INTRODUCTION

Innovation is a crucial driver of productivity advance, which is the contemporary economic growth engine and arena for states to flex their international security muscle. Political phenomena in the shape of Brexit and the US-China trade war are inserting substantial uncertainty into the system, uncertainty that could thwart the potential for countries to achieve essential advances in innovation. Brexit raises questions about the availability of high-technology talent to live and work, as well as concerns over short-term disruptions to the import and export of goods, in Europe. The semiconductor industry is a particularly essential, and
Semiconductors—including silicon, the material for which Silicon Valley got its name—are the materials that conduct currents, which are essential to electronic circuits. Microchips with electronic circuits enabled by silicon wafers help to power contemporary society’s innovations, from computers, to smartphones, appliances, cars, spacecraft and more. Since the creation of the first chip back in 1959, there has been an unprecedented rise in the production and use of semiconductors. As more of the physical world is brought online, and made “smart”, so the global semiconductor industry has boomed. The development of semiconductor design, research and manufacturing is a harbinger for innovation-centric economic growth, as semiconductors are crucial “in other fields essential to future economic growth, such as personalized healthcare, robotics, and intelligent products”.

The semiconductor is as internationally produced as it is essential to our modern lives. The designs of the processors that power 95% of the world’s smartphones come from UK headquartered Arm Holdings. Brexit could mean that these essential designs could become suddenly less available to semiconductor manufacturers. For its part, the US-China trade war threatens to increase the cost of cross-border trade vis-à-vis the direct application of tariffs, but it poses further ripple effects. The inclusion of Huawei on the US Entity List, for instance, has meant that manufacturers around the world worry whether they can, or should, continue to supply Huawei and its subsidiaries, such as HiSilicon, for fear of losing access to the US market. European manufacturers in the globally-connected semiconductor industry, especially ASML, also lie exposed to disruptions due to evolving trade agreements and tensions. For makers of semiconductor components, supply chains are extraordinarily global, and individual parts are difficult—nearly impossible—to replace overnight, accentuating the potential havoc stemming from Brexit and the US-China trade war.

The chapter explores how Brexit could undermine or boost Taiwan’s semiconductor industry. The focus on Taiwan-Europe relations with respect to the semiconductor industry stands to make a contribution to political economy literature. Scholarship on Taiwan’s industrial upgrading, high-technology industry advances and venture capital market growth have focused squarely on the “bridge” to Silicon Valley. Numerous studies have detailed how Taiwan’s “New Argonauts” travelled between California and Hsinchu Park, establishing connections that drove
technology transfer (initially from RCA to Taiwan), investment, and an upgrading of the talent pool in Hsinchu Park. Much less has been written on the topic of the interactions between Taiwanese tech and Europe, and even less on the UK-Taiwan semiconductor connections. This has left a gap in our understanding, and one that is important to fill given contemporary trends that collectively constitute marked uncertainty about trade openness.

The chapter’s second core focus is the impact of the US-China trade war on Taiwan’s semiconductor industry. In doing so, we offer a sector-specific account of the trade war, to complement Bob Wang’s chapter on the US political response to the escalations. Companies on both the US and Chinese side of the dispute have spoken of reducing exposure to one another. For the Americans, this means moving out of China, with announcements of establishing or increasing operations in Taiwan, as well as India and Vietnam. While for the Chinese side, this involves a “de-Americanization” strategy. Both countries could increase their business with the Taiwanese semiconductor industry. On account of the industry’s massive contribution to the local economy, this would be a boon for the island as a whole.

The following section sets the scene for the analysis, with an overview of the global semiconductor industry, and the stature of the various countries in this key industry. The chapter then interrogates, in turn, ways in which realization and escalation of Brexit and the US-China trade war could affect the industry, particularly in Taiwan. We close with brief concluding remarks on the potential effects of the rising uncertainty on semiconductors.

