

FOREIGN AFFAIRS

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The Missing Chips

How to Protect the Semiconductor Supply Chain

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During the COVID-19 pandemic, demand for semiconductor chips, a key component of all electronics, skyrocketed as many jobs and crucial services moved online and workers upgraded their home offices. Combined with major supply disruptions, the result has been a worsening semiconductor shortage. In May, wait times for chip orders stretched to 18 weeks, four weeks longer than the previous peak. The supply crunch has hit a range of sectors. Automotive plants have idled as they await delivery of chips used in their cars. Makers of microwaves, refrigerators, and washing machines have been unable to fill their orders. Long the obscure concern of experts in the technology sector, semiconductor supply chains have now been thrust into the spotlight.

But the supply of semiconductors was at risk long before the pandemic, and the virus is only partly to blame for today's shortages. One of the biggest culprits was a sudden shift in U.S. trade policy. In 2018, motivated by national security concerns, the Trump administration launched a trade and tech war with China that jolted the entire globalized semiconductor supply chain. The fiasco contributed to the current shortages, hurting American businesses and workers. Now, the Biden administration must pick up the pieces.

In its first five months, the Biden administration has laid the groundwork for a more resilient semiconductor supply chain. Discarding the nationalistic policies that got the United States into this mess, the Biden administration has reached agreements at summits with Japan, South Korea, and the European Union to cooperate on a new semiconductor strategy. With their overarching goal now set, Washington and its partners must turn to the hard work of hammering out the details. Only then will they be able to protect their national security and stave off another economic crisis.

WEAPONIZING TRADE

The troubles for the United States' multibillion dollar semiconductor industry started when the Trump administration used it as a pawn to go after Huawei, the Chinese telecommunications giant and a major chip consumer. For years, Western policymakers worried that Huawei's shoddy gear was vulnerable to cyber-hacking and thus a threat to critical telecommunications infrastructure. More worrisome were the company's close ties to the Chinese Communist Party, raising the prospect that Beijing would use Huawei's 5G network equipment to spy on rivals and steal their military intelligence, governmental communications, or trade secrets.

In January 2019, the U.S. Department of Justice indicted Huawei for financial fraud, money laundering, conspiracy to defraud the United States, obstruction of justice, and sanctions violations. On paper, the case had little to do with concerns about national security and 5G networks, but there was no doubt that those issues motivated prosecutors. Unusually, the Trump administration chose not to punish Huawei with financial sanctions. Instead, it weaponized trade. The administration restricted companies from selling to Huawei from the United States by imposing export controls in an attempt to starve Huawei of inputs, especially semiconductors.

The Trump administration had a clumsy approach to a complex supply chain. Modern semiconductor manufacturing is a fragmented process, and even the chips developed by U.S. companies are often not made in the

United States. Qualcomm and Nvidia, two major U.S. technology companies, design world-leading semiconductors, but they often farm out the production of those chips to foreign firms, especially Taiwan Semiconductor Manufacturing Company (TSMC), the world's largest contract manufacturer of chips. Because U.S. law was designed to stop exports leaving the United States, the Trump administration's export control rollout in 2019 could do nothing about chips being made abroad, blunting the policy's effectiveness.

Export controls imposed by the United States alone were bound to flop. Non-American companies make great chips, too, allowing Huawei to swap out the American semiconductors it used in its 5G equipment with those from Japan, South Korea, Taiwan, or Europe. The policy was lose-lose: it ended up hurting U.S. companies and failing to mitigate the national security threat. What is more, the export controls discouraged chip manufacturers from investing in the United States. American producers ultimately faced trade limits that no country besides their own was applying.

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Undeterred, the Trump administration reached deeper into the semiconductor supply chain. Huawei's other suppliers all needed cutting-edge equipment to produce their chips. But many of those tools were also made by U.S. companies, such as Applied Materials, KLA, and Lam Research. So beginning in mid-2020, the administration tried to use the dominance of U.S. equipment manufacturers as leverage with foreign chipmakers that were still selling to Huawei. It presented companies such as TSMC and Samsung with an ultimatum: stop selling to Huawei or lose the ability to use American tools.

These export controls have also had nasty side effects. To TSMC, Samsung, or any other company that was about to invest hundreds of millions of dollars on new chip-making tools produced by U.S. companies, other equipment makers—including Tokyo Electron in Japan or ASML in the Netherlands—were suddenly much more attractive suppliers.

Furthermore, China threw even more money at its already heavily subsidized chipmakers. Under pressure to accelerate its industrial development, Beijing has sought to quickly free itself from the tight grip of Western technologies. Simultaneously, the fear of losing access to the Chinese market has the U.S. semiconductor industry now seeking upward of \$50 billion in federal subsidies as part of legislation now winding its way through Congress. By the industry's reckoning, the conflict with China could threaten a third of its revenues, requiring a new funding source to spur the research and development of future chips.

