the prices in the domestic markets. So, everything considered, these long-term arrangements are likely to be win-win all around.

Another fast-growing component of U.S. exports of services to China that has huge potential for expansion is education and tourism. The expenditures of Chinese students (currently totalling 360,000) and tourists in the U.S. have been rising rapidly. Moreover, their presence in the U.S. can enhance the understanding between the Chinese and American peoples and improve long-term ties. And on their return to China, they can act as goodwill ambassadors for the U.S., especially those who have been students in the U.S. U.S. students and tourists in China can also play the same role.

A further area of significant potential win-win collaboration is the deployment of the excess Chinese savings in the U.S. for the financing of the renovation and upgrading of U.S. basic infrastructure as well as the augmentation of the equity capital of U.S. corporations through a secondary listing of their shares on the Chinese stock market.

Can “managed trade” change the aggregate trade balance of a country with the world? The conventional wisdom takes the aggregate output of each economy as given so that given the savings-investment gap, reallocation of trade flows among trading partners cannot change the aggregate trade balance with the world. However, to the extent that a “managed trade” agreement leads to new output being produced from previously idle resources, it can increase both GDP and employment, as well as exports. Thus, the aggregate trade balance will be improved in the positive direction.

10. Bilateral Economic Issues

U.S. economic issues include intellectual property right protection, forced transfer of technology, market access for U.S. direct investors, cyber-theft and state-owned enterprises. (Note that none of these issues have much to do with trade per se.) Chinese economic issues include the U.S. restrictions on high-technology exports to China and the U.S.'s practice of unilateral enforcement of agreements rather than reliance on multilateral organisations such as the World Trade Organisation (WTO).

U.S. Issues

Intellectual Property Right Protection

Intellectual property right protection in China has actually been vastly improved since special intellectual property courts were established in Beijing, Shanghai and Guangzhou in 2014. Economically meaningful fines have begun to be levied on violators of intellectual property rights in China. Both Japan and Taiwan in their early stages of economic development did not do much to protect intellectual property rights either. But as they changed from being a user and imitator to a creator of intellectual property, they began to enforce intellectual property rights vigorously. Intellectual property right protection in China should get even better over time. Today, China grants the largest number of patents in the world, over 300,000 a year. And Chinese inventors and discoverers, just like their foreign counterparts, will want their intellectual property rights protected. The way forward is to step up enforcement action in and by Chinese courts, especially through lawsuits filed by the victims against the violators of intellectual property rights.

Forced Technology Transfer

Forced technology transfer has to do with the Chinese requirements for foreign direct investors in certain industries to take Chinese enterprises as equal (50-50) joint-venture partners. If foreign direct investors are no longer required to take an equal domestic joint-venture partner, no transfer of technology to a Chinese enterprise is required, and certainly no forced transfer of technology. On 30 June 2019, Chinese Premier LI Keqiang announced in

Dalian that foreign investors in the Chinese financial sector will be permitted to have wholly-owned Chinese subsidiaries beginning in 2020, instead of the previously announced 2021.

Thus, forced transfer of technology is fast becoming a moot issue because of recent Chinese liberalisation measures, including the abolition of the joint-venture requirement for direct investors. For example, in the automobile manufacturing industry, Tesla of the U.S. has been able to establish a wholly-owned subsidiary in Shanghai to manufacture electric cars; Germany's BMW has been able to increase its ownership stake in its China automobile-manufacturing joint-venture to 75%; and even though it is now possible for the U.S.'s General Motors to buy out its Chinese joint-venture partner, it has indicated that it does not intend to do so. Allianz of Germany and Chubb of the U.S. (based in Switzerland) have also been allowed to wholly-own insurance companies in China.

Market Access for U.S. Direct Investors

The newly passed Chinese Foreign Investment Law is also a step in the right direction. The expectation is that China will continue to open its economy to international trade in goods and services and to both inbound and outbound cross-border direct investment on a reciprocal basis, regardless of the outcome of the China-U.S. trade war. The new and much shortened negative list on foreign direct investment should also go a long way towards improving market access. The expectation is that China will continue to open its economy to international trade in goods and services and to both inbound and outbound cross-border direct investment on a reciprocal basis, regardless of the outcome of the China-U.S. trade war. The best solution is for China to grant national treatment to all foreign direct investors on a reciprocal basis (with national security consideration being the only possible exception).