**Front Lines of Innovation in Uncertainty: The Semiconductor Industry**

Semiconductor industry prowess has long been a key component of developmental state strategies, beginning with Japan’s Ministry of International Trade and Industry-led consortia in Japan in the 1970s, through to Taiwan and Korea’s highly effective interventions to boost their positions in the global industry. Taiwan, on account of its effective developmental state apparatus, has been a world leader in the fabrication of semiconductors since the 1990s. Semiconductor revenue is an important contributor to the gross domestic product of these countries with major
manufacturers. In addition, politicians—in the USA, China and beyond—see that semiconductors are essential to contemporary national security. Semiconductors may contain backdoors that expose them to vulnerabilities, and lack of stock could inhibit economic activities. As a result, just as oil independence was essential to high politics in the 1970s, so semiconductor independence is at the top of the agenda in 2020. As evidence of the desire to have “chip independence”, Vice Premier Ma Kai said, at China’s 2018 National People’s Congress, that “we cannot be reliant on foreign chips”. ⁹

The national giants of the semiconductor world are the USA, China, Taiwan, South Korea and Japan. At the time of writing, several of these giants are locking horns in trade disputes; notably the tit-for-tat tariffs (and “blacklisting” of specific firms) between the USA and China. The trade disputes spark uncertainty that undermines consumer confidence—hampering consumption volumes. This, along with trepidation over the sustainability of supply in the light of the Coronavirus outbreak at the outset of 2020, has caused several firms to reconsider their supply chains in an effort to reduce their exposure to global supply chain disruptions due to illness, or, in the case of Huawei, the loss of a key buyer.

Taiwan is a crucial manufacturer, particularly in the “foundry” segment, of the global semiconductor industry. Foundries are the facilities that manufacture—but not necessarily design—semiconductor chips. Their global production capacity—based on projections by TrendForce in March 2019—was expected to reach nearly US$70 billion by the end of 2019. The semiconductor industry is regarded to be a veritable pillar of Taiwan’s economy. As of 2018, integrated circuits and micro-assemblies accounted for 28.5% of Taiwan’s exports. ¹⁰ Given its massive share of the total economy and trade, disruptions in the semiconductor industry would have a disastrous impact on the Taiwanese economy.

The three largest Taiwanese semiconductor manufacturers are Taiwan Semiconductor Manufacturing Company (TSMC), United Microelectronics Corp (UMC), and Powerchip Technology Co. Globally, these Hsinchu Park-based firms are essential players, as TSMC and UMC are two of the world’s largest pure-play foundries. ¹¹ In fact, TSMC is the world’s largest pure-play foundry, accounting for about half of the global foundry market share. ¹² Taiwan’s semiconductor foundry giants are essential to the world’s production of semiconductor chips, for chip makers ranging from Intel, AMD and HiSilicon through to electronics
firms ranging from Apple, IBM and beyond. The names and key statistics of Taiwan’s largest semiconductor manufacturers are detailed in Tables 8.1 and 8.2.

The semiconductor industry constitutes a significant share of Taiwan’s economy and its electronics exports in particular. Despite the prominent position of Taiwan’s semiconductor industry, President Tsai did not choose semiconductors as one of the priority industries when she came to power in 2016. Instead, her administration prioritized the following five industries: green energy technology, smart machinery, Internet of things, biotechnology and defence industry. In commenting on President Tsai’s administration balances between supporting emerging and existing industries, the founder of TSMC, Morris Chang, expressed his surprise that the industry receives little support from the Government’s plan. As the administration entered its second year (in 2017), this priority list developed into the so-called “5 + 2 Industrial Innovation Plan,” covering seven industries and projects: intelligent machinery, Asia Silicon Valley, green energy, biomedicine, national defence and aerospace, new agriculture and the circular economy. Again, semiconductors were not specified.

