

China | Gauging the impact of US tech war on China: an input-output table analysis

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China-US tariff war likely comes to an end while a tech war looms large

After the outbreak of a tariff war between the US and China in mid-2018, global investors have been nervously watching for the trade relation between the two economic clouts and attempting to gauge the impact on global economy. At last, the two countries have successfully narrowed their difference in the aftermath of the Buenos Aires meeting between President Trump and Xi. Over the past couple of weeks, some positive signals emerged which lifted investors' hope that the US and China might end the ongoing tariff war soon. If materialized, the solution of the US-China tariff war will add impetus to the sluggish international trade.

However, the US is now waging a tech war against China on top of those punitive tariffs. As China has successfully become a competitive player in many high-tech areas, the US wants to ensure that its leading position at the tech frontier will not be challenged by China. Towards this end, the US has deployed a number of tactics on different fronts.

We could summarize the potential US tech war measures on China in the following aspects: (i) to selectively file lawsuits, on the basis of its long arm jurisdiction, against Chinese high-tech enterprises (ZTE, Huawei etc.) in a bid to thwart their efforts to climb on the global supply chain; (ii) to bind some requests together with the trade talks in attempt to halt China's grand plan of enhancing technical progress, for example the "Made in China 2025"; (iii) to press China to enhance domestic protection for intellectual property and allow the US companies to open their subsidies of full-ownership in China; (iv) in some cases, to directly ban American companies from exporting essential components to Chinese high tech companies; (v) to restrict Chinese firms from investing in the high tech sector of the US; (vi) to tightening the screening for Chinese students to study in science and technology disciplines in the US etc.

All in all, we deem that the US tech war, including the above stated various forms of US efforts to suppress the development of China's enterprises, is unlikely to come to a halt even after the two sides reach a deal to solve other trade disputes and lift punitive tariffs imposed on each other's exports.

It begs the question that to what extent the US tech war will hinder China's pace of climbing on global supply chain and drag down its growth. To answer this question, we employ an analytical framework of input-output table to explore the inter-sector linkage of high-tech sector on other sectors thus gauge the influence of China-US tech war on China's economic growth.

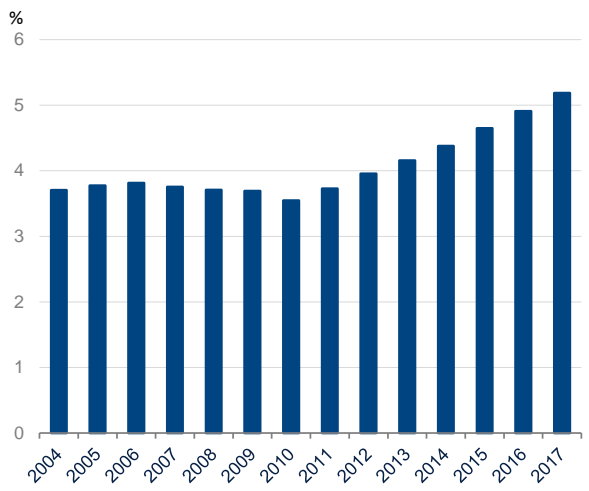
Headline figures show the increasing importance of the high tech sector in China...

Since China's accession to the World Trade Organization (WTO), its economy has witnessed a fast expansion of almost two decades. Notably, the growth in China is not only based on the accumulation in capital and labour input, but also based on the general gain on productivity. The productivity gain particularly reflects on the fast rise of China's high-tech sector. Nowadays, China-produced high-speed railway systems are sold globally. Even the advanced countries are considering importing China-invented 5G system to be used in their mobile networks. All these must seem unimaginable back to twenty years ago when China was still in the run-up of joining the WTO.