Cyber-Security

There is disagreement on the regulation of cross-border flows of data as well as the location of the national data. The Chinese position is that Chinese data must stay within the country for national security reasons. I believe the U.S. will not be happy either if U.S. data are stored in China. National storage of national data is likely to become the norm in the future. Commercial cyber-thefts should be vigourously prosecuted, with the collaboration and cooperation of both governments. Spying, the world's second oldest profession, will probably

go on as usual. However, it may be useful for China and the U.S. to agree on some rules for cyber-warfare, in the same way as the arms control treaties on biological, chemical, missiles and nuclear weapons in the past.

State-Owned Enterprises

Another potential issue is that of Chinese "state-owned enterprises (SOEs)". Chinese SOEs are here to stay, and they have social responsibilities that go beyond the simple maximisation of profits. However, it is useful if the U.S. can be specific on its objections to SOEs. It can be either behaviour, for example, anti-competitive behaviour such as predatory pricing, or attempting to monopolise the market, etc.; or it can be government subsidies; or it can be something else. It is much more effective and productive to focus on the behaviour of the enterprises and discriminatory treatment by the government rather than the ownership per se. Otherwise, if all firms, domestic (state-owned or private), joint-venture and foreign firms, are granted full national treatment, it will be a level playing field for all. (National security considerations will be the only acceptable exception.) However, basic research will need to be financed and supported by the government and non-profit organisations as is done in all countries including the U.S.

Chinese Issues

Restrictions on U.S. High-Technology Exports

The U.S. restrictions on high-technology exports to China, which dated back to the Korean War, have never been lifted. The recent U.S. measures aimed at Huawei, Dajiang Industries, and Hikvision raised the question whether there would be a full technological embargo against China. (It was a "Sputnik" moment for China. It would mean that China must develop its own indigenous scientific and technological capabilities in order to continue its economic development.) Potentially, this may lead to de-coupling of the high-technology industries of the two countries, which is probably not good for either country. However, some redundancy in critical systems is not a bad idea, even though it may be somewhat costly, because it provides insurance against catastrophic risks such as natural disasters or epidemics. In fact, second-sourcing of critical inputs is standard practice. Moreover, having more than one firm producing the same product or providing the same service also prevents the rise of

monopolies in specific industries of the high-technology sector, which is good for the consumers and good for the rest of the world.

Unilateral Enforcement of Agreement

Any trade agreement should be jointly enforced by both China and the U.S. after the necessary judicial process in either (or both) countries. Unilateral enforcement by any one side will likely lead to the demise of the agreement. It is also unlikely that any country would pre-commit not to retaliate in response to unilateral action taken by the other country, unless there is some other leverage possessed by the other country, for example, it may require the military protection of the other country.

11. Enhancing Mutual Economic Interdependence

The problem with a trade war is that there are no real winners—both countries lose because the feasible choices open to each of them are reduced. Exporters in both countries will be hurt because of the reduction in their exports, and importers in both countries will see their businesses decline. And the consumers and producers who rely on imported goods and inputs in both countries will have to pay higher prices.

A better way to narrow the U.S. trade deficit with China is for the U.S. to increase its exports of goods and services to China, especially new production of goods and services, for example, by exporting newly developed liquefied natural gas from Alaska and shale oil and shale gas from the continental U.S. and producing and exporting meat (beef, pork and poultry) instead of feed grains (corn and soybeans) to China. However, such trade should be structured so that it is reliable, sustainable and long-term. Long-term bilateral trade can enhance economic interdependence, and economic interdependence can enhance mutual trust over time, and mutual trust in turn can promote more long-term bilateral trade and direct investment.

