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A Global Industrial Rebalance: China, the U.S. and Energy-intensive Manufacturing

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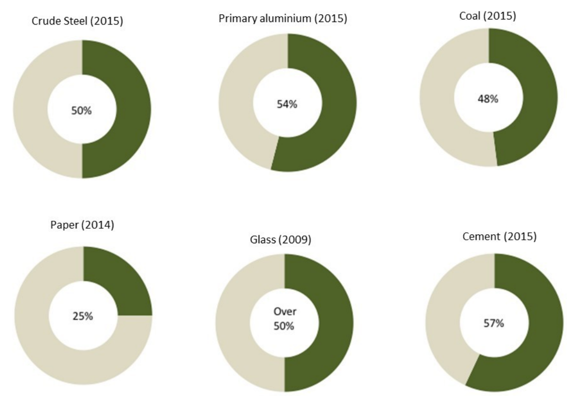
Abstract

A "global industrial rebalance" refers to a recent relocation of some energy-intensive industries from China to technologically more advanced countries. This is a reversal of the trend of several decades, which has resulted in a global concentration of energy-intensive manufacturing in China, notably steel, cement, aluminum, paper and glass. In this article, I argue that such a global industrial rebalance would benefit both China and the world. The relocation of energy-intensive production is also economically viable, as illustrated by a number of recent investments in the U.S. by Chinese firms in those industries.

As a global powerhouse in manufacturing, China now produces more steel, aluminium, glass and cement than the rest of the world combined (Fig. 1). The global concentration of energy-intensive manufacturing has been at the center of China's rapid industrialization and its positioning as the world's factory in the course of recent decades, as well as the deindustrialization that has concurrently occurred in many western countries.

Figure 1. China's share of world production in selected industries



Source: author based on the data available from the World Steel Association (for steel), the US Geographical Survey (for aluminium and cement), the BP Statistical Review of World Energy (for coal), Wintour (2014) (for glass), and statistica.com (for paper).

Yet today, excessive production and export of many energy-intensive products in China, such as steel, aluminium and glass, are becoming increasingly problematic for the country and for the world. These Chinese industries are plagued by rising costs and shrinking demand, and they bear heavy responsibility for high levels of air, water and soil pollution that have accompanied China's emergence as the world's leading producer of greenhouse gases. Overcapacity in these sectors, where their capacity to produce efficiently exceeds demand, has been widely recognized by the Chinese government, the industries and the public.[1]

The oversupply of these products in China has produced strong criticism from other countries. In western countries, increasing trade with China, especially since China's entry into the WTO in the early 2000s, has brought considerable economic benefits in terms of providing consumers with low cost products. However, the trade has also had negative consequences for certain industries and regions, an effect that economists have termed "China shock".[2] The spectre of competition from Chinese imports has been used by politicians in a number of countries to introduce protectionist measures amidst charges of illegal Chinese protectionism, sometimes to justify nationalist agendas.

In 2017, the total U.S. trade deficit was $566 billion, of which about $375 billion, two thirds of the total, was with China. The Trump administration has recently introduced a number of protectionist trade policies with a claimed aim to reduce the trade imbalance with China, including tariffs imposed in March 2018 on imported steel and aluminium, and further tariffs on billions of dollars of Chinese imports following the Section 301 investigation. Since the U.S. trade deficit is primarily driven by factors such as the comparative advantage of low wages and high efficiency in East Asian economies and long-term flight of major industries abroad,[3] together with overspending by Americans and over-saving by Chinese and others,[4] those tariffs alone will have limited impact on the pattern of world trade.[5] The U.S. trade deficits also reflect the positionings of the two countries in their economic relationship, where China is mainly an exporter of manufactured goods while the U.S. exports more services.[6]