As the following section demonstrates, the importance of the industry has been evidenced by media headlines and political discussions. This

Table 8.1  Leading Taiwanese semiconductor foundries

| Firm                            | Founded (Date and Location) | Executive team       | Share (%) of global foundry market | Revenue (2018, US$ bn) | Stock Exchange (Ticker symbol) |
|--------------------------------|-----------------------------|----------------------|-----------------------------------|------------------------|--------------------------------|
| Taiwan Semiconductor Manufacture Co (TSMC) | 1987 Hsinchu                | Mark Liu & C.C. Wei  | 48.1                              | 34.2                   | NYSE (TSM), TWSE (2330)        |
| United Microelectronics Corp (UMC)     | 1980 Hsinchu                | Stan Hung, SC Chien, Jason Wang | 7.2                               | 4.9                    | NYSE (UMC), TWSE (2303)        |
| Powerchip Technology Co.             | 1994 Hsinchu                | Frank Huang          | 1.7                               | 1.6                    | TWSE (5346; delisted)          |

Sources  Company websites, stock market listing information, TrendForce March 2019 market data
Table 8.2  Taiwan’s market share and ranking of global semiconductor industry

| Output value of IC Industry Chain | Revenue (Taiwan) (US$100m) | Revenue (Global) (US$100m) | Market Share (%) | World Ranking | Leading Companies | Leading Countries |
|----------------------------------|----------------------------|-----------------------------|------------------|---------------|------------------|------------------|
| Integrated Circuit (IC)          | 868                        | 5812                        | 14.9             | 3             | TSMC             | Korea, the US    |
| IDM (including Memory)           | 212                        | 1234                        | 17.2             | 2             | Media Tek        | the US           |
| IC Foundry                       | 66                         | 3694                        | 1.8              | 5             | Nanya Technology | Korea, the US, Japan, Europe |
| IC Packaging and Testing         | 427                        | 592                         | 72.2             | 1             | TSMC             | Taiwan           |
| Output Value of IC products      | 163                        | 292                         | 55.9             | 1             | ASE              | Taiwan           |
|                                  | 278                        | 4928                        | 5.6              | 4             | Media Tek        | Korea, the US, Japan |

NB: The 2018 data is provided by the Industrial Technology Research Institute in Taiwan and is compiled by the Smart Electronic Industry Project Promotion Office (SIPO), Industrial Development Bureau, Ministry of Economic Affairs. Source: The SIPO Website (Semiconductor Industry Status Quo) (September 2019) (‘Smart Electronic Industry Project Promotion Office (SIPO), Industrial Development Bureau, Ministry of Economic Affairs,’ Smart Electronics Industry Project Promotion Office (SIPO), IDB, MOEA, 2018, [https://www.sipo.org.tw/en/industry-overview/industry-categories/the-scope-of-semiconductor-industry.html](https://www.sipo.org.tw/en/industry-overview/industry-categories/the-scope-of-semiconductor-industry.html), accessed on 21 February 2020)

is because uncertainties have peaked due to Brexit and the US-China trade war, even if it was not specified as one of the Tsai administration’s priorities.
THE IMPACT OF BREXIT AND THE US-CHINA TRADE WAR

Brexit

Partnerships with European firms have long been essential to Taiwan’s semiconductor industry. In fact, Taiwan’s largest semiconductor manufacturer, TSMC, was co-established by the Taiwanese Government’s Industrial Technology Research Institute (ITRI) and Royal Philips Electronics (“Philips”) of the Netherlands in 1987. As a founding shareholder, Philips provided technological support for TSMC’s establishing and growth. The collaboration did not end there. In 1998, for instance, TSMC, Philips and Singapore’s Economic Development Board Investments agreed to form a joint venture to build a new wafer fabrication facility (Systems-on-Silicon Manufacturing company) in Singapore’s Pasir Ris Wafer Fab. Only in 2007 did TSMC and Philips jointly announce a multi-phased plan whereby Philips would release its shares, planning to gradually exit from its shareholding in TSMC, 30 years after its initial investment.

