**Coming Back Home:**

Addressing the 2021 Microchip Shortage by Investing in Domestic Manufacturing

December 13, 2021

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**Table of Contents**

Introduction ………………………………………………………………………………………….. 1

Research Plan ………………………………………………………………………………………. 2

Results of Study …………………………………………………………………………………… 3

Discussion of Results ………………………………………………………………………….. 8

Conclusion ……………………………………………………………………………………………. 9

Works Cited ………………………………………………………………………………………….. 11

**Abstract**

The purpose of this report is to assess whether the United States’ goal of shifting towards domestic manufacturing of semiconductors as its primary source of supply would be an effective means of addressing the effects of the global semiconductor shortage in America. This was done first by analyzing the root causes of the shortage and the United States’ response strategy of boosting domestic production. This strategy was then compared with that of China and the European Union, which ascertained that such a policy is inadequate for addressing the immediate market concerns of the shortage. I suggest that the United States bolster this strategy with additional efforts to collaborate with foriegn nations in creating an open, international production pipeline that is not bound by national competition.

**Introduction**

Microchips (aka semiconductors) are a crucial component in nearly all modern electronics, and the United States currently relies on importing the majority of its supply from foreign manufacturers based around eastern Asia. As of 2021, the sustainability of this business practice has increasingly come into question as the impact of COVID-19 and an ongoing trade war between the United States and China have exacerbated the global shortage of semiconductors to astronomical heights. In the hopes of shifting towards a more sustainable method of acquiring microchips and gaining a lead in the industry, both the Trump and Biden administrations have been investing in the development of more local means of manufacturing these semiconductors in recent years. The purpose of this report will be to analyze this shift in the United States’ microchip acquisition strategy, and evaluate whether it will be an effective means of combating the shortage of supply in America. To do this, I researched the root causes of the semiconductor shortage and identified the ones that the United States could feasibly address via legislation. I then observed what the United States have taken so far to address the shortage and improve sustainability and compared it to actions taken by China and the European Union in order to ascertain what’s been done well and what could be improved on. From my research, I have concluded that the effects of shortage causes affected by U.S. legislation are outweighed by the effects of global causes that are beyond U.S. control. The United States’ priorities seem misplaced, as there is an emphasis placed on future sustainability over alleviating the more pressing effects of the shortage today. To address this concern, I suggest that the United States open up to a collaborative approach of developing international production methods alongside foreign nations.

**Research Plan**

To better judge the United States’ shift in policy towards domestic semiconductor production, I split my investigation of the microchip shortage into two phases:

Phase 1: Root causes of the microchip shortage

Phase 2: Changes in U.S. policy regarding microchip acquisition

**Phase 1: Examining Root Causes of the Microchip Shortage**

While researching some of the primary causes of the global semiconductor shortage, I found it important to distinguish between two *types* of causes:

1. Causes that are predominantly beyond the United States’ control
2. Rising foreign competition
3. Effects of coronavirus/constantly increasing demand
4. Scalpers & hoarders
5. Causes that the United States has actively played some role in
   1. Tariffs on Chinese imports
   2. Port congestion

It is important to keep in mind that the semiconductor shortage is a global, multi-faceted issue that the United States only plays a small part in. These facets, which have been brought about by the combined contributions of all nations around the world, would require international collaboration on an unprecedented scale in order to be mitigated. In order to identify what the United States can realistically do to relieve the shortage on the domestic side, I chose to identify causes that are primarily impacted by U.S. policy and differentiated them from causes that have been brought about by factors that are largely beyond the United States’ control. By doing so, I delineated what factors of the shortage the United States should prioritize over others depending on how feasibly each cause could be dealt with.

**Phase 2: Evaluating U.S. Microchip Acquisition Policy**

After identifying the major causes of the microchip shortage, I narrowed the scope of my research towards actions that the United States have taken so far. I observed a number of recent legislative actions made in efforts to boost domestic semiconductor production, and compared them to select strategies that other nations have employed to deal with the shortage in Asia and Europe.

**Results of Study**

**Root Causes of the Microchip Shortage**

By far, the primary factor that has been impacting the semiconductor market for years is the rise of foreign manufacturers who provide western nations with semiconductors that are considerably cheaper than ones made locally. Currently, Taiwan and South Korea have come to dominate the industry with over 70% combined control of the global manufacturing market. Meanwhile, other Asian nations like China and India have also made massive advancements in their own manufacturing capabilities thanks to heavy investments made early on by their respective governments (Kharpal, 2021). The United States is relatively late to this trend by comparison, and is now struggling to catch up with its competitors. While a select few integrated device managers (IDMs) like Intel still design and manufacture their own chips, the majority of semiconductor firms in the United States tend to outsource manufacturing to foreign production sites like Samsung and TSMC - these are known as “fabless” semiconductor firms. These firms deem the construction of local production sites to be too much of an investment, as new facilities “cost billions of dollars and take years to become operational” (Yang & Sohn, 2021). Compared to the enormous amount of time and money it would take to get a semiconductor factory up and running domestically, the option to outsource is now a cheaper alternative for most U.S. based firms thanks to tax breaks, grants, and other financial incentives (Canales, 2021). The United States’ microchip market has now grown a dependency on foreign manufacturers for its microchip supply, a business strategy that is now buckling under the impact of a global pandemic.