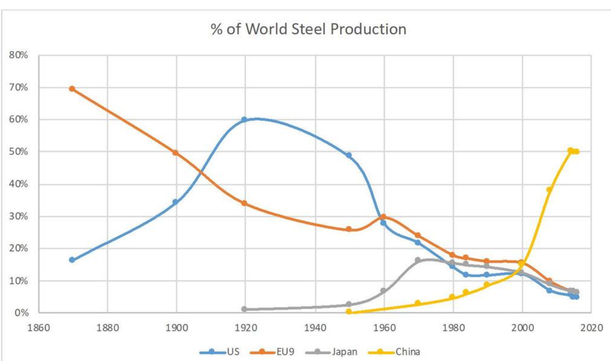
Economists have also pointed out that American officials regularly overstate the size of the U.S. deficit with China. For example, the actual trade surplus of China with the U.S. in 2011 was actually one-third smaller than the official figure when measured in terms of value added when the foreign content of Chinese exports was deducted from the value of gross exports.[7] This is the major reason why U.S. estimates of the trade imbalance are far higher than Chinese estimates. Further, limitations of unilateral trade protectionist actions to reduce the trade deficit, and the damages to global trade for all economies including those who start the trade war, have been well discussed in the literature.[8] Indeed, China's tit-for-tat trade retaliation, especially its targeting of U.S. exports of soybeans and cars, has already created turmoil in the U.S. stock market and provoked concerns of American enterprises and farmers.

Despite the protectionist measures currently being imposed by countries, fundamental economic and political changes are occurring in China and western countries that will have more long-lasting effects on trade and the global industrial structure. Shifting economics in energy-intensive industries, such as steel, glass and aluminium, and domestic political considerations, are driving relocation of manufacturing activities in those industries from China to developed countries, in particular the U.S. The result of this is what I call "a global industrial rebalance." Such a rebalance will benefit the global environment thanks to differences in energy efficiency across countries.

Energy-intensive production in China and the challenges this poses

Since the 1980s, China has emerged as a major producer in a number of heavy industries, including steel and aluminium. China produced less than 0.01% of global steel at the time of the Chinese revolution in 1949, and about 5% in 1980 when it started its "Reform and Opening" policy. Chinese steel output expanded from 10% to 50% of the global total between 1990 and 2015. By contrast, the share of steel output from major steel producing countries in Europe in the global total has consistently declined over most of the past 150 years (Fig. 2). Steel production in the U.S. as a percentage of the global total peaked in the early 1920s and fell sharply thereafter. The U.S. currently accounts for less than 5% of global steel production. Similarly, the share of Japanese steel production continues to fall after reaching over 15% of the global total in the 1970s. Increased steel production has not been limited to China. It has also grown in other new industrialising countries such as India, which currently contributes about 6% of the global total - but China's steel production has outstripped that of all other countries. The result is that global steel production has shifted dramatically against the United States, Europe and Japan and toward China over the last century and particularly the last four decades.

Figure 2. Shares of world steel production by countries (1870-2016)



Source: author based on data available in Tarr (1988)[9] (for the period up to 1984) and from the World Steel Association (for the period since 1984.)

The rapid growth of China's heavy industries such as steel and aluminium played an important role in the country's industrialization. The level of steel consumption per capita in China (480kg finished steel equivalent in 2014) is now not only well above that in other BRIC countries, including India (58kg), Brazil (136kg), and Russia (351kg), but also surpasses the level in many developed economies, including the US (387kg), Japan (411kg), and Germany (364kg).[10] However, the continuous growth of production in these industries in China is increasingly recognized as being unsustainable.

These industries have struggled financially in recent years. According to official Chinese statistics, steel was the least profitable of all Chinese manufacturing industries for six consecutive years between 2011 and 2016, the profitability level ranging between -2.2% and 2.9%.[11] In 2015, the industry as a whole lost RMB 78 billion (US$12 billion). The profitability of aluminium was not much better, below 4% in a majority of recent years. The poor financial performance of those industries has been due to intensifying competition resulting from excess capacity, and fast-growing production costs. The latter has particularly been driven by rising costs of labour and more rigorous enforcement of environmental laws as both official and popular concern about climate crisis and local pollutions grows. While many environmental policies and laws introduced in China in the 1980s and 1990s were regarded as 'paper tigers',[12] enforcement of environmental laws has been strengthened in recent years. For example, authorities launched a number of so-called 'environmental protection storms' during which many steel plants that did not meet environmental standards were forced to upgrade their technologies or in some cases were shut down.[13]

