

Economic Watch

China

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Economic Watch

Asia

Chief Economist of Emerging
Markets

Alicia Garcia Herrero

alicia.garcia-herrero@bbva.com.hk

Senior Economist

Fielding Chen

fielding.chen@bbva.com.hk

Innovation: Where does China stand?

We offer a brief overview about China's innovation policies and outcomes. Innovation is becoming increasingly important for Chinese policy makers as a key growth engine once the urbanization process is accomplished and population ages. We first, illustrate the importance of China's innovation for growth; we then evaluate China's efforts to enhance its innovation capacity (i.e., the inputs in the innovation process) and the actual output; finally, we assess the importance of FDI for China's innovation.

- **Innovation will be key to underpin China's growth in the medium term**

New technologies can boost productivity and help China to move up in the global value chains. Therefore, China is keen on acquiring new technologies either by importing from abroad or by developing them via "indigenous innovation". The government initiated seven strategic emerging industries to facilitate the development and use of new technologies for the first time in its 12th Five Year Plan.

- **...however, China is still relatively behind**

China is a main manufacturing center of high tech products but, generally, only the low end of the value chain of global high tech industries is produced in China. The situation, however, is improving over time

- **China's efforts towards innovation increasingly important:**

More and better inputs

China has put great efforts to enhance its innovation capacity through R&D investment, building up a huge human capital pool, improving the enforcement of the protection of intellectual property rights as well as a set of government stimulus policies.

- **As regards the output of the innovation process, more successful on quantity than on quality**

China has been quite successful in terms of quantity (number of patents, etc) but far less in terms of "relevant" (i.e. path breaking patents).

- **... in the process FDI has made significant contribution**

FDI plays an important role in China's innovation, both by introducing new technology to China and by enhancing research capacity in China as well. The Chinese authorities should take this into account when designing innovation policies. They may want to be especially careful in how they define indigenous innovation.

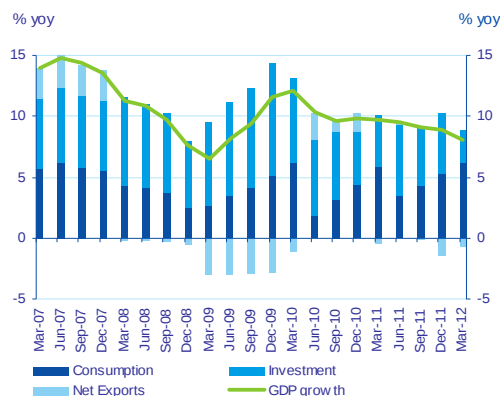
Innovation will be key to underpin China's growth in the medium term

China's interest in new technologies recently was reaffirmed by news from different sources: the first news is that China's Vice Premier Li Keqiang in his trip to the Europe from April 26 to May 4 urged Europe to loosen the ban of high tech to China; the second news is that in the third China-US Strategic and Economic Dialogue in May 3-4, China reached agreement with the US that the latter commits to take efforts to facilitate the export of civilian high-tech exports to China for civilian end-users and civilian end-uses; the third one is that China recently planned to lower import tariffs to encourage high tech imports; the lately one is that on May 30 China State Council stressed the support for seven strategic emerging industries via preferential policies and cooperation with international parties, aimed to stimulate the slowing growth. The news underscored China's efforts to acquire high technologies. According to China Ministry of Commerce, China imported 50 thousand items of technologies with a contract value of 119.5 billion USD from 2006 to November 2010.

Not surprisingly, foreign technologies are not always easy to acquire. In the meantime, China, a country with a strong tradition of self-consciousness, also feels uncomfortable for excessive reliance on foreign technologies. Therefore, besides foreign technologies China is keen on developing its own high technology, which is introduced as "indigenous innovation" in China's 11th Five-Year Plan (2006-2010), and also addressed in China State Council's "Medium and Long Term National Plan for Science and Technology Development 2006-2020". China's government has made a range of policies and regulations of intellectual property, standards, taxation, and government procurement to encourage indigenous innovation.

