China pursued mercantilist policies to help its rail industry dominate in China and expand globally. This strategy starved superior firms of the opportunity to participate.

### Speed Rail

China became a net exporter of rail products in 2010, and while it is still behind the United States, it has become a major player in the global market and what it no doubt would like to achieve in the global high-speed rail market.

#### Leading High-Speed Rail Firms

- CRRC has the largest share of the global high-speed rail market due to its dominance of the Chinese market.
- Other major players include Siemens and Alstom.

#### Export Share

- China's high-speed rail export share has grown significantly since 2010, reaching almost one-quarter of those of the merged Alstom/Bombardier and only 13 percent of CRRC's.

#### Innovation and Competition

- More recently, foreign firms have stated that China's high-speed rail industry has dominated global markets, although this is likely due to a combination of price and quality.
- The emergence of China's high-speed rail industry is likely to continue to drive innovation and competition on a global scale.

#### Future Prospects

- The global high-speed rail market will continue to grow, albeit at a slower pace, as compared to the past decade.
- China's high-speed rail network is expected to continue to expand, with plans to triple the length of its network by 2030.

### Conclusion

- China's high-speed rail network is expected to continue to expand, with plans to triple the length of its network by 2030.
- The broad rail sector includes light, metro, and regional passenger trains, and the digital transformation of the supply chain is transforming manufacturing.
- Automation, big data, and the integration of various systems are key areas of focus for rail firms.

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**Figure 1**: Rail supply industry production (locomotives and rolling stock, major general rail producer and exporter).

**Figure 2**: Speed Rail.

**Figure 3**: Leading rolling stock manufacturers in 2017 by revenue of rail equipment.
91 percent of CRRC's revenue. It became "CRRC versus everyone." That year, the combined sales of CNR and CSR totaled

The 2015 forced merger of CNR and CSR created CRRC. While CSR and CNR used to compete in the initial stage after they benefit from forced tech transfers and efforts to scale (which supplies signaling systems to Chinese subway projects) stated in 2016 that it had

in Chinese high-speed trains (e.g., traction, brakes, and control software).

2020 for public transit rolling stock), it's a false equivalence when combined with the

requirements amount to a large market access barrier and an ongoing mandate for forced

take a targeted (and punitive) approach to reducing the use of foreign firms and technology

Figure 6: European market share of imported products in China (locomotives and

percent for Hungary, and 22 percent for Germany. Likewise, exports from Japan and the

metro signaling (55 percent in 2013).

2010 and

complete high-speed rail trains has been effectively closed to most of them since 2010 and

agreements with the United States (during the U.S.–China Strategic and Economic

The approach simply reflects the lack of reciprocity, given no U.S., European, or Japanese

compete in many third-country markets despite local content and production requirements. For example, Chinese rail firms have taken on tremendous amounts of state-

launched a tender to supply some 232 high-speed trains for a contract from which

Canadian company and a unit of CRRC. Showing the complexity of entering and competing

signaling and propulsion systems to 30 Chinese cities.

Canadian company and a unit of CRRC. Showing the complexity of entering and competing

of dollars a year.

significantly, from 5 to 20 percent of China's GDP. Chinese government statistics claim it is

discriminatory public procurement criteria alongside other mercantilist policies, especially

these lines will be profitable for the foreseeable future are hard to see.

high-speed rail operators lost a minimum of $100 million each in 2018 and continued

high-speed rail lines in China running at a loss. CSRG reported that more than 60 percent of

reported that CRRC's income stemming from government subsidies was just $3.96

In terms of direct financial support, CRRC is one of the most heavily subsidized

CRRC is one of the most heavily subsidized

in Chinese high-speed trains (e.g., traction, brakes, and control software).

In some instances, China's procurement rules prevent Sino-foreign JVs from

Wabtec is the product of a

for exports. Chinese firms are now selling their illegal clones back into foreign markets in

extensive forced technology transfers, China debuted the first "Chinese-standard" 400-kph

prototype—"the Star of China," which could reach a top trial speed of 321 kph—to

Amtrak and Alstom officials blamed a 2005 disruption in Acela services (from April to July,

a major general rail producer and exporter, and potential market for high-speed rail.

Technology transfer contracts typically consist of four components: (1) the joint design of

competition with the companies from which they coerced the technology.

not for exports. Chinese firms are now selling their illegal clones back into foreign markets in

CRRC noted that it received $194 million in government subsidies in 2014 and an additional

Full weight and money of the state behind them in the way the Chinese rail companies

Heavy Industries, and Siemens are not banks and do not have the political influence or the

most of its high-speed rolling stock from foreign firms. After the CRRC takeover, Chinese

financial statements list far more.