Facing an increasingly saturated domestic market, Chinese companies have set their sights upon the international market. Over the ten years since 2005, exports of Chinese steel products increased more than 500%, from 20 million tons in 2005 to 112 million tons in 2015. Exports of Chinese aluminium products quadrupled during the same period, from one million tons to four million tons. Chinese exports of energy-intensive goods, particularly steel, have become a major subject of international trade disputes with a record number of trade remedy investigations of Chinese steel launched by its trading partners in 2016. Among 119 anti-dumping and anti-subsidy investigations in the year, 49 concerned Chinese steel products.[14] Consequently, exports of Chinese steel fell to under 100 million tons in 2016 and 75 million tons in 2017.

The few, if any, financial gains for China's energy-intensive industries come at a significant cost for the rest of the country. A 2014 study by researchers from Tsinghua University, for instance, found that coal, a main ingredient in energy-intensive production in China, would be 40% more expensive if local social and environmental costs were taken into account, even without considering costs associated with climate change as a result of carbon emissions.[15] This comes at a time when Chinese citizens and officials alike are pressing to improve the country's environmental record — according to a 2015 online survey, air pollution was the single most important issue concerning the Chinese public, even ranking above corruption and the wealth gap.[16]

Exports of energy-intensive goods such as steel and aluminium are creating ever greater environmental problems and other challenges for China. One 2015 study indicated that export-related production from China accounted for 15% of the country's emissions of PM2.5, a deadly industrial byproduct that kills 157,000 Chinese each year.[17] Exports also account for around 20% of the country's carbon dioxide emissions—a substantial amount, given that China is the world's largest carbon emitter.[18] China's steel industry uses more energy than any other domestic industry. Production of steel, aluminium, cement and glass accounts for approximately one fourth of total energy consumption in the country. China needs to greatly reduce production in those energy-intensive industries in order both to combat local pollution and to fulfill its commitment as part of the Paris agreement to reach peak carbon emissions by 2030.

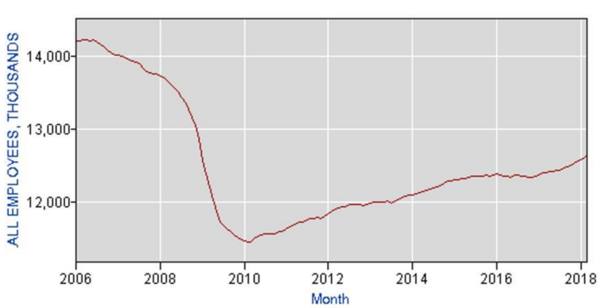
The Chinese government has initiated some steps in this direction, announcing plans to cut steel production capacity by 100 to 150 million tonnes over the 13th Five-Year plan period (2016 - 2020), and to significantly reduce production in other energy-intensive industries, such as cement, aluminium, and glass. Some recent plant closures, such as those in Hangzhou and Sichuan, have drawn intense scrutiny from international media.[19] In April 2017, the Chinese government announced a plan to create a massive "special economic zone" called the Xiongan New Area in Hebei Province. Hebei is the heartland of China's steel industry, currently producing almost one-quarter of the crude steel output in the country. To establish Xiongan, which the government has billed as a "world-class, green, modern and smart city," many of the old, polluting steel mills will reportedly be dismantled. For example, Baoding, a former steel city in Hebei near Xiongan New Area, announced in 2017 that it had become a 'steel production free' city.[20]

Relocation of energy-intensive manufacturing

At the same time that China is looking to reduce its energy-intensive production, U.S. energy-intensive manufacturing is becoming more economically viable thanks to the recent revolution in shale gas production. Shale gas production through fracking technologies in the United States and other developed countries has confronted powerful, but largely abortive, anti-fracking movements denouncing the environmental consequences of fracking. Nevertheless, soaring shale gas output has effectively brought down energy costs of manufacturing in the U.S.