A straightforward way to measure the importance of China's high-tech sector to its economy is to calculate this sector's output relative to the total GDP. In China, this ratio has been rising steadily over time, from 3.7% in 2004 to 5.2% in 2017. (Figure 1) Moreover, China's high-tech exports also experienced a solid growth over the past decade. More importantly, the share of high-tech products to total exports steadily increased from 26.6% in 2010 to 28.5% in 2018. (Figure 2)

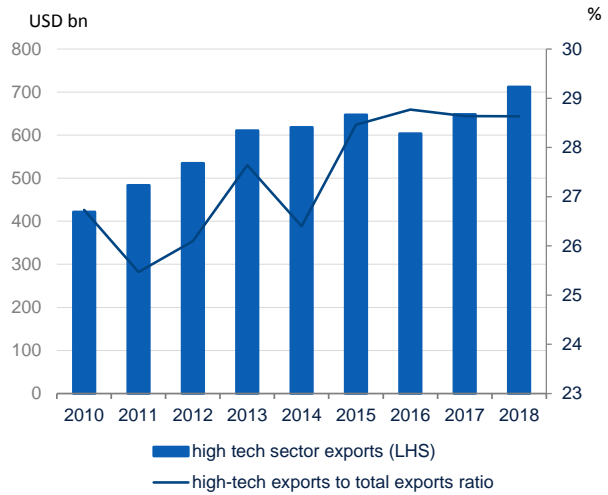
On top of the increasing high tech sector's GDP ratio and its export share, the employees in high tech sector have also increased over time (Figure 3), mainly due to the improvement in higher education domestically and the favourable policies to attract the talents with foreign educational background in high-tech related disciplines. In addition, the number of patents applied in China also has rocketed significantly, with its number significantly surpassing that of some other developed countries such as US, Japan, and Germany, although the quality of Chinese filed patents might not be very high for the moment. (Figure 4)

Figure 1 The ratio of high tech sector's GDP to total GDP has been rising over time



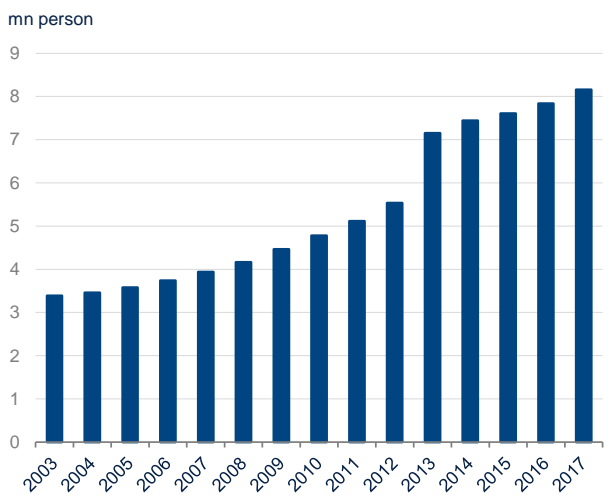
Source: BBVA Research and CEIC

Figure 2 China's high tech sector exports have increased for the past decade, so has its ratio to total exports



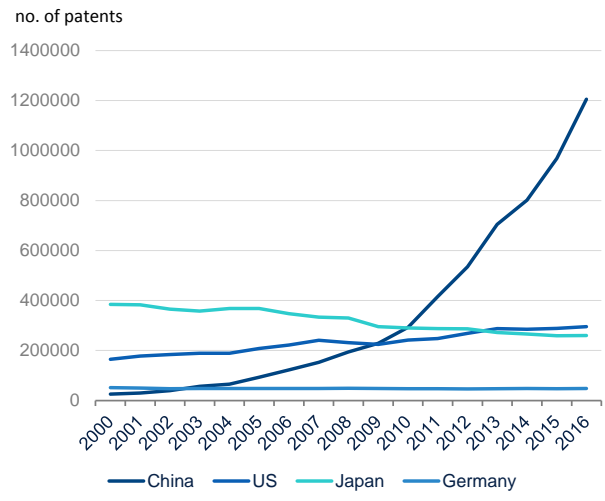
Source: BBVA Research and CEIC

Figure 3 Number of employees in high tech sector has also increased over time...



Source: BBVA Research and CEIC

Figure 4 ...so has the number of patent applications in China, outnumbering many advanced countries



Source: BBVA Research and CEIC

... while they are subject to bias

Although the figures shown in above charts are very informative, they are subject to bias. First, the export data only reflects the final products for shipment which includes contents not produced in the country. It is especially relevant since China has been famous for its processing exports. For many high-tech products, Chinese enterprises might just import the key elements from other countries and then use Chinese cheap labours to assemble them for export. Therefore, we cannot jump to the conclusion of China becoming more competitive in their high-tech exports by just comparing its shipment figures.