Top management was not blind. Foreign rail companies were forced to enter

Van der Does maintains ongoing JVs in China focused on the metro rail, components, and signaling

Alstom's experience in China has since been rocky. China's then MOR decided to operate the

imported equipment to be assembled in China, and finally, 51 domestic trainsets, with 65

engineers on their technologies. They would supply full kits—known as a "knock-down kits"

technologies and developing new technologies in accordance with China's goal of

the use of informal, indirect guidance from trade associations and state-owned

many years, maybe decades.
due to lack of effort, funding, success, or some other reason. If the data showed that the
for high-speed trains between 1985 to 2009.

categories). Alstom had 10 patents in the 3 key technologies. However, in traction technology,
and the top firms in the three key technologies. Overall, China (1,539) was the most-active
High-Speed Rail Industry based on Patent Analysis”—focused on patents in key high-speed

Figure 13: EPO rail patents granted by company (2011–2017)

and 2017, 557 patents belonged to German companies, 149 to French companies, 103 to

how this affects enterprises' R&D and their ability to maintain a technological lead.

reports from 2015 to 2019 reveal that their aggregate average gross profit margin was 14

that, using an aggregated average, Chinese firms are far more profitable than their foreign

projects around the world. This becomes a bigger factor in the competition, as firms are able

The battle for future high-speed rail innovation will not only depend on R&D staff and

development strategy, what has the impact been on innovation in the global high-speed rail

163.2 billion.

Australia (albeit a much different market) provides a cautionary tale. In 2008, Bredken,

firm to make passenger rail cars, the Pullman Company, produced its final car in 1981,

rail line between Los Angeles and Las Vegas.

While the United States lags far behind China in terms of high-speed train lines, Chinese

and rolling stock to the United States represented 42 percent of all imports in this segment

States, especially in metro rail projects. Indicative of this, Chinese exports of locomotives

made some inroads in developed markets, winning rail contracts in Australia, Europe (as in

maintenance.

A Harder Nut to Crack: Entering and Competing in Developed Country Markets

limited (but growing) sales and projects in developed markets. Finally, having already

of China's equipment, technology, standards, and services to go global by

innovate and export high-value goods to global markets.

encourage “more of China's equipment, technology, standards, and services to go global by

subsidized investments in new rolling stock after 2018, the main market for rail cars and

figure 14

Concerns about China's “debt trap diplomacy”—wherein China forgives a country's debt in

represented over two-thirds of all Chinese overseas railway projects over the 10 years prior to

financing as it is over train technology. It has also become a proxy for the broader

estimates that the cost of railway construction accounts for about 82 percent of total project

and the high-speed trains are just one relatively minor part. For example, the World Bank

contract from the Los Angeles County Metropolitan Transportation Authority for 64 subway

Southeastern Pennsylvania Transportation Authority for 45 commuter rail cars. CRRC's bid

Strategy" that the goal was acquisition of strategic resources (referring chiefly to technology

Austria, South Africa, Turkey, the Czech Republic, Israel, Italy, Germany, the United

technology creation,” but “outward technology exploration.”

level and ability, but also built a new generation of vehicles with complete intellectual

CRRC remained reliant on forced cooperation and foreign technology transfers, which

champion that was dominant at home and, over time, increasingly active internationally.

91 percent of CRRC's revenue.
will send several; and CRRC will not only pay annual membership fees for SDOs (which can firm representatives to support their preferred outcomes. Canada, Europe, Japan, and stand standards become central to high-speed rail technologies. In other sectors it identifies as generally made their local content policies more flexible, thanks to the fierce competition percent) are far too high, and U.S.-flag shipping requirements are restrictive.

firms need to explicitly support the sector. Advanced rail equipment is 1 of the 10 sectors better compete against China.

firms. Chinese firms captured as much as 21 percent of all World Bank transportation related projects in developing countries that may involve CRRC and other Chinese rail-related potential acquisitions in specific sectors.

Countries could do this via public procurement criteria that preclude bids from Chinese firms a trigger for mandatory foreign investment reviews.

need to add rail to the list of sectors they are watching. about—and indictment of—China's predatory economic policies.

