

Chips and the Future of Taiwan

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ABSTRACT

This paper provides (1) an outlook of Taiwan's chip industry relative to other countries, (2) projections for Taiwan's future with possible scenarios, (3) tentative forecasts for the future prospect of Taiwanese chip firms, and (4) policy suggestions in the interests of Taiwan. Our results show varying degrees of impacts on the revenues of chip firms based upon different war-peace scenarios. Taiwan's government should take active steps to de-risk and stabilize political relationships with China.

Introduction

Following World War II, and especially from the 1970s, Taiwan swiftly evolved into a robustly advanced economy, primarily propelled by its formidable chip and IT sector. The Taiwanese government's encouragement of overseas education created a "brain circulation" of Taiwan-born, but U.S.-educated and trained, engineers and entrepreneurs which drove innovation back in Taiwan. The chip technology was actually invented in America and gave Silicon Valley its name - as most chips are created with silicon. In the 1990s, the US was manufacturing a third of the world's chips. But today, none of the most advanced chips are made in the US. Most of them are made in Taiwan. However, recently, Taiwan has become a territory of a "proxy war" between the two global powers, China and the US. Both superpowers are also trying to position themselves in the chip technology race. This raises many key issues for Taiwan's chip industry and the future of the island.

We first need to understand Taiwan's current central position in the global semiconductor market and the recent technologies and innovations regarding AI and 5G chips. We must investigate those issues in the context of the core importance of the chip industry for Taiwan's economy and of geopolitical crises in the Taiwan Strait. The main issue is the future geopolitical scenarios Taiwan must deal with in terms of war or peace with China. This means analysing potential diversification and de-risking strategies of Taiwanese chip firms, potential foreign investments and partnerships to mitigate political tensions, and trade and foreign policies to adopt in the case of heavy trade or military wars between the West and China. Given the complexity of the issue, we must lay out different scenarios for the future of Taiwan's chip industry, and notably of its main company TSMC.

I will first present the current situation of the Taiwanese chip industry, its landscape and policies (1). Then, I will examine the potential scenarios for the future of the island (2). Finally, I will make tentative forecasts of the Taiwanese chip industry based on these scenarios (3).