In addition to the Philips-TSMC link, there are other key supplier and partnership relationships between European (primarily Dutch) and Taiwanese firms. Notably, ASML, based in the Netherlands, is a leading supplier for wafer processing. At the time of writing, it is the world’s largest supplier for photolithography systems for the semiconductor industry, which use light to etch integrated circuits onto silicon wafers. Given the importance of ASML’s photolithographic machines, in 2012, TSMC and ASML announced a collaboration on the Customer Co-Investment Programme, committing to investing 276 million EUR in R&D to accelerate the development of Extreme Ultraviolet lithography technology and 450-millimetre lithography tools. Also in 2012, ASML’s headquarters agreed to allow the whole manufacturing of new products in Taiwan. As of February 2020, TSMC was reported as being “reliant on ASML’s wares”. As evidence of their reliance on ASML as a supplier, TSMC—along with Samsung and Intel—have committed to financing R&D in exchange for ownership stakes in the Dutch firm. Beyond the ASML-TSMC connections, in 2016, ASML acquired its Taiwanese peer, Hermes Microvision Inc., in a cash transaction valued at about TWD 100 billion (approximately EUR 2.75 billion at current exchange rates) to further enhance its lithography product portfolio.

The Taiwan-European connection in the semiconductor industry also relates to British manufacturers. The UK is not one of the global powerhouses in the sector, and in recent years, the UK players in semiconductor
manufacturing have been acquired by international firms. Cambridge Silicon Radio was bought by Qualcomm, an American company, in August 2015, and Arm Holdings was acquired by SoftBank Group—Masayoshi Son’s technology and investment giant—for US$32 billion in the days after the Brexit vote in 2016. However, one of these UK-based firms—Arm Holdings Plc.—is a particularly important player in the global semiconductor industry given the use of its designs by major Chinese and American firms. Arm designs and licenses processors that “power 95% of smartphones”. In addition to Arm’s input into virtually all global smartphones, it has a direct impact on Taiwan’s leading semiconductor manufacturer vis-à-vis a partnership agreement signed in October 2014 with TSMC.

From TSMC’s roots with Philips through to contemporary collaborations and supplier relationships, there is significant interdependence between Taiwan and Europe in the semiconductor industry. The question is then: What does Brexit, in particular, mean to these relations?

Mark Liu, co-chairman of TSMC and chairman of the Taiwan Semiconductor Industry Association, spoke at a semiconductor show in Taiwan on 19 September 2019, where he pointed out that Taiwan’s semiconductor industry has been the most acutely damaged by talent shortages. Liu urged the Taiwanese Government to strengthen Taiwan’s basic scientific research capacity and attract professionals and experts to teach students at Taiwanese universities. In fact, Liu is not alone in pointing out the talent shortages. Other Taiwanese industrialists have been asking the Government and universities to make extra effort to prepare talents to be ready for both domestic and international high-skill jobs, despite the fact that there have been many public and academic debates concerning to what extent higher education institutions should or could prepare their students for the labour market. One channel for such talent flows comes in the context of UK-Taiwan student exchanges. Since March 2009, there has been a visa waiver programme in place for the UK and Taiwan, and a Taiwan-UK Youth Mobility Scheme that encourages students (between 18 and 30 years old) to travel between countries. More recently, Taiwan’s Ministry of Science and Technology has been working with the UK’s British Academy and research councils to encourage greater research collaboration and facilitate exchange visit programmes. In addition, in March 2018 the UK-Taiwan Innovative Industries Programme was launched with a focus on R&D collaboration in key areas, such as biotechnology, AI, robotics, clean energy and
autonomous vehicles. Taiwanese researchers are able to conduct projects at UK universities and research institutions.\textsuperscript{28}

The thrust of the impact of Brexit on Taiwanese semiconductor manufacturer, it seems, relates more to the exchange of knowledge and development of talent. Production agreements with ASML, in the Netherlands, and Arm, in the UK, are in place and seem to be assured to be out of the crosshairs of Brexit negotiations. Nevertheless, the relationships between these key players—Arm, ASML and TSMC—are not exempt from tensions on account of the US-China trade war. For Brexit-specific concerns, the primary concern is the continuation of education programmes between Europe and the UK. As we explore in the next section, the stability of partnerships between Taiwanese and European firms is more immediately affected by ongoing US-China tensions.

