# China Prompting Western Creativity

Apple store in Grand Central Terminal, New York City.

## Chinese manufacturing exporters are capturing low-skill production but driving high-skill innovation in the West

*Nick Bloom, Mirko Draca, and John Van Reenen*

WHEN the California high-tech company Eye-Fi introduced a new memory chip in 2005 with built-in wi-fi capability it faced a challenge common to many technology firms: how to take a promising prototype and turn it into a mass-market, low-cost product—and get it to market before its rivals.

Eye-Fi's solution was an approach that Western firms increasingly are taking in response to the emergence of China as a manufacturing superpower. It used a local California boutique manufacturer to develop prototypes, which Eye-Fi's engineers refined on an almost daily basis. As demand took off and the product was widely marketed, Eye-Fi moved from low-volume boutique production in the United States to high-volume, low-cost production in China. The high-skill innovation and development took place in the United States, but the lower-skill mass production was moved offshore. As Chinese mass manufacturing increasingly dominates global production, this story is being repeated across the United States, Europe, and Japan.

The stories of Apple's iPhone and iPad are similar. Both were designed and prototyped in California, then produced in China. Chinese manufacturing competition is increasingly capturing low-skill production while simultaneously fostering high-skill innovation in the West.

This reflects how many Western firms are successfully facing the growing economic power of China. The tenfold increase in China's share of imports to the United States and Europe between 1987 and 2007 may have cost many low-skilled workers their jobs (see Chart 1). That is the bad news. But as Eye-Fi illustrates, the dramatic surge in Chinese exports to Europe and the United States is good news for the economic prospects of Western economies, which must be based on innovation. Chinese exports have encouraged the best firms in advanced economies to get better, powering the innovations that will provide future growth. Of course not everyone will gain—low-skilled workers in Europe and the United States are suffering as employers switch to more highly skilled employees.

Chart 1

**On the cheap**

China accounted for nearly all of the sharp growth in imports from low-wage countries to the United States and Europe between 1987 and 2007.

(share of imports to Europe and the United States, percent)


Source: Authors' calculations.

Note: Low-wage countries are those whose GDP per capita was less than 5 percent of U.S. GDP per capita between 1972 and 2001.

Take footwear, a classic low-tech sector. Under conventional wisdom, shoe production would be totally offshored to a low-cost producer like China or Vietnam. Indeed, many shoe manufacturers in the United States and Europe have disappeared. But some are innovating with designs that serve parts of the market in which China is less able to compete.

For example, Masai Barefoot Technology (MBT), which makes posture-correcting shoes, began when Karl Müller, a Swiss engineer with a bad back, found relief by walking barefoot on Korean grass. He patented a design to emulate the effect, which has gone on to great success and now attracts many imitators.

Many firms, like MBT and Eye-Fi, have responded to potential inroads by Chinese manufacturers by investing in new technology and human capital and by innovating with highly customized designs. There were far fewer firms doing such innovation before trade integration with China because it is much easier to keep doing things the same way. But a big shock, like competition from Chinese manufacturers, reduces the opportunity cost of innovation and discourages firms from coasting along doing business as usual.

## Chinese accession to WTO

A big part of the shock to manufacturers in advanced economies came when China joined the World Trade Organization (WTO) in December 2001 and many trade barriers to Chinese goods were eliminated over the ensuing four years, particularly in textiles. This led to a huge surge in Chinese imports in those economies and to a battle between retailers looking for low-cost products and domestic manufacturers seeking to preserve their markets. Domestic manufacturers, in fact, had partial success in restoring some quotas. Chinese-made clothing, notably women's underwear, piled up in European ports until the European Union and China brokered a deal to end the so-called bra wars.

Events such as China's accession to the WTO are natural experiments for examining the effect of competition from low-wage countries—an opportunity we put to use in our research. In the largest ever study of the impact of China on Western technological change, we tracked the performance of almost half a million manufacturing firms in 12 European countries over the past decade (Bloom, Draca, and Van Reenen, 2011).

We looked in detail at firms' investments in information technology (IT), patenting, research and development (R&D) expenditures, management practices, and productivity growth across all manufacturers. We then quantified the natural experiment offered by WTO accession using detailed information on European textile, clothing, and footwear import quotas.

## China effect on technology and jobs

A startling finding is that about 15 percent of technical change in Europe in the past decade can be attributed directly to competition from Chinese imports, an annual benefit of almost €10 billion to European economies. Firms have responded to the threat of Chinese imports by increasing their productivity—adopting better IT, boosting R&D spending, and increasing patenting. Unsurprisingly these actions led to major increases in productivity.

Overall, our findings are consistent with a "trapped factor" explanation of how trade from China drives innovation in exposed firms (Bloom and others, 2012). The intuition behind this model is that some factors of production are costly to move between firms because of adjustment costs and sunk investment—that is, partially irreversible investments (say in firm-specific skills) that cannot be fully recovered. Although Chinese imports reduce the relative profitability of making low-tech products, firms cannot easily dispose of their "trapped" labor and capital factors. As a result, the shadow cost of innovating and producing a new good falls. That is, by reducing the profitability of current low-tech products, Chinese trade reduces the opportunity cost of innovation, which frees up inputs to produce new products and revamp processes.