The Taiwanese Chip Industry

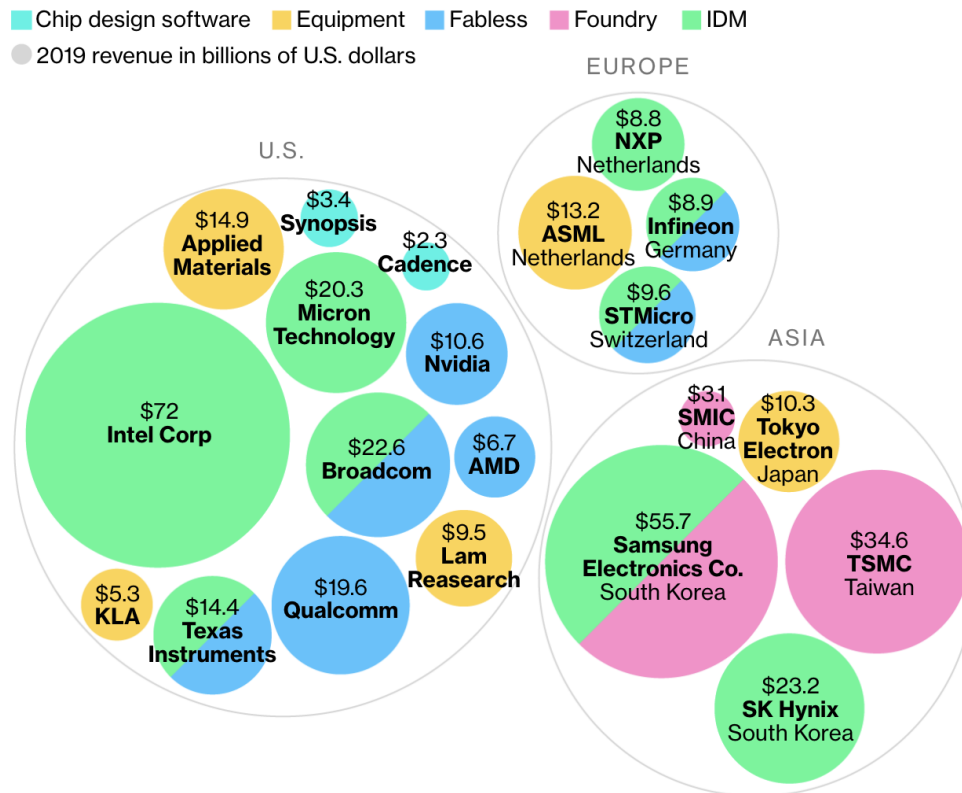
The Taiwanese Chip Landscape and Policy

The Taiwanese Chip Landscape

Taiwan's yearly production of electronics currently represents around 28 billion US dollars (Statista). It has been decreasing during most of the 2010s but has been increasing since 2018. A "chip" is the commonly used

word for an integrated circuit of semiconductor material. Semiconductors are assembled into transistors and are the main components of computing equipment such as computers and smartphones, but also military equipment and household appliances, as well as advanced camera lenses among others (Li and Ting-Fang, 2023). Semiconductor materials include silicon and have electrical conductivity above the conductivity of a “conductor” material and an “insulator” material.

The TSMC company (Taiwan Semiconductor Manufacturing Company Limited) has experienced significant growth in both revenues and profits in the last decade (Figures 1 and 2). Its revenues are now above 1 trillion \$, and it invested 21 billion \$ in capital in 2021 (Crawford, 2021).



Source: Bloomberg data

Note: Samsung revenue figures are for its semiconductor segment.

Figure 1. Revenues of the biggest chip-making companies in the world in 2019, from Bloomberg.

NB : Companies are categorized under three countries. Under each country, the colouring represents the specialization of each company. The size of the circle represents the magnitude of the revenues

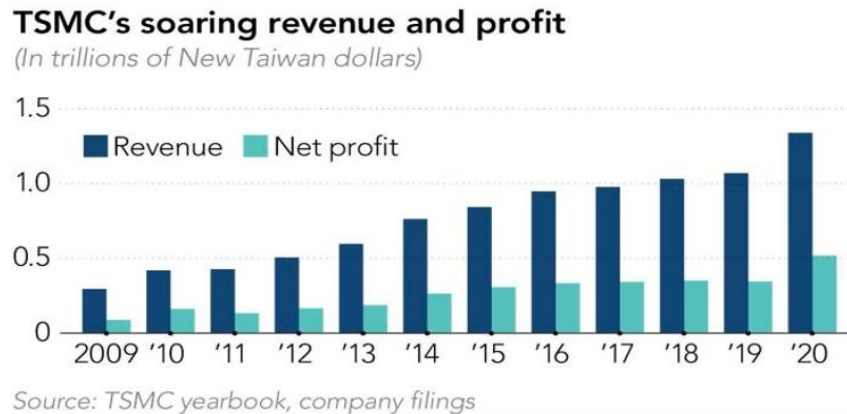


Figure 2. TSMC’s revenues and net profit from 2009 to 2020, from the Financial Times.

NB : The dark blue denotes revenue, which is the total income of TSMC per year. The light blue is net profit, which is the revenue subtracting all the expenses.

The Taiwanese Chip Policy

The Taiwan chip industry relies on what has come to be called the “Foundry Model”. In this type of industry, semiconductors are first produced and then assembled inside integrated circuits. In Taiwan, most companies produce only chips and sell them to assemblers, which then produce computers and other electronics. Producers such as the Korean Samsung or the American Intel produce chips and electronic equipment. TSMC is on the contrary a “pure play” that only designs chips and outsources its production to foundries in order to optimize productivity. It was born in 1987 as a spin-off of Taiwan’s Industrial Technology Research Institute. Today, the Taiwanese industry counts the biggest foundries in the chip industry. Other companies, especially Intel in the US, concentrate on the design of chips rather than on the making process itself. A lot of them completely delegate the making process to external companies, retaining only the designing business. These delegating companies are called “fabless”. Expansion costs for the industry are costly. A new chip foundry plant can cost up to 1 billion US dollars. Many chip producers are teaming up in joint-venture agreements with their competitors to lower costs. In this context, data theft is a major issue.