Energy is a significant portion of total production costs in energy-intensive industries, for example, up to 40% in steel making,[21] and 14 - 40% in glass production, depending on plant location. Today, the price of liquefied natural gas (LNG) is 70% lower in the U.S. than in China, and electricity for industrial consumers is almost 40% cheaper,[22] making energy-intensive manufacturing in the U.S. increasingly attractive. Some companies are taking note. In 2017, one of Taiwan's largest steel companies announced that it had abandoned a plan to invest in Vietnam, and instead planned to invest $1.6 billion to build a steel factory in the U.S.[23] The largest auto glass producer in China, Fuyao Glass, recently made a $1-billion investment in Ohio.[24] This trend is further illustrated by Chinese manufacturers' recent investments in other energy-intensive industries, such as paper[25] and aluminium[26], in the U.S. According to data from the U.S. Bureau of Labor Statistics, manufacturing jobs in the U.S. , which have fallen since 1979, have indeed increased since 2010 (Figure 3). While still at an early stage, manufacturing industry in the U.S. has considerably benefited from reshoring and foreign direct investment activities.[27]

Figure 3. Number of manufacturing employees in the U.S.



Source: Bureau of Labor Statistics, seasonally adjusted

In addition to becoming more price competitive, energy-intensive production is likely to be cleaner in developed countries than in China. Steel manufacturing in China on average emits 24% more carbon than that in the U.S. and 26% more than in Germany, because electric arc furnaces (EAFs), a more environmentally friendly technology used in steel making there, are less common in China.[28]

A global rebalancing of energy-intensive manufacturing would cost jobs in China, but international relocation of production from China is already taking place. In the steel industry, a number of state-owned steel conglomerates have built or acquired overseas facilities, including HBIS Group's purchase of the largest steel mill in Serbia;[29] Shougang Steel's investment in a new plant in Malaysia;[30] Wuhan Steel's new plant in Liberia;[31] and Nanjing Iron and Steel's joint venture with a local partner in Indonesia.[32] A private Chinese steel company, Delong, has also recently invested in Thailand.[33]

This international investment has so far focused on developing countries involved in the Belt and Road Initiative (BRI). But although such investment aligns with the signature foreign policy of Chinese president, Xi Jinping, it is economically risky because of weak institutional infrastructure, heavy debt burdens, and high levels of political instability in many of these countries.

The BRI was initially proposed both to provide development assistance to poor countries and as an economic policy tool to address the overcapacity problem facing Chinese industry. One goal was to provide "roundabout subsidies" to Chinese companies using the country's foreign reserves to fund major infrastructure and construction projects in developing countries.[34] The strategic objectives of BRI have been adjusted since being officially introduced by the Chinese government in 2013. Initially in part launched to counter former U.S. President Barack Obama's pivot to Asia, with the U.S. withdrawal from the Trans-Pacific Partnership (TPP),[35] and the re-orientation of American strategy in Asia by the Trump administration, the geopolitical argument for Chinese investment in developing countries along the current "Belt and Road" regions has become less compelling. In fact, China has been actively seeking involvement of developed countries in the BRI, a move which could be seen as part of the efforts of China to shift its role from an institution-follower to an institution-builder.[36]

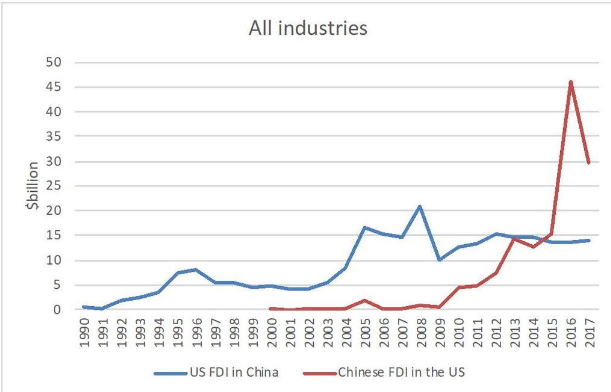
A global industrial rebalance in the making