Second, the figure of high-tech sector's contribution to total GDP is based on the final output of the sector, which tends to ignore the important inter-sector linkages. As such, this ratio could underestimate the importance of a sector to the entire economy if its linkage with other sectors is strong.

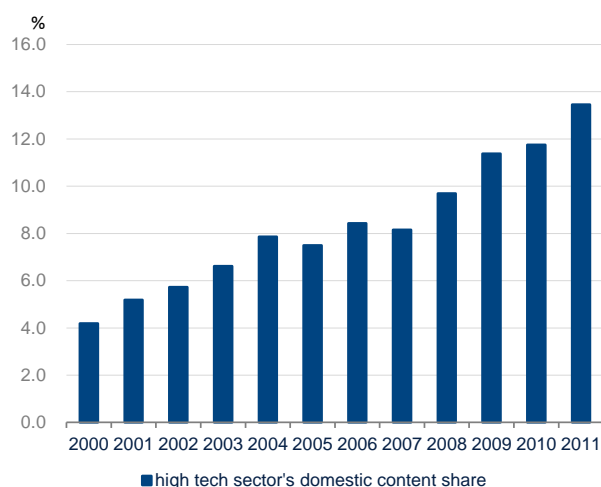
Analysis based on input-output table

Fortunately, based on the OECD TiVA database, we are able to derive important information with respect to the adding value of different sectors, which enables us to further gauge the relative importance of the high tech sector to the aggregate economic activities as well as the potential impact of China-US trade war on Chinese growth.

Indeed, the OECD TiVA database provides a Chinese input-output table of 35 sub-sectors. To define our high-tech sector for China, we combine 4 sub-sectors in the OECD TiVA database, namely sector D26--- computer, electronic and optical products; sector D27--- Electrical equipment; sector D 61---Telecommunications and sector D62T63--- IT and other information services. Based on this, we restructure the input-output table to form a new one of 32 sub-sectors including a self-defined high-tech sector.

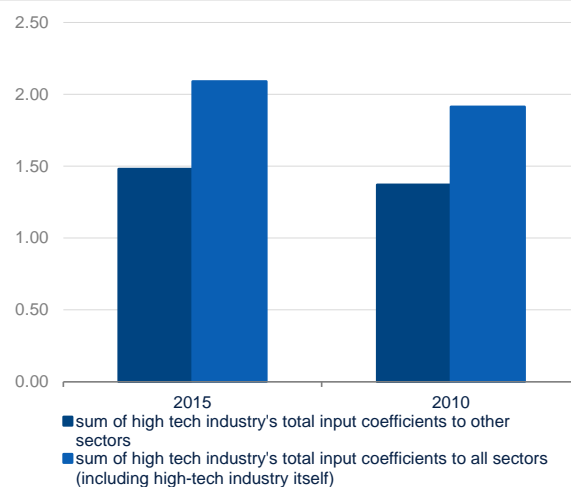
The OECD TiVA database directly provides an indicator of domestic content of China's high-tech exports, which rose swiftly during the period of 2000-2011. (Figure 5) We believe that such an uptrend continues until now. This indicator provides more reliable evidence that China is climbing on the global value chain by advancing their technologies. It also explains why the US, as well as other advanced economies albeit to a less extent, have become more concerned about China and are pushing China to play a fairer game in the global competition of the high tech sector.

Figure 5 The ratio of high tech sector exports' domestic content rose over time based on OECD TiVA database



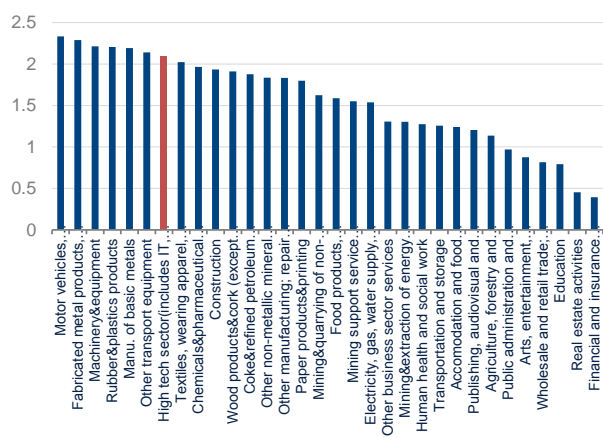
Source: BBVA Research and OECD TiVA

Figure 6 Comparison of high tech sector's importance to other sectors: 2010 vs. 2015