**US-China Trade War**

The trade war between the USA and China is indeed a battle for technology supremacy\textsuperscript{29} and the “huge commercial and national security advantages that come with it”.\textsuperscript{30} When examining the reason why the semiconductor is at the heart of US-China technology tensions, Horwitz notes that “innovation in semiconductors leads to innovative products”. Furthermore, “chips are an economic boon” as the US chip industry “directly employs about 250,000 people, and generates $164 billion in sales each year”.\textsuperscript{31} He adds that “a small but critical portion of the semiconductor industry has specific applications in the defence sector, for use in things like missiles and radars. Mastery of the semiconductor technology can help ensure that a country’s military technology remains at the cutting edge”. For these reasons, semiconductor production capabilities—and each country’s independent ability to manufacture semiconductors—are front and centre in the US-China dispute.

The US-China trade war could spell marked dislocations in the globally-integrated semiconductor industry.\textsuperscript{32} As one analyst remarked, the US president’s “campaign of tariffs and export restrictions against Chinese champions, such as Huawei Technologies, threatens to upend the production of the world’s electronics, from iPhones and laptops to 4K televisions”.\textsuperscript{33} It has prompted firms to consider who they do business with, and how. Gordon Sun, the director of the Taiwan Institute of Economic Research Macroeconomic Forecasting Centre, said that “both US and Chinese companies are diversifying their supply chains due
to similar reasons—to mitigate geopolitical risks”. Some analysts raised concerns that Taiwan could be badly affected by the trade war. As we will show later in this section, at the time of writing, the opposite is proving true, as trade tensions have fuelled a rise in Taiwan’s semiconductor activities.

Companies from other countries, particularly in Europe, have been affected by the US-China trade war. Notably, in 2018, ASML, the Dutch firm with close collaborations with TSMC and a core position in the global semiconductor industry, was caught in the crosshairs. When ASML received an order from a Chinese customer “widely thought to be the Semiconductor Manufacturing International Corporation, China’s biggest chipmaker”, under US pressure “the Dutch Government has yet to grant ASML an export license”. Yet given the size of the Chinese market, ASML does not want to lose access to it. Perhaps even more worrying, if Chinese manufacturers are not able to buy ASML inputs, then they will be forced to develop the capability in-house. Ultimately, blocking ASML from exporting to China could mean that Chinese firms learn to do it themselves, and then no longer need ASML.

Britain’s leading semiconductor firm, Arm Holdings, also came very publicly into the crosshairs of the dispute in May 2019 when it suspended its licensing agreements to Huawei. Some analysts said such a move would be a “death sentence” for Huawei, given its dependence on Arm designs. Yet a reprieve was quickly given, as the president of Arm, Graham Budd, said in June 2019 that the company was “evaluating its options and seeking a ‘swift solution’ from policymakers” in order to continue to do business with Huawei. Arm’s business model sees them licensing designs to others to make the chips, so the announcement that Arm would not work with—or even speak to—Huawei had meant that (overnight) the Chinese firm no longer had access to essential designs for processors. What is more, Arm’s designs are playing “a significant role in [Huawei’s] efforts to develop its own chips as part of its plan to circumvent technology blocks from the US”. This includes HiSilicon’s “Kirin” series of chips that were launched in 2018, which were based on Arm designs.

In the light of ongoing uncertainties around Huawei—and Arm’s willingness to continue to work with the firm—the successor chip will “have to be made from scratch”. Ostensibly in an effort to develop that “from scratch” capability in-house, in May 2019, Huawei revealed that it was building a 400-person chip R&D factory just outside of Cambridge, just
In doing so, Huawei is establishing a facility that can benefit from the semiconductor design talent pool around Cambridge that is working at Arm Holdings, CSR (now Qualcomm) and more. Once the facility is up and running from 2021, Huawei will then be less dependent on corporate contracts with these British firms; the hope is to be capable of design, which has so far been elusive from its capabilities. Questions about Huawei’s continued ability to operate in the UK resumed when news broke in late May 2020 that Britain was considering alternative suppliers for building its (non-sensitive) aspects of the 5G network.