By cutting off Huawei's access to semiconductors, the full suite of U.S. export controls imposed in 2019 and 2020 may ultimately hurt the company's 5G equipment sales enough to protect U.S. national security, although it is too early to say for sure. Nevertheless, the extreme collateral damage from the episode demands that policymakers find a new way to ensure the resilience of the semiconductor supply chain.

THE SHORTAGE HEARD ROUND THE WORLD

By the time U.S. President Joe Biden took office, the COVID-19 pandemic had laid bare the extent of the semiconductor crisis. Carmakers overreacted to the initial shock of COVID-19 and, in early 2020, slashed orders for chips. By the time the auto companies realized their mistake, chipmakers were already at capacity supplying the suddenly booming market for work-from-home goods. The perfect storm only got worse: Arctic weather in Texas, a drought in Taiwan, and an earthquake and fire in Japan all worked to slow production.

U.S. trade policy also squeezed supply. In July 2018, the Trump administration imposed 25 percent tariffs on imported chips as part of its trade war. Despite growth in the global semiconductor market, the tariffs meant that the United States was buying half as many chips from China in 2020 as it was before the trade war, and imports from elsewhere did not replace those missing semiconductors. Making matters worse, Chinese buyers, fearful of the ever-tightening U.S. export controls, hoarded chips, thus contributing to the global shortage.

The semiconductor shortage was high on the agenda in April when Biden welcomed to the White House his first foreign leader, Japanese Prime Minister Yoshihide Suga. Although there was nothing Biden or Suga could do to immediately boost production and alleviate the shortages facing their auto sectors, they agreed to “cooperate on sensitive supply chains, including semi-conductors.” Similar priorities were set in May at Biden’s summit with South Korean President Moon Jae-in and in June with leaders from the European Union.

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Washington’s efforts to shore up the semiconductor supply chain require bringing each partner into the fold. Japan, South Korea, Taiwan, and Europe are home to some of the world’s most important equipment suppliers and chipmakers. Getting everyone on the same page will require a deft diplomatic touch. Relations between Tokyo and Seoul remain tense, in light of a recent flare-up that led Japan to impose export controls on chemicals critical to South Korean semiconductor producers. Because its companies produce most of the world’s leading chips, Taiwan must also be central to Washington’s efforts. But coordinating policy with Taipei inevitably antagonizes Beijing, which views the island as a renegade province and seeks to eventually reunify it with the rest of China.

On export controls, the semiconductor saga has revealed the need for a common policy that Washington and its partners agree on. Broad, unilateral, and extraterritorial U.S. export controls are not a viable long-term strategy to protect national security. U.S. partners won’t put up with them for long, since democratically elected leaders face domestic pushback when they cede sovereignty to Washington and impose huge commercial costs on their companies. European firms, for example, were quick to accuse the Trump administration of designing its export controls less to address any Chinese national security threat and more to advantage their American competitors.

Extraterritorial controls also won’t work for long, because foreign semiconductor manufacturers will seek to swap out U.S. equipment with

tools from alternative suppliers. Once they have done so, Washington loses the only short-term leverage it had over them and over the ultimate target, Chinese firms buying the chips. Preventing this outcome requires collaboration. U.S. partners must both buy into the security threats that China poses and enforce the commonly set export limits on their own firms. Given the difficulties with multinational enforcement, overly broad attempts to control everything are likely to end up controlling nothing. Success may instead demand tighter export limits but on fewer technologies.

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Washington and its partners will also need to get more creative. Both the U.S.-Japanese and U.S.-South Korean summits signaled the potential embrace of an innovative policy called “Open RAN.” Under this approach, policymakers would agree on common industry standards that force greater compatibility between different types of 5G equipment. The end goal is to prevent Huawei—or any other 5G equipment provider—from dominating global telecommunications infrastructure. This policy would introduce competition and could weaken the market power of major vendors. It may also be more effective than the existing approach: better to allow for a diversity of suppliers than dedicate resources to killing off one bad actor, such as Huawei, only to see another take its place.

Nevertheless, the United States and its partners will have to accept that aligning their policies comes with costs. If they agree to common export controls, for instance, China will almost certainly carry out a more confrontational foreign and economic policy, intensifying its own efforts to decouple. In turn, semiconductor firms in U.S. partner countries will likely join their American counterparts in losing commercial access to the Chinese market.

Washington and its partners must thus prepare for their semiconductor industries to lose revenues, which fund their considerable R & D expenditures. To ease the sting, they should jointly fund an R & D consortium for firms in allied countries along the semiconductor supply

chain. R& D consortiums, which pool resources for chip research to prevent each company from having to reinvent the wheel, are nothing new for the chip sector at the national level. In fact, Japan developed one in the 1970s, as did South Korea, Taiwan, and the United States shortly thereafter. Here, coordinating a new multilateral consortium could also help allied countries withstand pressure to compete among themselves, thus preventing excessive subsidization and a race to the bottom.

Given the uncertain pace and trajectory of semiconductor innovation, there will be bumps in the road. But failing to coordinate the export controls needed to mitigate the most critical national security threats, develop common industry standards, and prevent excessive subsidies to stave off infighting over suppliers—that would be much, much worse.