As scores of people entered lockdown around the world in early 2020, demand for personal electronics like game consoles, webcams, and laptops has skyrocketed. Paired with an already impared manufacturing force and heavily congested supply lines, consumers and electronics manufacturers alike are now finding it harder than ever to get their hands on microchips and microchip-based products. Wait times have nearly doubled from 12.8 months in October 2020 to 21.9 months in just a year (Susquehanna Financial Group, as cited in Yang & Sohn, 2021). This pattern of escalation is showing few signs of slowing down, as global demand for semiconductors is still on the rise. To compound this issue, many hoarders have been using bots to snag online orders as soon as they go live - thereby denying consumers the chance to purchase items at retail price and reselling them at an exorbitant mark-up. Thanks to the actions of these “scalpers,” demand has only heightened further with the release of highly coveted devices like Sony’s Playstation 5 and Apple's iPhone 13. In an effort to combat these scalpers, a new bill called the “Stopping Grinch Bots Act'' has been proposed in Congress which renders the circumvention of security measures that limit purchases and the reselling of goods acquired by such methods unlawful (2021). This bill has only just been introduced however, and has yet to pass the senate. Many doubt whether this bill would even be effective at all, as scalpers are constantly updating their bots to evolve alongside whatever security measures they are meant to evade in attempts to enhance efficiency and skirt detection. The world of scalper bots is an emerging field in cyber security, and only time will tell whether new legislation will be enough to mitigate the effect that these hoarders have on the market.

Yet another factor of the semiconductor shortage in America is the ongoing trade war between the United States and China. In 2017, the United States initiated an investigation into China’s unfair trade practices under Section 301 with accusations of forcing foreign firms into joint ventures and state-sponsored industrial espionage among others (Bown, 2020). A year later, the investigation would culminate in the imposition of 25% tariffs on Chinese semiconductor imports. China soon followed suit with tariffs of their own, thus beginning a cycle of escalating trade restrictions that would last for years to come. While the two nations have since come to a tentative truce under the Phase One agreement in February of 2020, in which a limited exchange of materials was authorized, the tariffs on commercial trade have yet to be lifted. Other Asian manufacturers are also impacted by this trade war, as the United States currently imports much of its semiconductor supply from countries situated in geopolitically sensitive areas like Taiwan (Triolo, as cited in Kharpal, 2021). This further brings the sustainability of the United State’s reliance on importation into question, as escalating tension between the U.S. and China could further impact trade with these outside nations as well.

Despite the many restrictions placed on Chinese trade, the United States continues to be impacted by the global supply chain crisis. According to Hanbury, this crisis came about as shipping demands saw a massive spike in late 2020 following a relative low point brought about by the pandemic earlier in the year (2021). Particularly in America, supply chain personnel like dockworkers and truckers are also running thin in numbers due to rocky workplace negotiations. So far, the United States has taken very little legislative action in regards to the crisis. Supply chains across the world are now heavily congested, and freight company CEO Jeremy Nixon claims that governments need to step in to provide support for critical parts of the supply chain like ports and railways. Should no drastic action be taken, the shipping crisis is slated to last until 2023.

**U.S. Microchip Acquisition Policy**

In February of 2021, Joe Biden unveiled a $2 trillion infrastructure plan for economic recovery. As a subset of this plan, $50 billion was set aside for the domestic research and manufacturing of semiconductors in the hopes of out-competing China. While the proposed intent of this investment was to bolster domestic semiconductor production in order to diminish the United States’ dependency on foreign contract manufacturers, there are a number of additional factors that may complicate this goal. As I have pointed out previously, new semiconductor production plants take millions of dollars to produce, and the actual construction process takes years. As the majority of U.S. semiconductor supply is sourced internationally, it would be far easier said than done to construct enough production plants to supplement a shift away from foreign importation. The labor shortage also plays a role, as American producers may struggle to find enough workers to operate at full capacity (Canales, 2021).

Just a few months following Joe Biden’s unveiling of his infrastructure plan, U.S. based IDM Intel announced that it would be investing $20 billion into constructing two new manufacturing plants in Arizona in hopes of curbing the semiconductor shortage and helping the United States regain semiconductor leadership (Leggate, 2021). As these plants are slated to become operational by 2024, it seems that Intel’s investment is aimed more at strengthening competition and establishing sustainability than alleviating the current shortage. While this is undoubtedly a positive investment for the long-term, the shortage is so severe already that Intel’s current investments fail to address many of the existing issues plaguing the semiconductor market currently.