TSMC has been courted—and scolded—by both sides of the US-China trade dispute. Following months of being affected by the inclusion and reprieve from “Entity List” status in the USA, in early November 2019, Huawei was reported to have met with TSMC. The discussion covered the production of key components for its smartphones as well as networking equipment after the USA banned firms from supplying components and technology to this Chinese technology giant. Officials in Washington responded to Huawei’s approach to TSMC by repeatedly asking the Taiwanese Government to restrain TSMC from selling chips to Huawei and urging TSMC’s US clients to make chips in America for security reasons. Furthermore, TSMC “has been pressured by the US to move production of some of its military-grade chips to the US”. Such specific types of chips are used in American F-35 fighter jets. Ostensibly in an effort to shore up its access to the American market, and in response to these explicit political pressures, in May 2020 TSMC announced that it would build a $12 billion factory in Arizona, in the USA.

In the light of its pivotal position, TSMC-founder Morris Chang said, “as the world becomes more chaotic, TSMC is emerging as a strategic territory that all geopolitical forces aim to secure”. Cheng and Li commented that, on account of TSMC’s crucial position in the global semiconductor industry, “Taiwan finds itself in the middle as the world’s two biggest economies struggle to decouple and build more isolated supply chains in the battle for future tech supremacy”. Analysts have referred to this as a “geo-technological triangle” comprised of the USA, China and Taiwan.

The US-China trade war, and the resultant production of chips for both China and the USA separately, could represent substantial potential upside for Taiwan’s semiconductor industry. Trade data for 2019 suggests that diversification towards Taiwan is already well underway. An
UNCTAD report asserted that Taiwan is “the largest beneficiary of the trade diversion effects of United States tariffs on China, accounting for additional exports to the United States of almost US$ 4.2 billion in the first half of 2019”. The gains were related to an increase in exports of office machinery and communication equipment—of which semiconductors are a large share. Compared to the same period the previous year, the annual growth rate of electronic component exports to China was approximately 18.23%; more than 90% of these components are integrated circuits. As some market analysts point out, this phenomenon is mainly due to the fact that the Chinese technology industry has been pursuing “de-Americanization” in response to the trade war. Taiwan is considered by Chinese 5G developers to have considerable competitive advantages in the 5G-related supply chain.

Earlier in the chapter, we underscored the fact that the Tsai administration did not include the semiconductor industry as a priority sector. Recently, though, the US-China trade war escalations stimulated the Taiwanese Government to launch some initiatives to encourage Taiwanese factories based in China to relocate their manufacturing back to Taiwan. These initiatives did attract some Taiwanese firms to shift their operations back to Taiwan. However, some manufacturers are continuing to wait and see what happens with the trade tensions, hoping that the tensions (and now the virus disruption) are short term in nature.

**Conclusion**

The impacts of trade discussions in the USA, Europe and Asia are interconnected. The US-China trade war ensnares European companies in tensions over manufacturing partnerships and supplier relationships. Can Taiwanese and European companies sell to Huawei while also producing chip components for the US military? Thus far, the Taiwanese semiconductor industry appears to be a beneficiary of the US-China trade dispute, and the island’s economy is expected to be one of East Asia’s better performers in 2020. To do this, Taiwan’s leading firms, notably TSMC, are having to please both the USA and China. This means moving their production facilities, in some cases, outside of Taiwan, as the May 2020 announcement of the new Arizona plant underscored. In working to please both sides, they risk their non-alignment strategy backfiring, and then having one of the world tech giants reprimanding them, or worse, cutting them off. It seems, though, that TSMC is such an essential
provider for both China and the USA, especially for chips that are essential to national security, that the foundry should be able to continue to expand its productive relationships with both sides simultaneously.