The International Importance of Taiwanese Chips

The Dominance of Taiwanese Chip Makers

Taiwan produces more than 60% of the market share of semiconductors (Figure 2). Out of this, around 90% comes from TSMC alone. Asia represents around 80% of the total market. Samsung from South Korea is the second world leader. However, TSMC really appears in a very dominant situation. Under its former CEO, Intel even thought about delegating part of its chip production to TSMC (Crawford, 2021).

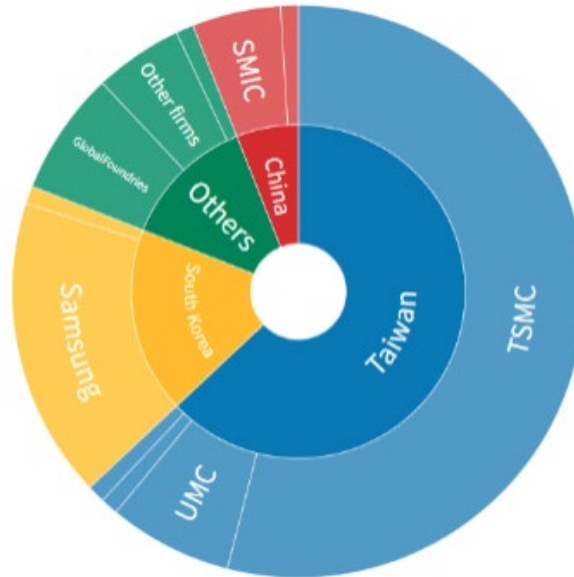


Figure 3. Semiconductor contract manufacturer by market share, from Trendforce (March 2021). Total semiconductor revenues: 85 billion US \$.

NB: It can be observed that the two dominant firms in Taiwan, TSMC and UMC, occupy the majority of the international market share. The second largest company is Samsung from South Korea. The third is a category of “others”, characterized by a host of other countries together. The last is China with SMIC occupying the smallest market share.

A relevant analogy can be drawn in this context. TSMC holds a dominant share of over 55% in the worldwide contract chip fabrication market, a significantly higher portion than OPEC's 40% share in the oil market. However, a notable distinction from the oil market is that each barrel of oil is relatively homogenous, unlike the diverse types of chips. Notably, Taiwan is responsible for 92% of the most cutting-edge processors, a market dominance that puts Saudi Arabia's 12% share of global oil production in a comparatively less remarkable light.

While there exist many metrics to define why TSMC's chips are advanced, aside from its sheer market share, TSMC's main technological advantage is its concentration on smaller, more advanced chips. Around 90% of all of the smallest chips, less than 10 nanometers in diameter, come from the island (Figure 3). Chips a bit bigger, at 10 to 22 nm, are mostly produced in the US. Europe focuses on the bigger sizes, above 28 nm, but even remains below the Taiwanese market share. TSMC in particular appears as a singular choke point in the chip industry. TSMC has clear technological advantages over all other producers, but others have lately been trying to catch up.



Figure 4. Semiconductor manufacturing capacity by country in 2019, share of total, from The Economist.

NB: The x-axis is divided into the size of chips, measured in nanometres. The y-axis is a measure of the percentage of the country's capacity to produce corresponding chip types. It can be observed that with chips greater than 45 nanometres, countries' capacities are quite evenly divided, with Taiwan having slight advantages. However, Taiwan occupies an absolute advantage with chips less than 10 nanometres.

From 2020, there have been many chip shortages in the West. This was first due to supply-side issues linked to the COVID crisis. Most notably, car production was significantly slowed down, including for big Western manufacturers (Crawford et al, 2021). As the COVID crisis subdued, chip hoarding also became a problem, as customers became wary of a future disruption in supply.

The West's Policy Response

In front of this issue, Western governments have sought a policy response. For example, the US Congress passed the CHIPS and Science Act, which provides \$52.7 billion to fund domestic semiconductor manufacturing, research and development, and workforce development (Badlam et al, 2022). First, they have sought to prevent key US technology to flow freely to China through Taiwan. Notably, Trump banned Taiwan's chip companies from access to US chip design. The idea was to prevent Chinese companies gaining access to those designs, notably Huawei through TSMC chips (Crawford et al, 2021). Second, they have sought to relocate chip production to the US. Since 2020, more than three dozen U.S. companies have pledged to invest nearly \$200 billion in semiconductor manufacturing in the United States. Even more significantly, TSMC committed to building a 12 billion USD semiconductor manufacturing facility in Arizona.