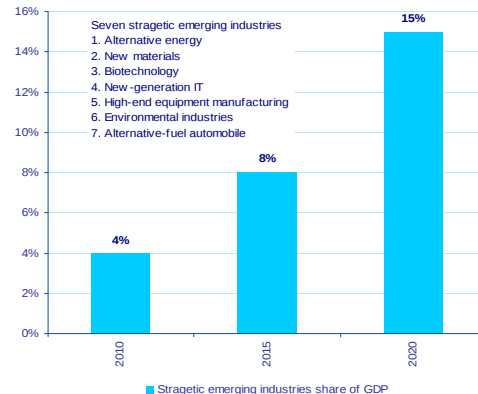
Why China pays so much attention to new technology? The answer is quite obvious: technologies are expected to play a bigger role to support China's economy, which is being rebalanced toward one with a slower but better quality growth from current labor intensive economy. New technologies can boost productivity and help China to move up in the global value chains. Therefore, China, to facilitate the development and use of new technologies, has selected seven strategic emerging industries as key growth engines in the medium term for the first time in its 12th Five Year Plan. The seven emerging industries, all more or less related to new technologies, include alternative energy, new materials, biotechnology, new-generation IT, high-end equipment manufacturing, environmental industries, and alternative-fuel automobile. The total size of these seven industries is expected to account for 8% of GDP in 2015 and 15% of GDP in 2020 from 4% as of 2010.

Chart 1
China is being rebalanced toward a slower but higher quality growth



Source: CEIC and BBVA Research

Chart 2
China aims to develop seven strategic emerging industries



Source: BBVA Research

...however, China is still relatively behind

China is a country widely deemed as relatively lack of innovation. That said, after opening up its door and reform the political and economic system for 30 years, numerous technologies came to China with foreign direct investment; on the other hand, China's enterprises also appear to be more creative and innovative in a more and more competitive market. Then, the question is that how innovative China is? The answer is mixed from a glimpse at China's innovation from two examples.

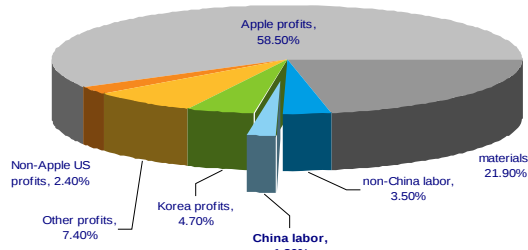
Let us first have a look at the popular iPhone example. According to a report (Xing, 2011¹), China in 2009 exported 25.7 million of iPhone, with a value of 4.6 billion USD in total. Nonetheless, the value added by China's iPhone exports only amounted to 6.5 million USD, or 3.6% of total value of iPhone exports. The lion's share went to the US, which included Apple profits (58.5% of total value) and non-Apple US profits (2.4% of total value). This is a typical story of "Made in China": main profits are attributed to foreign companies due to lack of new technology which leads to China's disadvantage position in the global value chains. The story tells us that China is still a country lack of innovation and new technology.

That said, not all stories are dim and disappointing. Data from export sectors tell an encouraging story. According to OECD data, China's exports of high technology products rose quickly to 28% as a share of total exports in 2006-09, from 14% in 1997-2000 and 24% in 2001-05. The ratio, which is comparable to those in the developed countries, has a wide lead to other developing countries (Brazil: 4.5%, India: 4.6%, and Russia: 1.4% as of 2006-09). Recalling the iPhone example above, nevertheless we should bear in mind that the value added in China are quite low when key parts and components accounted for about 80% of China's high-tech exports.

Now we might have a better understanding of China's innovativeness after examining the above examples. On one side, China is a main manufacturing center of high tech products; on the other hand, China, in the low end of the value chains of global high tech industries, contributes low value added to global high tech products. The facts confirm the common view that China is lack of innovation.

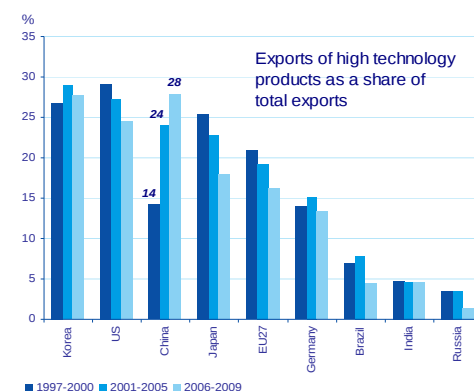
Chart 3
China's disadvantage in the global value chains: A case study of iPhone

Distribution of revenue for unit of iPhone



Source: Kraemer, Linden, and Dedrick (2011)³ and BBVA Research.