Though the immediate days and weeks after Brexit occurs could bring potentially significant short-term disruption to cross-border trade for Taiwanese firms, the real concern about Brexit is much longer term. Britain and Taiwan have long-established—and growing—relationships that foster talent development and flows. The maintenance of this asset is of increasing importance to Taiwan, given rising concerns about an outflow of high-skilled workers. There have already been warnings that Taiwan has begun losing its global competition for talent—a talent pool that is essential to its ability to keep its position as a global leader in the fast-paced, high-technology semiconductor industry. To keep Taiwan at the technological frontier, the Minister of Science and Technology, Chen Liang-gee, has pledged a 10% annual increase in the basic research budget (reversing the trend after years of decline). In August 2019, he delivered on that promise by announcing a US$149.7 million increase in the 2020 basic research budget, with a “focus on technologies related to 5G, cybersecurity and precision medicine”. Such critical funding is essential to continuing to its long-term capabilities in the emerging geo-technological triangle.

Broader than semiconductors, the impact of Brexit on this trade relationship comes in the form of its impact on the potential for a Taiwan-EU trade agreement. The European Commission first indicated its willingness to engage in talks about such an agreement with Taiwan in 2015. Such an advance for the EU in boosting cross-border investment with Taiwan would surely disadvantage future trade and investment with the UK. However, bilateral trade agreements with the EU notoriously take a long time to agree, so it may be many years before anything would come to be (and that is assuming that political will remains once the UK is out of the European Union).

In terms of a Taiwan-UK trade agreement, Boris Johnson secured his prime ministership in the December 2019 General Election while Tsai won her second term in January 2020. These two events will probably not change the political landscape for Britain and for Taiwan. But, reaffirmation for Johnson as a prime minister was almost synonymous with reaffirming the tone of a done-deal Brexit. At the same time, there have been no further developments regarding the progression of any trade agreement between the UK and Taiwan. Given that Taiwan has been put
in the middle of the US-China trade war, and the dynamics of geopolitics, the likelihood of a trade agreement between the UK and Taiwan reminds highly uncertain.

In summary, in Table 8.3, we distil the potential short- and long-term impacts of both Brexit and the US-China trade war, with a focus on Taiwan’s position in the global semiconductor industry.

In Europe, there are a few system-critical semiconductor firms that have significant engagements with Taiwanese manufacturers. Though Britain is not a leading buyer or supplier of semiconductors, it does contain some strategically important firms in the market, particularly Arm Holdings. Thus far, the US-China trade war has posed more of a risk to Arm-TSMC relations than Brexit has. Similarly, for Dutch ASML, concerns centre on US-China trade tensions rather than what Brexit could mean to market access. The uncertainties caused in terms of access to talent, ability to do business, and short-term trade complications, pose substantial risks to manufacturing and trade in this highly important, and globally organized, industry. In the long run, if US-China trade war interventions mean that Chinese manufacturers are not able to buy essential inputs from suppliers like ASML and Arm Holdings, they will dedicate the necessary time and money into developing their own capabilities. After all, independence in semiconductor manufacturing is raised again and again in the name of national security.

Table 8.3 Summary of long and short-term impacts on Taiwan’s semiconductor industry

|                        | Brexit                                                                 | US-China trade war                                                                 |
|------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| **Short-term**         | Disruption, particularly for goods indirectly traded through the EU to  | Disruption in trade, in particular, suspending contracts (e.g. with Huawei/HiSilicon) |
|                        | the UK                                                                  | Potential gains from relocation of production (from mainland China to Taiwan, and also, to the US) |
| **Long-term**          | Risk of disruption to education and talent flows between Britain and Taiwan | Chinese semiconductor manufacturers to develop design capacity to reduce reliance on foreign suppliers (e.g. Arm Holdings and ASML) |
|                        | Potential for EU-Taiwan trade deal would diminish with the UK out of the EU |                                                                                     |
For Taiwan, economic success has been central to its strategy for survival as an autonomous entity. So far, it has demonstrated its ability to thrive in the face of global volatility. Taiwan’s firms seem to be effectively growing their export numbers despite—or because of—trade disruptions elsewhere. However, new tensions are boiling on account of the outbreak of the novel coronavirus, and the semiconductor business is highly cyclical, as it is directly affected by slumps in global consumer demand. In addition, on the political front Taiwan has recently seen two countries—the Solomon Islands and Kiribati—shift their recognition to the PRC, leaving it with just over a dozen countries still recognizing it as a sovereign state. At the same time, the ongoing Hong Kong protests stir questions and concerns about the future of the “one country, two systems” model and the potential for the status quo to remain.