In Europe, the Commission and national governments are planning a 30 billion euros public-private investment push. For instance, GlobalWafersCo, a Taiwanese company, recently invested 4.4 billion euros in a plant in Germany, thus creating the world's largest wafer-maker (Crawford et al, 2021). However, this process takes time and resources. The objective is to raise Europe's market share in chip production from 10 to 20%.

Turning to Asia, in China, the 2022 five-year plan allocated 1.4 billion \$ to prop-up the local chip industry (Crawford, 2021). There are concerns that the country might engage in stealing chip designs, called "IP". Indeed, cyber-attacks against Taiwan's chip industry have geared up in recent years. In Taiwan itself, there has been a notable policy shift. Taiwanese President Tsai Ing-wen's "New Southbound Policy" is an effort

to steer Taiwanese trade and investment away from China. Aside from the US, in May 2023, G7 leaders met in Japan and vowed to “reduce excessive dependencies in our critical supply chains” (G7, 2023).

However, the West simply cannot catch up in the short run, and by short run, I mean the following decades. Companies with billions of dollars at their disposal have thus far failed to catch-up to TSMC, which continues to invest over \$30 billion annually into its business. Ironically, Apple’s most advanced semiconductors, which contain billions of transistors, can only be produced in a single building within TSMC’s sprawling campus in Taiwan.

Potential Scenarios for The Future of the Taiwanese Chip Industry

Taiwanese Chips in The Current Geopolitical Situation

The General Geopolitical Situation in The Taiwan Strait

Pundits frequently characterize the dynamic among the US, Taiwan, and China as existing within "the gray zone," which signifies actions occurring between the realms of war and peace. These actions include a wide range of activities, including the implementation of sanctions, influence-driven operations, and dissemination of disinformation. For example, in 2022, China executed its most extensive military encroachment around Taiwan to date, mobilizing 71 aircraft for tactical exercises (Johnson, 2023). Notably, these maneuvers didn't result in any harm to civilians or soldiers in Taiwan. Rather, they represented more of a coercive tactic and a deterrent, presented by China under the guise of a "military exercise."

Economically, within this "gray zone," Beijing imposed sanctions on Taiwan by halting imports of citrus fruits and fish following Senator Pelosi's visit to the island. Similarly, US foreign policy avoids overtly aggressive stances, opting for "strategic ambiguity." This strategy is rooted in the belief that keeping all parties uncertain about the extent of potential US military involvement in a conflict across the Taiwan Strait is most advantageous (Yee, 2023).

The Taiwanese Chip Industry and The “Chip Triangle”

Taiwanese chip firms own huge assembly plants in China. A lot of the final consumers of those assembled products live in the US. This has created a “triangle of critical interdependence” between Taiwan, China, and the US (Li and Ding-Fang, 2023). For instance, the iPhone is produced for 26% in China, 23% in Taiwan, and 18% in the US. 36% of the material bill originates from Taiwan, although those chips are mostly designed by US and European chipmakers.

Potential Scenarios

A China-Taiwan War

Analyzing the probabilities of war hinges on two key factors: capacity and incentives. The first possibility is intended war. From China's vantage point, it possesses ample capacity for war. This is made evident in the "Anti-Secession Law" by the Chinese Communist Party. The law outlines potential "non-peaceful means" in the Taiwan Strait. China's investment in vital military assets, like amphibious assault vehicles, essential for a cross-strait invasion, is substantial. Regular drills, termed "military exercises," showcase its capabilities. For example, China dispatched 71 aircraft for military maneuvers around Taiwan in 2022, its largest single incursion ever (Johnson, 2023).