From an American perspective, any increase in domestic production of energy-intensive goods such as steel would be a political victory for Trump, who campaigned in part on a promise to restore U.S. manufacturing pre-eminence. The U.S. steel industry currently employs about 269,000 workers, accounting for less than 0.2 percent of the U.S. work force.[37] However, steel production is largely concentrated in several Rust Belt states, including Indiana, Michigan, Ohio, and Pennsylvania, which played key roles in electing Trump. As a result, economic growth and job creation in these states are high on the new president's agenda.

An industrial rebalance that turns exports of energy-intensive goods from China into direct investment in those industries in the U.S. would seem to serve the interests of both sides. Compared with Chinese investments in the U.S. high technology sector, investment in more mature industries such as steel would be less politically sensitive, indeed it would be championed by the Trump White House. The first attempt by a Chinese steel company, the Angang Group, to invest in the U.S. faced opposition in 2010 from members of the powerful Congressional Steel Caucus. However, the Committee on Foreign Investment, the authority responsible to review and approve such foreign investments, did not launch an investigation as called for by the lawmakers, and the investment was free to proceed.[38] The plan was subsequently withdrawn for internal reasons within the company. Meanwhile, with incentives and support from the local government of Texas, another Chinese steel company, Tianjin Pipe Corporation, has been manufacturing seamless steel pipes in the U.S. since 2014.[39] When fully built, this $1-billion facility will be the largest single manufacturing investment in the U.S. by a Chinese firm. Other significant investments from China to the U.S. in energy-intensive industries include the $1.85 billion-project of YCI Methanol One by Shandong Yuhuang Chemical and the $100 million-project of Golden Dragon in Alabama to produce advanced copper tubing.

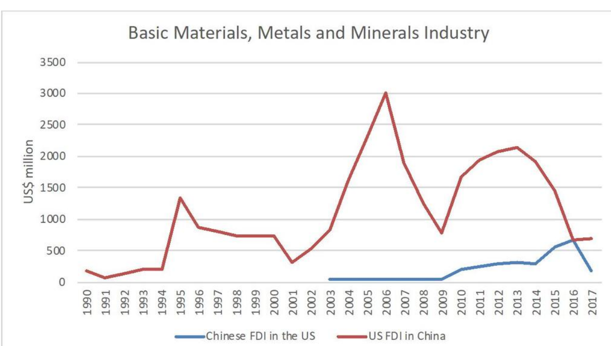
During the past several decades, production in a number of energy-intensive industries, such as steel, aluminium, and glass, has moved from developed countries to China. But a reversal seems to be taking place. Since 2015, China has invested more in the U.S. than the other way round (Fig. 4); and in 2016 for the first time the scale of the foreign direct investment (FDI) flow from China to the U.S. surpassed that from the U.S. to China in the basic materials, metals and minerals industries (Fig.5). Chinese investments in those industries in the U.S. have been motivated by cheap land, plant and energy, as well as reflecting a strategic move by Chinese companies to overcome barriers to trade such as tariffs and anti-dumping investigations into Chinese exports. Both total Chinese FDI in the U.S. and that in the metal industry fell in 2017 after rising sharply in the two preceding years, though, amid limits that the Chinese government imposed on overseas investment by Chinese companies as well as the tightening control of FDI in the U.S by the Trump administration.

Figure 4. Bilateral FDI flows between the US and China: 1990-2016



Primary data source (https://apjjf.org/admin/site_manage/details/us-china-fdi.com)

Figure 5. The bilateral FDI flows between the US and China in basic materials, metal and mineral industry: 1990-2016



Primary data source (https://apjjf.org/admin/site_manage/details/us-china-fdi.com)