To maintain its formidable position in this innovation arena, Taiwan will need to keep stable relations with mainland China. President Tsai’s win of a second term in office signalled “strong voter support for her tough stance against China”. When it comes to technology as well as the trade war between America and China, Tsai unsurprisingly takes a pro-American stance. However, it would be difficult for Tsai and her administration to ignore the fact that China has become Taiwan’s largest trading partner, and also the world’s dominant technology superpower. While Taiwan’s economy has grown its interdependence with China, it is not included in the Comprehensive and Progressive Agreement for Trans-Pacific Partnership or the Regional Comprehensive Economic Partnership. Thus, Taiwan’s strong political stance vis-à-vis China requires balance with the acknowledgement that China represents both a booming customer and competitor for its semiconductor industry. Taiwanese firms also need to tango around partnerships within a splintering Europe, as this remains essential to producing advances in the high-technology field of semiconductor manufacturing.

Notes
1. ‘Winning the Future: A Blueprint for Sustained US Leadership in Semiconductor Technology,’ Semiconductor Industry Association Executive Summary, 2019, 3, https://www.semiconductors.org/wp-content/uploads/2019/04/FINAL-SIA-Blueprint-for-web.pdf.
2. The US Commerce Department’s Bureau of Industry and Security (BIS) added Huawei Technologies Co., Ltd. (Huawei) and 68 non-US Huawei
affiliates to its Entity List on 16 May 2019. The 68 non-US affiliates are located in 26 countries, including Taiwan and the UK. The designation imposes an export license requirement on all exports, re-exports and transfers of items. Then, a few days later, the BIS issued a 90-day temporary general license (on May 20) which partially restored the previous licensing in four category areas: (1) continued operation of existing networks and equipment; (2) support to existing handsets; (3) cybersecurity research and vulnerability disclosure; and (4) engagement as necessary for development of 5G standards by a duly recognized standards body. The 90-day temporary license was originally set to expire on 19 August 2019, but was extended again, until 19 November 2019. For more details on the entity list, see Richard Burke et al., “Designates Huawei to Entity List, Issues Temporary General License”, White & Case, 2019, https://www.whitecase.com/publications/alert/us-designates-huawei-entity-list-issues-temporary-general-license.

3. Zen Soo, Li Tao, and Chua Kong Ho, ‘Taiwan Became Top Chip Manufacturer with US Help. Can It Stay There?,’ South China Morning Post, 11 September 2019, https://www.scmp.com/tech/tech-leaders-and-founders/article/3026766/taiwan-became-top-chip-manufacturer-us-help-can-it; Robyn Klingler-Vidra, The Venture Capital State: The Silicon Valley Model in East Asia (Ithaca: Cornell University Press, 2018); Chao-Tung Wen and Jun-Ming Chen, ‘Taiwan: Linkage-Based Clusters of Innovation—The Case of Taiwan’s IT Industry,’ in Global Clusters of Innovation: Entrepreneurial Engines of Economic Growth Around the World, ed. Jerome S. Engel (Cheltenham: Edward Elgar, 2014).

4. AnnaLee Saxenian, The New Argonauts: Regional Advantage in a Global Economy (Cambridge: Harvard University Press, 2006).

5. Debby Wu, ‘Trump Tumult Has Gadget Giants Splitting Along Us-China Lines,’ Taipei Times, 2019.

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