12. Concluding Remarks

Even though the direct real impacts of the China-U.S. trade war are relatively small and manageable for the Chinese economy, the uncertainty and unpredictability that it has created, and the negative influence it has on public confidence and expectations, have also affected investment and consumption and hence the real economy. Regardless of whether China and the U.S. can reach an agreement, once it is settled one way or the other, it will at least eliminate the uncertainty. And firms and households can make their investment and consumption decisions accordingly.

In response to the trade war, the Chinese Government is expected to implement cuts in its tax rates, including the value-added tax, corporate and individual income tax, social insurance contribution rates, and continue investing in basic infrastructure projects such as high-speed railroads and urban mass-transit systems. Additional investments in public goods provisions such as environmental preservation, protection and restoration are also possible, especially if a comprehensive trade agreement fails to materialise as expected.

The competition between China and the U.S., whether friendly or unfriendly, can be assumed to be an ongoing and long-term one. It is the "new normal". The trade dispute is only a symptom of the potential possible conflicts between the two countries. Professor Graham Allison (2017), of the Kennedy School of Government at Harvard University, has written a book titled Destined for War: Can America and China Escape Thucydides Trap?, about the inevitability of a war between China and the U.S. As a rising power challenges the dominance of an established power, the established power is likely to respond with force. He refers to this "inevitability" as the "Thucydides Trap", drawing on the book by Thucydides, History of the Peloponnesian War, a war in ancient Greece (431-404 B.C.) between Athens and Sparta.

However, the rise of the former Soviet Union between the end of the Second World War and 1990 provides a counter-example that an established power and a rising power must go to war. The truth is that a thermonuclear war today is so devastating that there are effectively no real winners. It is this "mutually assured destruction" that prevented the Soviet Union and the U.S. from going to war and instead to enter into a number of arms control treaties such as the Anti-Ballistic Missile (ABM) Treaty and the Strategic Arms Limitation Treaty (SALT). And it will similarly prevent wars between major powers in the future.

Moreover, it is also important to distinguish between the rivalry between the U.S. and the former Soviet Union with the competition between China and the U.S. The former was existential, as the former Soviet Union would like to impose the Communist system on other countries. China has no intention of proselytising its ideology or system of government to other countries, and is careful to emphasise the Chinese characteristics of its economic, political and social systems, implying that they cannot be easily adopted or transplanted elsewhere. Hence the competition between China and the U.S. is non-existential. In time, the U.S. will get used to the idea that another economy will be larger than its, but still with a GDP per capita that is much smaller.

To reduce the probability of an armed conflict between China and the U.S. down the road, China-U.S. relations must be carefully managed going forward. Both countries should try to promote greater mutual economic interdependence, to make their relations win-win, so that a war between them would be unthinkable. Two European powers, France and Germany, which were at one time rivals, fought three wars between them in 1870, 1914 and 1939 respectively. After World War II, the European Common Market was launched so as to increase the degree of economic collaboration and cooperation between them. Today, France and Germany and the best of allies in the European Union, and a war between them is not possible.

It is likely that the China-U.S. trade negotiations will be stretched out, perhaps with an interim "Phase 1" agreement. I believe a complete rupture of the China-U.S. relation is unlikely as the U.S. still needs Chinese cooperation on such issues as North Korean denuclearisation and at some point climate change. Large U.S. corporations still have significant interests in the large and growing Chinese market. China also needs the U.S. to continue to supply critical semi-conductors and semi-conductor manufacturing equipment.

China and the rest of the world, except possibly the U.S., will continue to uphold the current multilateral trading system under the World Trade Organisation (WTO). After all, they have all benefitted and will continue to benefit from it. China is committed to further opening of its economy to international trade and both inbound and outbound direct investment. It will likely move to adopt a "three zeroes strategy"—zero tariffs, zero barriers and zero subsidies and offer national treatment to foreign direct investors on a reciprocal basis. Maintaining good economic relations with the rest of the world, and opening its economy further to international

trade and investment, in particular, to the European Union, ASEAN, Japan and Russia on a reciprocal basis, is a must for China going forward.

