

June 15, 2011

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Testimony before the U.S.-China Economic and Security Review Commission
**Hearing on China's Five-Year Plan, Indigenous Innovation and Technology
Transfers, and Outsourcing**

Chairman Mulloy, Chairman Slane, and Members of the Commission, thank you for the opportunity to appear today to discuss the economic implications of China's efforts to boost its technological prowess. China has adopted stances, such as its "indigenous innovation" policies, to advance the country from its status as a prolific, but low-end, producer of manufactures to a position of technological leadership.¹ In 2006, China released "The National Medium- and Long-Term Plan for the Development of Science and Technology (2006-2020)" which included the call for scientific advancement because "despite the size of our economy, our country is not an economic power, primarily because of weak innovative capacity."²

These policies ought to be a real source of concern for the United States. They may well prove costly to American firms, but there are limits to how costly they can be. They are unlikely to achieve their objective of vaulting China to the forefront of global innovation, a spot that the United States has traditionally enjoyed. The costs, instead, will be extracted from the gains that American firms would otherwise enjoy in the Chinese market. Contesting this policy should be a principal focus of U.S. commercial diplomacy with China.

In my brief remarks, I will focus not on the details of how China has implemented its policies, but on the broader economic ramifications. We should ask not only whether China is trying to achieve technological leadership and grow national champions – it is – but also whether such a policy is likely to succeed and what the policy will mean for the well-being of the United States. There is a long history of state-sponsored attempts to

¹ There are two excellent and comprehensive recent analyses of China's indigenous innovation policies: McGregor, James "China's Drive for Indigenous Innovation: A Web of Industrial Policies," July 2010, http://www.apcoworldwide.com/content/PDFs/Chinas_Drive_for_Indigenous_Innovation.pdf; and United States International Trade Commission, "China: Intellectual Property Infringement, Indigenous Innovation Policies, and Frameworks for Measuring the Effects on the U.S. Economy," Publication 4199, November 2010, <http://www.usitc.gov/publications/332/pub4199.pdf>

²McGregor 2010, p. 4.

grab technological leadership, from Soviet steel factories to European aircraft consortia. The key question is how we measure the success or failure of such plans. Is it the ability to make a commercial sale in a technologically advanced product category? If so, success is virtually assured. If, instead, we measure whether society gets a reasonable return on its investment, or whether the infant industry grows into a viable and thriving mature industry, or whether the country captures economic rents on the world stage that more than make up for its initial investment, then the prospects of success are very much in question.

Even if China were to succeed in creating new innovative sectors, it is by no means obvious what this success would imply for U.S. well-being. One can certainly construct economic scenarios in which a technological leader reaps inordinate gains. But one can also construct scenarios in which innovative industries spread their benefits globally, not just locally. In this latter case, outsized Chinese investments in technological development would benefit, not hurt, the United States.

China's motivation

China's insecurity about its place on the technological ladder may seem puzzling. After decades of double-digit economic growth, a relatively smooth ride through the recent global financial crisis, and sitting astride a growing mountain of foreign exchange reserves, China often appears to be a paragon of economic accomplishment. Yet China faces enormous challenges. For all its advances, it remains a relatively poor country. According to the World Bank, China's per capita income in 2009 was under \$4,000, less than 1/10 that of the United States.³ One common description of the problem facing China is that it is racing to get rich before it gets old. The race is a daunting one because China is aging at an extraordinary rate.⁴ It is careening toward a future in which a shrinking population of workers will have to support a growing population of dependents.

China's recent dominance of the global manufacturing scene is neither as secure nor as lucrative as it may seem. Prices and wages are rising in China and the supply of young, pliable workers who streamed from the interior of the country to work in the coastal factories has begun to dry up. There are newcomers such as Vietnam and Bangladesh eager to take China's place. Further, China's impressive export statistics and participation in production of advanced products often concealed a much smaller role when carefully assessed.