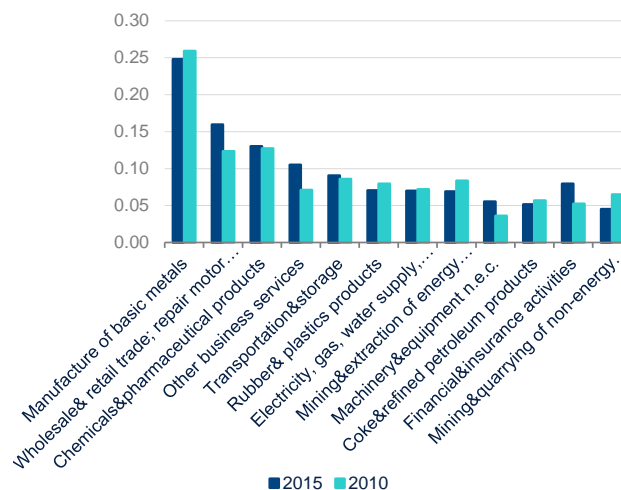
Source: BBVA Research and CEIC

Figure 7 Sum of each sector's total input coefficients: high tech sector ranks 7th, among the highest ones



Source: BBVA Research and OECD TiVA database

Figure 8 High tech' s total coefficients to other sectors based on input-output table analysis



Source: BBVA Research and OECD TiVA database

Moreover, through the typical input-output table matrix calculations (see Technical APPENDIX in a separate pdf file), our input-output table analysis yields more interesting findings about China's high tech sector. Specifically, we calculate the total input coefficient, a typical concept in input-output analysis, which illustrates how much output from each sector is used as intermediate inputs to meet one unit of increase in the final demand of the high tech sector, with both direct and indirect effects considered. This is indeed a good summary of inter-sector linkages which captures not only the final demand linkage but also the linkages through intermediate demand.

Our findings from this input-output table analysis can be summarized in the following three aspects:

First, high tech sector's linkage with other sectors has been strengthening over time. (Figure 6) In particular, the sum of high tech sector's total input coefficients to other sectors (both including and not including high sector itself) have increased from 2010 to 2015. In particular, the 2010 total input coefficient is 1.8, indicating that one USD increase of the final demand of high tech sector results in a change in the economy's total output by 1.8 USD. This includes the initial dollar change (1 USD) in high tech sector's final demand (direct effect) and changes in the outputs of other related sectors to support the initial dollar change in high tech sector output (indirect effect) (0.8 USD). By 2015 this figure rose to 2.2, indicating that the high tech sector will consume more intermediate inputs from other sectors. It shows that the importance of China's high tech sector has been on the rise in terms of its stronger derived demand on other sectors.

Moreover, we observe that high tech sector ranks the 7th, among all of 32 sectors. This indicates the importance of the high tech sector to the economy in terms of its spill-over effect to other sectors. (Figure 7)

Second, we find that the spill-over effects of the high tech sector are in particular strong in a number of other sectors, including: manufacturing of basic metals, wholesale and retail trade, chemicals and pharmaceutical products, other business service and transportation and storage. In addition, for most of the sectors, the linkage with the high tech sector has been strengthening over time, corroborating our first result. (Figure 8)

Last, we also explore the relative importance of high tech sector by estimating the loss in the economy's total gross output caused by a hypothetical elimination of the linkage of high-tech sector with other sectors. (See details in Technical APPENDIX) Our result shows that the Chinese economy's total gross output would be around 10.8% less if we shut down high-tech sector's linkage with other sectors, based on the input-output table of 2015.

A scenario analysis: how will the tech war affect China's growth?

With the results of input-output table analysis at hand, we are able to gauge the impact of the US-initiated tech war on China's growth. Towards this end, we employ a scenario analysis approach, in which we defined three scenarios corresponding to different growth rates of China's high tech sector.

In the first scenario we assume a growth rate of 13.4% in China's high tech sector, which is the average annual growth during the period of 2010-2015. In our analysis, scenario 1 is treated as a benchmark without tech war risk.

In the second scenario, we assume the growth rate of the high tech sector decrease to 6.2%, the historical low of 2010-2015 due to the US tech war against China.