Understanding of the rebalance that is underway could lead China and a number of developed countries, especially the U.S., to make the rebalance more economically, politically and environmentally favorable. This could involve measures discouraging steel production and exports on the Chinese side, and encouragement of Chinese investment in steel plants in the U.S., measures that would be more effective than the current punitive tariff imposed by the United States that threaten to lead to economic warfare between the two countries. For example, China could remove incentives for steel exports, such as value-added tax (VAT) rebates,[40] which refund steel producers part of the VAT they pay when making export sales. China could also re-instate its export tariff on energy-intensive products, such as steel, which it introduced in the middle of the previous decade amid concerns about the environment and the country's resource security. Since the financial crisis of 2007–08, however, the export tariff has been largely scaled back to help the steel industry weather difficult economic conditions. By taking measures to restrict its steel exports, however, China could simultaneously free itself from accusations of steel dumping and reduce excess production and environmental degradation while improving relations with the Trump administration as the two countries continue to negotiate a bilateral investment treaty. On the American side, the Trump administration could make clear that Chinese investment in the U.S. steel industry is welcome and could strengthen bonds between the two countries.

Given the imbalance accumulated over past decades, a global industrial rebalance in energy-intensive manufacturing will take many years, if not decades, to achieve. But if successful, it would reduce the environmental costs of producing energy-intensive goods, and thus benefit the world.

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states/2017-05-19/art-steel-deal). This research was supported in part by the Academy of the Social Sciences in Australia (ASSA) under its international program.

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Notes

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[5] Rines, S. 2018. Trump's tariffs are a trade tool. The National Interest, 9 Mar. Available here (http://nationalinterest.org/feature/trumps-tariffs-are-trade-tool-24841).

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[12] Ryan, E. 2016. The elaborate paper tiger: environmental enforcement and the rule of law in China. *Duke Environmental Law & Policy Forum*, XXIV, 183-239.

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[14] See here (https://in.reuters.com/article/china-economy-trade/china-says-hit-with-record-retaliatory-trade-measures-in-2016-idINKBN14P0GS).

[15] The calculation in this cited study (http://www.nrdc.cn/Public/uploads/2017-01-20/58817a3ad38e1.pdf) is presumably based on the costing in the Chinese context. The real cost of coal would be even higher if the costings in more advanced countries is used as references.

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[23] See here (http://www.taiwannews.com.tw/en/news/3122903).
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[26] See here (http://investor.aleris.com/2016-08-29-Aleris-To-Be-Acquired-By-Zhongwang-USA-LLC).
[27] See a study by the Reshoring Initiative here (http://reshorenow.org/blog/reshoring-initiative-2017-data-report-reshoring-plus-fdi-job-announcements-up-2-800-since-2010/).
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[30] See here (https://www.metalbulletin.com/Article/3424583/Shougangs-Malaysia-jv-mill-produces-first-slab.html).
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[32] See here (http://www.thejakartapost.com/news/2014/04/26/construction-gahapi-nanjing-200-million-steel-mill-begins.html).
[33] See here (http://delong.listedcompany.com/profile.html).
[34] See here (https://www.chinadialogue.net/article/show/single/en/8001-The-trouble-with-China-s-One-Belt-One-Road-strategy).
[35] Despite the withdrawal of the U.S. from TPP, the trade agreement is being revived by Japan and other members and President Trump has indicated a possible willingness to renegotiate and re-join the TPP.
[36] Wilson, J. D. 2017. What does China want from the Asian Infrastructure Investment Bank

(http://perthusasia.edu.au/getattachment/47a101e8-1a67-47b9-97b7-7ac8f485d6f7/PUAC-Indo-Pacific-Insight-Series-vol5-Jeff-Wilson.pdf.aspx?lang=en-AU). Indo-Pacific Insight Series.

[37] See here (https://www.bls.gov/cps/cpsaat18.htm).

[38] See here (https://visclosky.house.gov/media-center/statements/steel-caucus-chairman-and-vice-chairman-respond-to-anshan-investment).

[39] See here (http://www.paulsoninstitute.org/wp-content/uploads/2017/01/TPCO-final-english_R.pdf).

[40] See here (http://www.reuters.com/article/us-china-steel-exports-idUSKBN0TS2ST20151209).