Chart 4
China's high-tech industries² grow their shares in total exports



Source: OECD and BBVA Research.

¹ Xing, Yuqing (2011) China's High-tech Exports: Myth and Reality, GRIPS Discussion paper 11-05.

² High-tech industries include aerospace, office & computing equipment, communications equipment, drugs & medicines, scientific instruments, and electrical machinery.

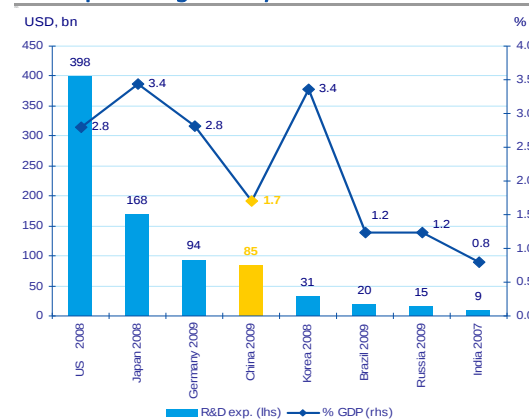
China's efforts towards innovation increasingly important: More and better inputs

Lack of innovation is embarrassing for China – the second biggest economy in the world that grew fastest in the world in the past three decades. China's innovation is apparently not a match to the economic giant from every aspect. Recognizing its need of high tech industries, China has put a great effort to enhance its innovation capacity.

As of 2009, China spent 85 billion USD on R&D, which accounted for 1.7% of GDP. China's R&D expenditure in 2009 is less than one fourth of that of the US, and about one half of Japan's. That said, it is much bigger than other developing countries both in absolute amount and as share of GDP (Chart 5). Moreover, in the 12th Five Year Plan China targets a R&D expenditure of 2.2% of GDP by 2015 and 2.5% of GDP by 2020 from current 1.8% (2006-2010 average).

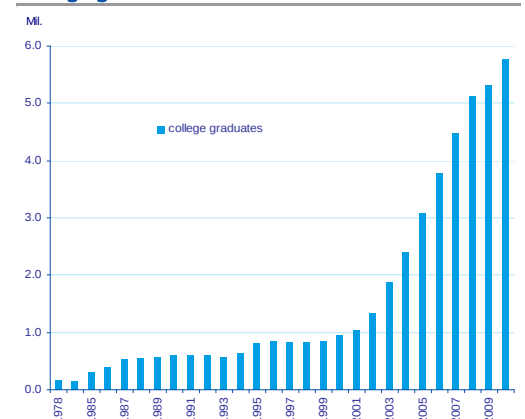
Another way to show China's effort lies in its rapidly rising human capital. According to China's National Bureau of Statistics, China's college graduates reached 5.7 million in 2010, after growing about 20% per year from 2001 (1 million graduates in 2001). (Chart 6) In the meantime, overseas Chinese students also increased rapidly in the past decade, by 10 per year from 2001 to 2010. The number of overseas Chinese reached 285 thousand in 2010, and 30% of them returned to China in that year. The rapid increase in domestic college graduates and returning overseas Chinese students boosts China's human capital.

Chart 5
China spends huge money on R&D



Source: OECD, CEIC and BBVA Research.

Chart 6
College graduates reached 5.7 million in 2010



Source: China NBS and BBVA Research.

³ Kraemer, Kenneth L.; Linden, Greg; and Dedrick, Jason (2011) Capturing Value in Global Networks: Apple's iPad and iPhone,

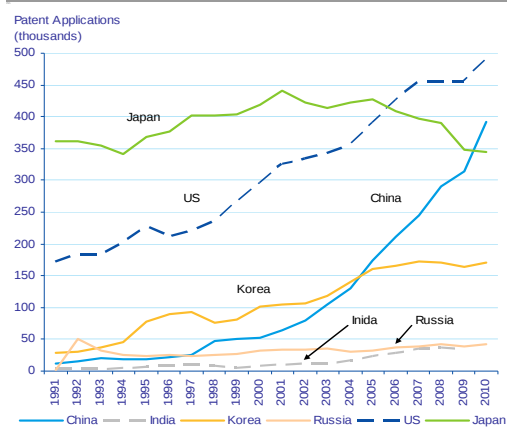
As regards the output of the innovation process, more successful on quantity than on quality

China actually has been benefiting from its efforts. The rising share of high-tech industries to total exports the note talked about in the previous section to some extent reflects China's success in innovation and high technology. Another story can be the increasing number of China's patents – the standard quantity measure to evaluate China's innovativeness.