One such recent, striking illustration of the source of China's concern came in a U.S. study of Apple iPods. The researchers attempted to disentangle the value chain used to produce a 30GB Video iPod, with inspiration from Apple Computer in the United States,

³ World Bank, GNI Per Capita, Atlas Method (Current US\$), <http://data.worldbank.org/indicator/NY.GNP.PCAP.CD>. China's 2009 figure – the latest data available – was \$3,650; the comparable United States figure was \$46,360.

⁴ See Nicholas Eberstadt, "The Demographic Future," *Foreign Affairs*, November/December 2010. <http://www.foreignaffairs.com/articles/66805/nicholas-eberstadt/the-demographic-future>

parts from suppliers around the world, and assembly in China. They found that for an iPod with \$194 in “captured value” \$80 went to Apple and \$4 went to the manufacturers in China.⁵

Adam Segal of the Council on Foreign Relations provides a complementary example: “(F)or every Chinese-made DVD player sold, the Chinese manufacturer must pay a large royalty fee to the European or Japanese companies that patented various components of the unit, such as its optical reader. These foreign firms reap substantial profits, but the Chinese take is extremely small – and is shrinking further as energy, labor, and commodity prices rise.”⁶

The purpose of exploring the motivations behind China’s indigenous innovation policies is not to evoke sympathy for China’s plight but to understand the forces behind the drive to improve China’s status as an innovator. A policy such as this, based on fundamental Chinese concerns about the plight of their nation, will not be easily redirected. A diplomatic strategy to tackle these problematic policies will need to simultaneously address these Chinese concerns.

The Chinese Quest for Technological Advancement

China has used its indigenous innovation policies and support of domestic industries to try to move to the technological forefront in manufacturing. The indigenous innovation policies seek to leverage access to the large Chinese government procurement market. To leverage this market and spur Chinese innovation, in November 2009, the relevant Chinese ministries announced that there would be a national catalogue of products that met the criteria of “indigenous innovation.” The criteria dealt with the source and status of the intellectual property contained in the product, such as whether it was registered and owned in China. The effect was to favor home-grown firms over foreign ones. The Shanghai version of the catalogue listed 258 products, for example, of which only two were from manufacturers with foreign investment.⁷

A central and troubling feature of the policies is that they seem intent on extracting foreign technology as the price of access to the Chinese market. By prompting firms to reveal their technological secrets through either official disclosure or joint venture arrangements, foreign investors may lose valuable intellectual property advantages. Arguing for the centrality of this approach to the broader policy, McGregor cites the aforementioned Chinese Medium- and Long-Term Plan from 2006: “One should be clearly aware that the importation of technologies without emphasizing the assimilation,

⁵ Dedrick, Jason, Kenneth L. Kraemer, and Greg Linden, 2008, “Who Profits from Innovation in Global Value Chains? A Study of the iPod and notebook PCs,” Alfred P. Sloan Foundation Industry Studies, http://web.mit.edu/is08/pdf/Dedrick_Kraemer_Linden.pdf. Table 4, p. 21.

⁶ Segal, Adam, “China’s Innovation Wall: Beijing’s Push for Homegrown Technology,” *Foreign Affairs* online, September 28, 2010.

<http://www.foreignaffairs.com/articles/66753/adam-segal/chinas-innovation-wall>

⁷ McGregor, 2010, p. 19.

absorption and re-innovation is bound to weaken the nation's indigenous research and development capacity.”⁸ The USITC notes the “concern that foreign companies will need to share sensitive and proprietary technology with Chinese firms or government agencies in order to reap the full benefits of their investments in China.”⁹

There are two broader points worth noting about the indigenous innovation policies: 1. The policies are malleable and in a state of flux. 2. The catalogues and circulars describing government purchasing preferences are just one aspect of the broader push to stimulate Chinese innovation, largely at foreign expense.