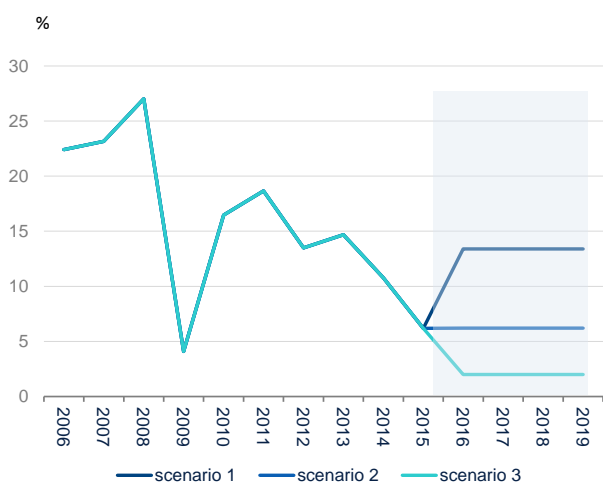
In the third scenario, the growth rate is assumed to decelerate to 2%, reflecting more adverse environment stemming from the tech war. (Figure 9)

Based on our total input coefficient result as displayed in the previous section (Figure 6), we assume that this coefficient is constant throughout 2015 to 2019. It indicates that one dollar increasing in final demand of high tech sector will lead to an increase of 2.2 dollars in total gross output of the economy.

In Figure 10 we display the size of total gross output increase with respect to the growth of high tech sector under three scenarios. Indeed, what we concern here is not the size but rather the gaps of gross output increase between different scenarios. If we treat scenario 1 as the one without the disturbance of the tech war, the gaps of scenario 2 and 3 relative to scenario 1 can reflect to what extent the tech war affects the total gross output of Chinese economy.

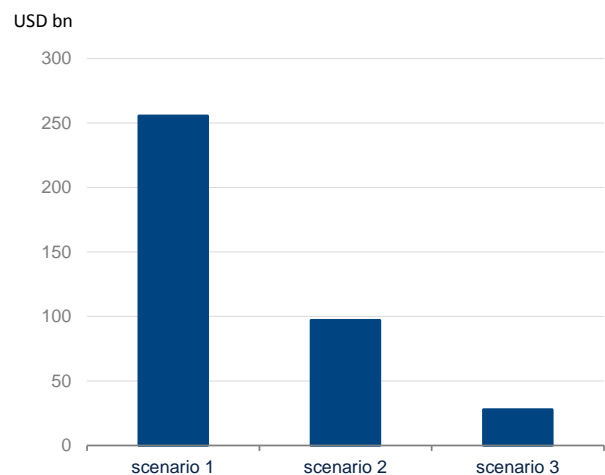
We estimate that a tech war risk will decrease the total gross output in China by 0.54%, or USD 158.6 billion if it slows the growth of high tech sector to 6.2% from 13.4% (scenario 2). In a worse case (scenario 3), China's total gross output could be slashed by 0.78%, or USD 227.7 billion if its growth of high tech sector decelerated to 2% due to the escalation of the trade war.

Figure 9 The assumptions of three scenarios of high-tech sector growth rate



Source: BBVA Research and OECD TiVA database

Figure 10 The comparison of the three scenarios of 2019: impact on total gross output



Source: BBVA Research and OECD TiVA database

Conclusion

Although the US-China tariff war is likely to come to an end soon, a tech war between these two economic and tech clouts are looming large. In this report, we try to quantify to what extent that China-US tech war will drag on Chinese economic growth based on input-output table analysis.

By use of data provided by OECD TiVA database, we find that the high tech sector has become increasingly important to the Chinese economy due to its strengthening linkage with other sectors, also suggesting that Chinese enterprises are climbing up the global supply chain. In particular, the total input coefficients, which gauge how much output from each sector is used as intermediate inputs to meet one unit of increase in the final demand of the high tech sector, have steadily risen over time from 2005 to 2015.

We further set up three scenarios to analyse to what extent the risk of China-US tech war weighs on China's aggregate output. Our results suggest that a tech war risk will decrease China's annual total gross output by 0.54% and 0.78% respectively if its high tech sector growth slows to 6.2% and 2.0% from the previous normal level of around 13.4%.

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