According to the World Development Indicators of the World Bank, the numbers of China's patents approached 400 in 2010, ranking second (just after the US) in the world. For purpose of comparison, the numbers of patents for the US, Japan, Korea and India are 490 thousand (2010), and 345 thousand (2010), and 170 thousand (Korea), and 34 (2009) respectively. (Chart 7) If the number of China's annual patent applications increase at the same speed as in the past decade, it will outnumber that of the US just in a few years. It is worthy to note that FDI plays an important role, with data showing that non residents contributed more than one third of China's total patent applications in the past decade. (Chart 8) The number of patent applications definitely shows us an exciting story of China's huge progress in lifting its innovativeness.

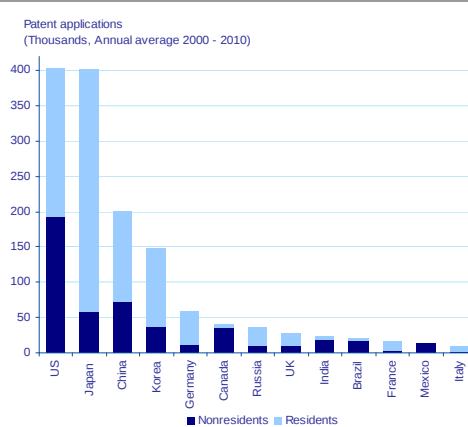
However, not all the data tell us a successful story about China's patents. If we examine the data from the quality perspective, we will find something disappointing: over 95% of China's patents were filed domestically. The fact that only a small portion of China's patents have been filed via the internationally recognized patent systems could reflect the lack of quality in China's patents.

Chart 7
China's patent applications accelerated in the past 20 years, outpacing its cohort countries...



Source: WDI and BBVA Research.

Chart 8
...of all, more than one third are attributed to non residents

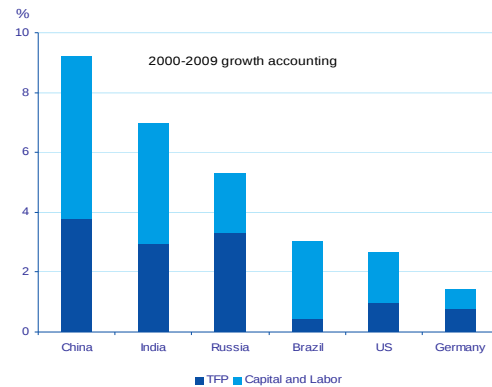


Source: WDI and BBVA Research.

Now let us look at innovation and technology from the view of Macroeconomics. According to the standard growth accounting method, a country's potential growth can be attributed to three factors: labor force, capital stock, and total factor productivity. Total factor productivity (TFP) is a measure of long term technological change. Estimating the contributions of these factors to China's growth in the past decade, we found that China's rapid growth in the period were contributed by all three factors, with TFP contributing 40% of 9.2% growth per year on average. (Chart 9) Our projection also shows that TFP will continue to support China's growth in the coming decade, by contributing 34% of projected 8.4% growth per year on average from 2010-2020. (Chart 10)

Chart 9

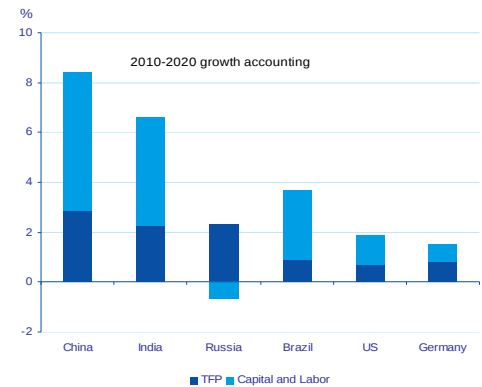
Total factor productivity (TFP) has contributed to China's rapid growth in the past decade



Source: BBVA Research.

Chart 10

...and is expected to continue supporting China's growth in the coming decade



Source: BBVA Research.