The malleability of the policies suggests that this is an area in which diplomatic pressure could have an effect. The Chinese Ministry of Science and Technology requested comments on its initial and subsequent indigenous innovation regulations. In April 2010, the rules of 2009 were revised, partially responding to criticisms that had been lodged against the initial policy.¹⁰ Chinese leaders promised further revisions at the December 2010 meeting of the U.S.-China Joint Commission on Commerce and Trade (JCCT).¹¹ In January 2011, as an outcome of the summit meeting between Presidents Obama and Hu:

“The United States and China committed that 1) government procurement decisions will not be made based on where the goods’ or services’ intellectual property is developed or maintained, 2) that there will be no discrimination against innovative products made by foreign suppliers operating in China, and 3) China will delink its innovation policies from its government procurement preferences.

China agreed to eliminate discriminatory “indigenous innovation” criteria used to select industrial equipment for an important government catalogue prepared by the Ministry of Industry and Information Technology, to ensure that it will not be used for import substitution, the provision of export subsidies, or to discriminate against American equipment manufacturers in Chinese government programs targeting these products.”¹²

If they were to be taken at face value, these commitments would sound enormously promising. But their true value will depend heavily on the way they are implemented. Just this month there was one early indication of China's intent when the United States

⁸ McGregor, 2010, p. 4.

⁹ USITC, 2020, p. 5-5.

¹⁰ U.S.-China Business Council, “China Proposes Partial Solution to Indigenous innovation Issues,” April 12, 2010.

<http://www.uschina.org/public/documents/2010/04/indigenous-innovation-memo.html>

¹¹ U.S. Department of Commerce, “21st U.S.-China Joint Commission on Commerce and Trade Fact Sheet,” December 2010. <http://www.commerce.gov/node/12467>

¹² White House Office of the Press Secretary, “Fact Sheet: U.S.-China Economic Issues,” January 19, 2011. <http://www.whitehouse.gov/the-press-office/2011/01/19/fact-sheet-us-china-economic-issues>

Trade Representative's Office announced that China would end subsidies for wind power equipment, to which the United States had objected.¹³

The importance of implementation highlights the importance of the second point – the interconnected set of Chinese policies that are directed at the broader goal of advancing Chinese innovation and disadvantaging foreign firms with leading-edge technology. Other related policies include weak enforcement of intellectual property rights protections for firms operating in China, biased standard-setting, support for Chinese state-owned enterprises to serve as “national champions,” and the potential interplay between China's anti-monopoly law and the intellectual property regime.¹⁴ Thus, the implementation question concerns not only revisions to indigenous innovation catalogues but a much broader set of governance tools that can be used to achieve similar ends.

The impact on the United States

One implication of the rapid pace at which the policies are evolving is that the economic impact is particularly difficult to analyze.

“Many policies remain in draft form, many of the implementing regulations for major laws are still not in place, and enforcement of most indigenous innovation policies has not yet begun. Much of the concern thus reflects fear of future Chinese policies and of the way new laws may be implemented, and not simply objections to policy actions that the Chinese government has already taken. It remains unclear how the effects of the new policies will play out.”¹⁵

A first, important point to establish, however, is that the Chinese approach to indigenous innovation is unlikely to succeed. The vibrant and innovative U.S. technology industry has benefited from federal support for basic research, from independent and successful research universities, from a community of scholars and researchers drawn from around the world, from strong intellectual property protections, and from a competitive market environment that allows entrepreneurs to emerge and thrive. This is the antithesis of an approach that stifles the competitive environment, names national champions, and at least tacitly condones intellectual property theft. The environment that China is creating is unlikely to attract top research talent from around the world, for example, since such innovators generally value their intellectual freedom and independence. The weak protections for intellectual property will offer few incentives even for Chinese firms to invest heavily in risky new ventures.

One recent report described the fascination in China with Apple Computer and its new iPad. “Some members of China's top legislative bodies have expressed worries as to whether China will be able to match companies like Apple, as the country – like the rest

¹³ USTR, “China Ends Wind Power Equipment Subsidies Challenged by the United States in WTO Dispute,” [Press Release](#), June 2011.

¹⁴ USITC, 2010, pp. xx and 5-6 and McGregor, 2010, p. 23.