Policymakers from Canada, the European Union, Japan, South Korea, the United States, and have allowed CRRC and other Chinese rail companies to gain global market share at the innovation-driven firms.

have benefited from forced tech transfer, IP theft, massive subsidies, or being state-driven firms and rail sector innovation.

Innography.

International Patent Classifications to identify patents via the commercial IP search service that the sector is based on comparative advantage and genuine cooperation between firms patents are. While the United States is not home to a leading high-speed rail firm, it is clear technology growth index to analyze the technology growth in patent-contributing countries by China granted the most maglev patents, but very few were registered in foreign jurisdictions.

In this way, it could use chains of patent citations to draw network trees from 1985 to 2009, various CNR and CSR subsidiaries were among the subsequent iterations of innovation—to analyze the development of bogie technology for analysis—which looked backward in time to identify which patents were cited through due to lack of effort, funding, success, or some other reason. If the data showed that the
Siemens—Peter Spuhler, stated (after a visit by CRRC), “There are only about 10 companies Chinese firms and the Chinese government are going out into the world in search of strategic council bid for 100 trams.

not factor in abnormally low bids and market-distorting state aid and subsidies. In 2019, transport system of Porto, Portugal). The extension of this project was financed by the EU (its efforts to compete in all segments of the European rail market. In December 2019, CRRC

for cheap—and with EU funds. This could be a landmark project for CRRC, as it allows the line, between Belgrade and Nis (the country's third-largest city).

€ value of the project, CRSC established a laboratory in Belgrade to provide train operation At the Serbian end of this high-speed rail line, China's Ex-Im bank provided a $297 million European Commission, the Hungarian government issued a tender, albeit one tailored for the mandatory competitive bidding process to directly issue a contract to the Chinese firm for two high-speed trains, before working toward its ultimate goal of entering the high-speed rail segments from China, to abide by local content requirements for procurement contracts. It other (non-high-speed) segments of the rail market, they still help build CRRC's broader technology to be transferred for free. That was not good for us.”

Kawasaki also had to develop the local supply chain for components and train Chinese separate locomotive, such as those provided by Alstom.

Chinese firms. Whether China gets away with this will depend on these countries finally create a high-tech economy—at the cost of innovation in the global high-speed rail sector. To more resources to invest in innovation. And that would have benefitted the whole world. But its deployment, China could have played fair and used its large financial resources (including its massive trade surplus) to pay foreign firms for their products and technology, just like Canada, Europe, Japan, the United States, South Korea, and other countries national programs, such as tax discounts and low interest rate loans, as essential to ensuring rail firms) in considering, and allowing, mergers between rail firms.

To compete with the size and scope of CRRC, its foreign competitors have grown—or at least will send several; and CRRC will not only pay annual membership fees for SDOs (which can degree, their respective positions in other third-country markets—are tenuous. Similarly, the rail sector has suffered from a need to provide an acquisition of the railway unit of Bombardier in a $8.2 billion deal that created the global rail sector. On February 6, 2019, the European Commission blocked a merger of the rail firms) in considering, and allowing, mergers between rail firms.

The fact that Alstom and Siemens even considered such a large deal indicates the need for a broadened approach to the CRRC market. But that approach, according to the European Commission, failed to consider the implications for the rail sector as a whole. The European Commission's decision to block the merger was based on the need to preserve competition in the rail market. It argued that the merger could lead to a loss of competition, as CRRC would have become too dominant in the market.

The decision has been met with mixed reactions. While some analysts have praised the European Commission for taking a stand against market concentration, others have criticized the decision as being too narrow in scope.

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public input.

The European Commission's Horizon 2020 grants—the bloc's biggest investment in research and innovation—were also evaluated. The grants were designed to support research projects in key areas such as biotechnology, clean energy, and information and communication technologies. However, the European Commission is facing criticism for not taking a more proactive role in shaping the direction of research funding. Some stakeholders have argued that the commission's focus on short-term results has limited the potential for long-term innovation.

The European Commission has also been criticized for its failure to address the challenge of semiconductors, and biopharmaceuticals, once a leading country or firm loses this capability. In the past, the commission has focused on smaller-scale projects, such as those in the renewable energy sector. However, these projects have not always been effective in driving innovation, as many of them have been abandoned or failed to deliver the expected results.

The European Commission is now facing pressure to do more to foster innovation. Some stakeholders have called for the commission to develop a more comprehensive strategy for research funding. They argue that the commission needs to look beyond short-term results and focus on long-term goals. This could involve exploring new areas of research, as well as providing more financial support for projects with a high potential for innovation.

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