As a conclusion, China has put great efforts to enhance its innovation capacity, and is building up a human capital pool for innovation. It has achieved encouraging success in terms of quantity, but far less in terms of quality. From a macroeconomic perspective, technology is one of main contributor to China's rapid growth in the past and future, which explains why China emphasizes so much on innovation in its medium and long term development strategy. The importance of technology to China's growth underlines the necessity and urgency to enhance China's innovation. China in the past decades has been adept at absorbing foreign technology on one hand, and encouraged indigenous innovation on the other hand. However, it is lagged far behind in developing an institutional environment friendly for innovation, despite the improvement on relevant laws after joining the WTO (Patent Law; Copyright Law; and Trademark Law, etc.). For example, the protection and enforcement of Intellectual property Rights (IPRs) remains as a big problem in the country. Here in our short note we would not be able to elaborate how to help China to enhance its innovation capacity from the institutional perspective; nevertheless, we would like to cite some policy recommendations on the framework conditions for innovation in China by OECD (2012)⁴:

- *Improve the enforcement of intellectual property rights protection*
- *Foster competition to encourage firms to put innovation more at the centre of their business strategies*
- *Continue to improve corporate governance, with a view to improving incentives for business to invest in R&D and innovation*
- *Foster open and efficient capital markets to support the founding of new and innovative ventures, entry into new markets and the development of innovative products and services*
- *Implement innovation-oriented public procurement policy*
- *Use technology standards to foster innovation following international best practices*

⁴ OECD (2012), China in Focus: Lessons and Challenges, OECD, Paris.

...in the process foreign direct investment has made significant contribution

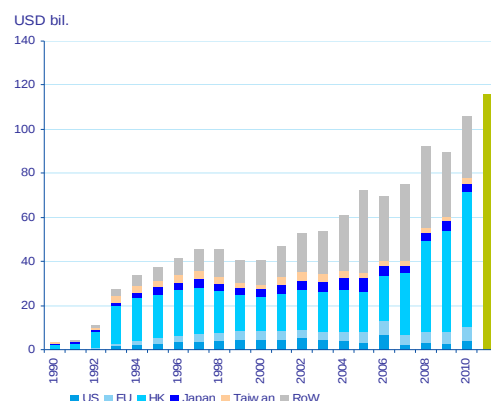
As early as 1978 when China began to open up its closed economy and started the reformation of the planning economic systems towards a market oriented economy, China adopted various policies to attract foreign direct investment which can bring the much needed capital, advanced management skills and technologies.

Thirty years later, massive FDI indeed has brought in China what had been expected. Japan, EU, US, and Hong Kong are main origins of China's FDI as well as main sources of technology transfers to China. This "coincidence" underscores the important role of FDI in technology transfer to China. (Chart 11 and 12)

Recent data from China's Ministry of Commerce show that in 2006-2010 50% of FDI concentrated on the manufacturing sector and foreign investment companies accounted for two thirds of China's high tech exports. Apparently, FDI has a significant role in help China to move up in the global value chains. On the other hand, data also show that international corporations have set up more than 1,400 research centers in China by September 2011 as 364 out of top 500 global companies have set up R&D centers in China as of 2010, which no doubt will help to enhance China's innovation capacity. The output of FDI and their R&D expenditure is considerable as shown in our previous story of China's patent application: non residents contributed more than one third of total patent applications in the past decade (Chart 8).

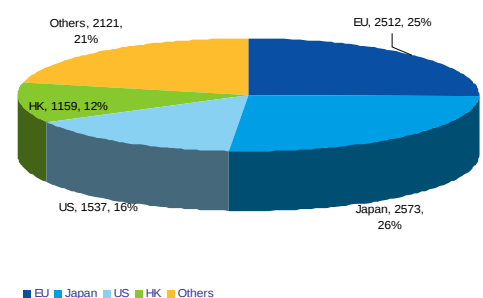
In a summary, FDI plays an important role in China's innovation, both by introducing new technology to China and by enhancing research capacity in China as well. In this regard, the Chinese authorities should take this into account when designing innovation policies. They may want to be especially careful in how they define indigenous innovation. The coming new amendment of *Catalogue for the Guidance of Foreign Investment Industries* by China's Ministry of Commerce is to encourage foreign direct investment in seven strategic emerging industries, which is expected to boost foreign investment and help to raise innovation in these key fields.

Chart 11
China's FDI increased by about 30 times in 1990-2010



Source: OECD, CEIC and BBVA Research.

Chart 12
Technology transfers to China by sources (Number of contracts, 2005)



Source: China NBS and BBVA Research.

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