¹⁵ USITC, 2010, p. 5-2.

of the world – has been enthralled by the succession of innovative products from the California-based company.”¹⁶

But would any government have been able to pick Apple as a future technological leader? It is worth noting that a decade ago, on the eve of the introduction of the iPod, Apple hardly looked like a likely candidate for such success. It was struggling. It produced a computer with an elegant operating system but a declining share of the personal computer market. Having apparently lost the desktop battle to Microsoft Windows, Apple was more often cited as a case study for how not to approach a technology market. And yet, through the introduction of the iPod, iPhone, and iPad, Apple revived its fortunes and prospered. Had one been looking for a technology champion to support in 2001, one would have looked elsewhere. In corresponding fashion, some of the technology giants of decades past have faded into obsolescence. There is a fundamental unpredictability about which firms are going to come up with new and market-leading technologies. This puts a centrally-planned approach at a distinct disadvantage.

There is little history to indicate that cutting-edge technology can emerge from a stultifying government-dominated approach. This would be true if China were already a market leader, trying to protect its advantage. It is even more true when China is a technological laggard trying to catch up. Appropriation of other countries’ technological advances can facilitate catch-up, but it is distinctly different from crafting a set of policies that will turn a country into a world leader.

The inadvisability of China’s approach to the promotion of innovation provides an opening for diplomatic dialogue. An alternative approach that shunned intellectual property theft, protected innovators of all nationalities, and supported basic research would be beneficial for both China and the West. It also means that the economic impact on U.S. firms investing in China can be analyzed in a more conventional way. For such firms, China’s as-yet-ill-defined policies can be thought of as a means of extracting a higher price for participating in the Chinese market.

Imagine a firm that estimated the net present value of future profits in the Chinese market at \$2 billion. Suppose China’s indigenous innovation policies effectively compelled that firm to turn over intellectual property worth \$1 billion. This would leave the firm distinctly worse off than without the policies, but still distinctly better off than if it were to abandon the Chinese market. If the price of participation were a technology worth \$3 billion, however, the firm would be better off leaving the Chinese market. This suggests that the present value of expected profits of U.S. high technology firms in the Chinese market provides an upper bound to the economic cost of Chinese policies. This could be very substantial, but it is much more modest than the costs of a world in which the United States hands over technological leadership to China.

¹⁶ Su, Andre, “Where is China’s Apple?” *Want China Times*,” March 5, 2011. <http://www.wantchinatimes.com/news-subclass-cnt.aspx?cid=1101&MainCatID=11&id=20110305000083>

There are a number of objections to this reasoning that can be grouped into ‘reasons that firms cannot walk away from China.’ They are described by the USITC report:

“First, China is the world’s largest and fastest-growing market, making it critical for global companies to remain active there. Second, U.S. industry representatives believe that even if they were to refrain from operating in China, their global competitors would fill the gap, leading to both large revenue losses and the likelihood that Chinese companies would be able to access similar IP elsewhere. Finally, in some industries, technology advances so quickly that by the time foreign companies in China are competing against technology stolen from them, they expect to be ready with a new generation of technology, so the stolen IP is no longer a critical competitive factor. In any event, because U.S. and other foreign firms are certainly profiting from their ongoing participation in the Chinese market, their shorter-term interest in maximizing current profits may encourage them to set aside their longer-term concerns regarding IP infringement and market access.”¹⁷

Taking each of these points in turn: First, the argument that China is a large market recalls the old joke about a businessman who acknowledged that he would lose money on each sale, but planned to make it up on the volume. It is profitability that matters. It is entirely possible to have a large, growing, competitive market that delivers little profit to participants.

Second, if an industry has close competitors whose technology serves as a close substitute, then it matters little whether that technology is in the hands of China or the original competitors; the U.S. firm would not seem to have much of an edge.

Third, the argument that technology rapidly becomes obsolete simply implies that there are limits to the costs China can impose by compelling technology transfer. This argument, in fact, explains why firms would not need to walk away from China.