In the long run, if China and the U.S. cooperate and work together, many global problems such as prevention of climate change, denuclearisation, and the economic development of Africa, can be solved. China and the U.S. can both collaborate and compete in finding cures for diseases such as cancer and Alzheimer's disease, and every country in the world will benefit from it. The U.S. can invite China to participate in the exploration of Mars and share in the cost, which has been estimated to be hundreds of billions of U.S. dollars. If the two countries compete in a friendly way, much innovation is possible, as in the competition to build the fastest super-computer. The two countries should aim to become competitive partners!

References

Graham T. Allison (2015), "The Thucydides Trap: Are the U.S. and China Headed for War?" The Atlantic, 24 September.

Graham T. Allison (2017), Destined for War: Can America and China Escape Thucydides Trap?, Boston: Houghton Mifflin Harcourt.

Xikang Chen, Leonard K. Cheng, Kwok-Chiu Fung and Lawrence J. Lau (2009), "The Estimation of Domestic Value-Added and Employment Induced by Exports: An Application to Chinese Exports to the United States," in Yin-Wong Cheung and Kar-Yiu Wong, eds., China and Asia: Economic and Financial Interactions, Oxon: Routledge, pp. 64-82.

Xikang Chen, Leonard K. Cheng, Kwok-Chiu Fung, Yun-Wing Sung, Kunfu Zhu, Cuihong Yang, Jiansuo Pei and Yuwan Duan (2012), "Domestic value added and employment generated by Chinese exports: A quantitative estimation," China Economic Review, Vol. 23, April, pp. 850-864.

Xikang Chen and Huijuan Wang (2016), Touru Zhanyong Chanchu Jishu (Input-Output-Occupancy Techniques), Beijing: Science Press.

Institute for Market Research, The Shanghai Stock Exchange (2017), "Lixing Touzi Xuxian Zhiji (To Invest Rationally, One Must First Know Oneself)," Shanghai Zhengquanbao (Shanghai Securities News), 11 April, 11.

Kwok-Chiu Fung and Lawrence J. Lau (1998), "The China-United States Bilateral Trade Balance: How Big Is It Really?" Pacific Economic Review, Vol. 3, No. 1, February 1998, pp. 33-47.

Kwok-Chiu Fung and Lawrence J. Lau (2001), "New Estimates of the United States-China Bilateral Trade Balances," Journal of the Japanese and International Economies, Vol. 15, No. 1, March 2001, pp. 102-130.

Kwok-Chiu Fung, Lawrence J. Lau and Yanyan Xiong (2006), "Adjusted Estimates of United States-China Bilateral Trade Balances: An Update," Pacific Economic Review, Vol. 11, No. 3, October, pp. 299-314.

Lawrence, J. Lau (2018), "A Better Alternative to a Trade War." China and the World: Ancient and Modern Silk Road, 1 (2): 1850014-1 – 1850014-13.

Lawrence J. Lau (2019a), The China-U.S. Trade War and Future Economic Relations, Hong Kong: The Chinese University of Hong Kong Press.

Lawrence J. Lau, translated by YU Jiang (2019b), Tian Ta Buxialai: Zhongmei Maoyizhan ji Weilai Jingji Guanxi (天塌不下來：中美貿易戰及未來經濟關係 (The Sky is Not Falling: The China-U.S. Trade War and Future Economic Relations)), Hong Kong: The Chinese University of Hong Kong Press.

Lawrence J. Lau, Xikang Chen and Yanyan Xiong (2017), "Adjusted China-U.S. Trade Balance," Working Paper No. 54, Lau Chor Tak Institute of Global Economics and Finance, The Chinese University of Hong Kong, March.

Lawrence J. Lau and Junjie Tang (2018), "The Impact of U.S. Imports from China on U.S. Consumer Prices and Expenditures," Working Paper No. 66, Lau Chor Tak Institute of Global Economics and Finance, The Chinese University of Hong Kong, April.

Lawrence J. Lau and Yanyan Xiong (2018), "Are There Laws of Innovation?: Part I, Introduction." Working Paper, Lau Chor Tak Institute of Global Economics and Finance, The Chinese University of Hong Kong.

Lawrence J. Lau and Yanyan Xiong (2020), Are There Laws of Innovation?, forthcoming.