As opposed to the United States, which once held a lead in both design and manufacturing, China has struggled to compete with a lack of early infrastructure building (even compared to the U.S.) and a massive loss of skilled workers during the Cultural Revolution between 1966 and 1967 (Poitiers & Weil, 2021). Instead, China’s first foray into the microchip industry was through the use of low-skilled labor to assemble semiconductors under contracts from foreign firms. Manufacturing capability had been the main priority since the beginning, and China has since settled into the niche of importing leading-edge chip designs and exporting a copious supply of low-end, affordable chips (Bown, 2020).

In response to the United States and China’s stances on the semiconductor industry, the European Union has similarly taken efforts to improve its capability of producing greater quantities of high-end semiconductors. Also like the United States and China, the EU’s main goal is to enhance its own competitiveness in the global semiconductor market. Poitiers and Weil note how the United States, European Union, and China all have greater infrastructure for semiconductor *design* than they do for semiconductor *manufacturing* (2021). While the United States may rely on China and other Asian countries for its supply of microchips, the inverse can also be said: the majority of the semiconductor designers in China are fabless, much like in the United States. Despite this, the United States and China both seem more interested in catching up to its competitors in manufacturing rather than doubling down on the industries in which they are already well established. As the European Commission is now following suit, Poitiers and Weil criticize the heavy prioritization of bolstering manufacturing. They argue that manufacturing competition is so high in Asia that there wouldn’t be enough demand to satisfy the EU’s uptake in microchip production (2021). Furthermore, it is argued that the Union would be better off diversifying its supply chain and focusing on the more niche market of high-end chip design.

**Discussion of Results**

While the United States’ projected strategy of investing in domestic production is a good move to improve the sustainability of microchip supply in America, it fails to consider some of the many issues brought about by the existing shortage. Most leading nations in the industry seem to be focusing on addressing supply shortages, but relatively little is being done by the U.S. to address the shipping crisis that is hindering the delivery of microchips already produced. Scalpers and hoarders continue to evade legislation and prey on web-based transaction methods, while the United States and CCP both continue to use the microchip industry as leverage in a budding Cold War between the two of them. Judging from what president Biden has announced so far, it seems that the United States is focused more on preventing new issues from arising in the future than addressing the issues that already exist within the market. This is not a bad strategy per se, as any investments made in establishing a better infrastructure of production serve the goal of improving sustainability. However, there is lingering concern that not enough is being done to satiate some of the market’s grievances in the short term. Global demand shows no signs of dropping, and new variants of Covid-19 continue to prohibit the world from returning to operating at full capacity. Because investing in domestic production takes so long to pay off, my concern is that the American semiconductor market simply will not be able to keep up with demand even when subsidized by foreign imports - let alone replacing fabless contracts as the primary method of production for American firms.

Rather than replacing its current policy with a new one, I feel it is in the United States’ best interest to take a page from Poitiers & Weil’s suggestion for the EU - continue to build collaborative relationships with foriegn semiconductor firms. This wouldn’t just entail the continuous use of the fabless model; foreign IDMs like Samsung have built fabs to manufacture chips within the United States (Bown), and similar manufacturers are continuously incentivized to develop new and more sustainable methods of producing microchips regardless of what country they’re based in. As such, I propose that the United States’ best course of action for dealing with the microchip shortage moving forward is to adopt a collaborative partnership with foreign manufacturers in order to create an international infrastructure of production that uniformly benefits from the combined contribution of multiple nations.

**Conclusion**

There are many different factors that contribute to the global microchip shortage, and the majority of them are beyond the control of any one nation. The United States, which has come to rely upon importing the majority of its semiconductor supply through contracts with foreign manufacturers, is now struggling to find a more sustainable means of satiating the constantly rising demand. In the midst of a trade war with China, the ability for important manufacturers in neighboring Asian nations to deliver on supply are now under threat. This inability to deliver is further exacerbated by the global shipping crisis, which rages on alongside the effects of Covid-19. The U.S. has recently begun investing in the production of new manufacturing sites domestically, in the hopes of weaning off of its reliance on importation. While this is a step in the right direction, the shortage is affected by such a large variety of compounding issues that the ultimate goal of self-sustainability and leading the industry is unobtainable without more intrusive intervention. In order to address these concerns, I suggest that the United States attempt to build a collaborative means of manufacturing semiconductors in cooperation with other nations. This is a massive undertaking of course, and the plan hinges on other nations’ willingness to collaborate. I would argue that collaboration is inevitable however, lest the market succumb to the sheer obstinacy of the American ego.

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