The final argument is an intriguing one. It suggests that technology firms will be myopic and overemphasize short-term gains relative to long-term costs. This is odd on at least two counts. Technology firms are generally in the business of balancing the short and the long term, since they must make large up-front investments (e.g. billions of dollars in developing a new semiconductor chip technology and fabrication plant) that will only pay off over time. If the firms are bad at such calculations, they have much deeper problems than China’s intellectual property environment. Further, what matters is the relative myopia of the private sector relative to governments. One way to interpret China’s pursuit of indigenous innovation is as a myopic mistake, an impatient effort to jump to the head of the world technology standings rather than developing an environment that is truly conducive to innovation and scientific development.

¹⁷ USITC, 2010, p. 5-23.

Should the United States feel threatened or thankful?

Finally, let us turn from the substantial costs that China can impose on U.S. firms through distortionary policies to the question of what Chinese leadership in a high technology sector might mean. It was argued earlier that such lasting leadership is unlikely to be achieved, without a complementary set of policies more conducive to innovation, such as intellectual freedom and IPR protection. Suppose, though, that China does ascend to the technological mountaintop in some key sector, just on the basis of massive government support. Suppose this support let Chinese scientists overcome a technological obstacle that had stymied competing scientists around the world? What would that mean for the United States?

The worst case scenario is that China would be the sole producer of this key product and would be able to charge high prices to all comers, extracting monopoly rents. To do that, though, the Chinese sector would need to keep its solution from becoming known around the world, lest it lose its edge. In economic parlance, the spillovers of technological innovation have to be local, not global.

In fact, the ample literature on technological diffusion frequently finds that spillovers are global, not local. One seminal paper by Klenow and Irwin on the semiconductor industry, for example, found that “learning spills over just as much between firms in different countries as between firms in a given country.”¹⁸ In semiconductors, Klenow and Irwin also found that there was very limited evidence of spillovers from one generation of chip to the next. Thus, grabbing a technological lead at one moment did not seem to ensure leadership thereafter. Nor were Klenow and Irwin alone in showing the difficulty of meeting the requirements of successful government intervention. Eaton and Grossman famously disabused enthusiasts of strategic trade policy through showing the sensitivity of the model to theoretical variations.¹⁹ Paul Krugman helped lead an empirical search for candidates for government support in trade, a search that came up empty.²⁰

We can certainly construct theoretical examples in which a government investment in an industry pays off many times over, but the strong theoretical assumptions that are needed to make such a case rarely seem to apply. Failures and missteps are rampant, when the government backs the wrong technology or the wrong firm. Even when the government succeeds, spillovers are often global, not local. Technological leadership is transitory, not permanent. These are the questions that have cast doubt on the advisability of industrial policies for decades.

¹⁸ Irwin, D.A. and Klenow, P.J. 1994. "Learning-by-Doing Spillovers in the Semiconductor Industry." *Journal of Political Economy* 102(6): 1200-1227.

¹⁹ Eaton, J., and G. Grossman. 1986. "Optimal trade and industrial policy under oligopoly." *Quarterly Journal of Economics* 101:383-406.

²⁰ Krugman, Paul, and Alasdair Smith, eds., Empirical Studies of Strategic Trade Policy, University of Chicago Press, 1994.

Conclusion

China is approaching the issue of technological leadership from a position of weakness, not strength. It faces a broad range of concerns about its economic future and is concerned about the economic effects of being relegated to a position of eternal, cheap, low-end manufacture.

The United States and China share an interest in seeing China emerge as a prosperous technological innovator. This emergence should come about through creation of an environment that supports basic research and international collaboration, provides for intellectual freedom, and facilitates entrepreneurial competition. It should not come about through the expropriation of foreign technology. China's indigenous innovation policies represent a serious misstep along this path. The policies do not threaten U.S. technological leadership in the long run, but they do threaten to impose substantial costs on U.S. businesses in the short run.

The willingness of China's leaders to rethink some aspects of this policy is welcome, but it remains to be seen whether it represents a sufficiently thorough reorientation. Such a reorientation is likely to require a sustained and focused prioritization of the issue in U.S. commercial diplomacy.