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The trapped factor effect is well illustrated at a U.S. machinery parts firm we recently visited. Until the early 2000s, the firm churned out a broad mix of products to supply the market. But Chinese firms entered and were able to produce all the standardized catalogue parts at almost half the price. So the U.S. firm simply stopped supplying the catalogue market. This led to some downsizing at the company—low-skilled workers were laid off and parts of the production line were closed down. But at the same time the firm saw it had a market for small production runs that required a fast turnaround (parts needed "tomorrow"), for sensitive customers (military or commercial prototypes), and for products ordered to specification (like the initial production runs for firms such as Eye-Fi). So innovation increased and more engineers were hired, while many low-skilled employees were laid off. Management practices also had to improve substantially to cope with the greater product range and faster turnaround times. Overall, the company shifted from being a mass-market to a niche-market operation, increasing its innovation and IT intensity.

In our study we found rigorous statistical evidence of this trapped factor effect. Big increases in the threat of Chinese competition boosted technical change on average, but the effects were much stronger where there were higher levels of firm-specific or industry-specific capital. Still, not all firms have responded positively by turning to innovation. Inefficient low-tech firms have been much more likely to shed jobs and simply disappear. This in itself raises productivity through the brute force of natural selection, as economic activity shifts from inefficient com-

panies to their more nimble-footed competitors. About a third of the overall effect of Chinese competition occurs in the form of this "creative destruction." Practically, we find that investing in technology can do much to shield firms in all types of markets from the negative job impact of Chinese competition.

Chart 2 shows creative destruction in action through an examination of job growth in different types of firms in Europe. In the left panel are plants in industries with relatively slow growth of Chinese imports—for example, pharmaceutical and medical device firms. Unsurprisingly, high-tech firms grew faster than low-tech firms. (In the chart we show this disparity for IT intensity, but the same pattern holds for all other technology indicators, such as patents and productivity.) The right panel shows job growth in industries such as furniture, apparel, and textiles in which Chinese import growth was rising dramatically. Just as for the industries less affected by Chinese imports, job growth in high-tech plants was about 10 percent. Although low-tech plants downsized on average in all sectors, many more jobs disappeared in industries more affected by competition from China. In those plants, employment declined nearly 20 percent compared with 10 percent in plants less affected by competition from China. Chart 2 actually underestimates the low-tech decline because it counts only firms that survived. We also found that competition from China increased the failure rate of low-tech firms, but not of high-tech firms.

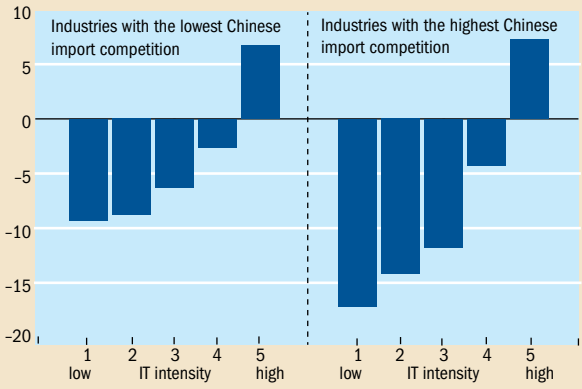
We measured the effects of Chinese import competition on final goods—those consumed by the purchaser. But there is an offshoring effect as well on intermediate, or downstream, goods used as inputs by firms in upstream industries. We calculated the effects of this offshoring channel and found that it generated additional positive effects on productivity.

Chart 2

**High-tech saves the day**

Jobs in low-tech plants in Europe shrank across the board between 2000 and 2005, especially in those more exposed to competition from China. Jobs in high-tech plants grew, even in industries with heavy import competition from China.

(employment growth, 2000–05, percent)




Source: Authors' calculations.

Note: The chart covers job growth between 2000 and 2005 at 21,000 plants in 12 European countries. The left panel depicts industries that were in the bottom 20 percent of Chinese import growth, such as pharmaceuticals. The right panel depicts industries in the top 20 percent of Chinese import growth. Information technology (IT) intensity measures computers per worker. Plants in the lowest 20 percent (1st quintile) had the fewest per worker; those in the top 20 percent (5th quintile) had the most.

## What policies are needed?

There are many benefits of Chinese trade beyond increasing the innovation rate of Western firms. For example, consumers enjoy lower prices, bigger export markets spur investment, and integration means classic gains from specialization.

Although openness improves overall prosperity, the burden of adjustment falls more heavily on poorer, largely unskilled workers, who are now competing with workers in Beijing rather than Birmingham. In addition to the usual channels, our data predict decreased demand for less-educated workers because of accelerated technical change induced by competition from China. Barring retraining or other work support, low-skilled workers face an increasingly bleak future.

It is job losses like these that generate political resistance to trade with China and lead to pressure to act. More export subsidies, labeling China a currency manipulator, and higher trade barriers to benefit industries that are losing out to China are likely to accomplish little and may actually be harmful. Not only will such activities drive up domestic prices—take a walk around a Walmart to see how Chinese goods are saving shoppers money—but restricting imports will also delay necessary restructuring and chill innovation. In fact, trade barriers are likely to persuade firms to divert spending from science and innovation to lobbying and political donations.

The better policy response is to enhance human capital through education and training. This would ease the transition of displaced workers across jobs and allow competitors to seize the opportunity for Chinese trade to drive their creative sectors while producing cheaper goods for their consumers, benefiting both China and the West. And when training is difficult or uneconomic—for example, for workers nearing retirement in heavily depressed areas—regional assistance and generous compensation will soften the blow and help those who wind up losers from globalization. ■

*Nick Bloom is a Professor of Economics at Stanford University and a Research Associate at the Centre for Economic Performance (CEP). Mirko Draca is a Research Economist in CEP's productivity and innovation program. John Van Reenen is Director of CEP and a professor of economics at the London School of Economics.*

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