Regarding incentives, China's heavy reliance on Taiwanese-manufactured chips acts as a deterrent. An attack risking Taiwan's chip production would cripple China's economy (Bremmer, 2023). A notable instance

occurred when China economically sanctioned Taiwan after Nancy Pelosi's visit, strategically excluding electronics. Chinese industries, including cloud infrastructure, electric vehicles, and advanced manufacturing, depend on Taiwan's chips from TSMC. The calculus is clear: the Status Quo grants China significant trade benefits, while obliterating semiconductor production carries undue risks. In a conflict, the US would probably target Taiwan's chip plants instead of allowing them to be seized by China, regardless of apparent victory. Recognizing this, China acknowledges the peril of venturing into a war laden with uncertainty, jeopardizing lives and resources. Even if China could confidently win the war, operational hurdles abound. Operating Taiwan's fabs necessitates ongoing access to US and allied technologies, which the US would undoubtedly withhold in such a scenario.

A final consideration is the specter of *unintended* war. Increased military presence elevates the likelihood of accidents, like air or sea collisions, cascading into an unwanted conflict. A single mishap could trigger reactive responses, spiraling into a catastrophic escalation neither side desires.

A "Grey-Zone" Of Worry Peace

The second scenario isn't anything new. For years, Taiwan has accused China of employing a variety of "grey-zone" tactics to threaten the island and undermine the morale of the Taiwanese people and leaders, such as through diplomatic and economic pressures, or means of (dis-information campaigning). The trend seems to suggest that grey-zone warfare will only intensify in the future. For example, just earlier in April 2023, the Chinese maritime police warned to board and inspect cargo ships and construction vessels in the Taiwan Strait as part of a "special three-day operation". Taiwan's defence minister Chiu Kuo-cheng warned of a fresh wave of such tactics, saying that there will be "many similar situations" like the ship inspection operation in the future.

Again, such grey zone tactics are never intended to cause physical harm, but increase the risks of miscalculation and military conflict. Empirical trends seem to suggest the plausibility of this hypothesis. According to a 2022 study, published by California-based Rand Corp, "China views grey-zone activities as "a natural extension of how countries exercise power", and a way to pressure others to act according to its interests. Beijing has over the past decade employed nearly 80 different grey-zone tactics against Japan, Vietnam, India and the Philippines."

Improvement and Stabilization

China's policy is clearly seeking to weaken Taiwan and its ties with the US for a broader goal of unification. However, Taiwan also has a plan to combat this. Taiwan's current strategy is to offset Chinese pressure with greater investments at home, improved defense capabilities, predictable sustainment of its central role in global value chains, and tighter coordination with countries abroad. The Democratic Progressive Party (DPP) party is actively coordinating with Washington around "substantive issues", such as strengthening Taiwan's asymmetric military capabilities and building a forward-looking trade and economic agenda. Taiwan also plans to raise defence spending in 2023. The stabilization and growth of Taiwan is not a given, and it must be led with a combination of policies. For example, Taiwan could seek close ties with its powerful neighbour. It could continue to fight for international and US recognition for independent statehood. Lastly, Taiwan could adopt permanent neutrality and act as a buffer for other Asian states.

Tentative Forecasts of the Future of the Taiwanese Chip Industry

Forecasting Challenges

The first challenge to forecast is that it requires a lot of assumptions for the extreme cases of full-on wars or very high-tension situations. We can however look at the evolution of past correlations and extrapolate to the future based on reasonable assumptions for each forecasting scenario. I will investigate the trend over the 2000-2020 Taiwanese chipmakers' revenues over chip exports, the share of Taiwanese components in global supply chains, and military tensions in the Taiwan Strait. Then, I will assume values for each of those explanatory variables in our three scenario cases in order to forecast the evolution of revenues and exports for Taiwan's chip industry.

The second challenge is in regard to political tensions. As observed in the case of the Russia-Ukraine war, totalitarian rulers tend to lack rationality while making political decisions such as the invasion of a country. Given that Taiwan's chip industry is heavily intertwined with political tensions, irrational decisions made by big-power leaders can lead to unpredictable results.

The third challenge is a lack of data for an accurate quantitative analysis. The chip industry involves a lot of cutting-edge technology which makes companies deliberately hide information about their production, technologies, and strategies. Also, there is a huge regulatory constraint and bureaucracy within China that makes data either unavailable or unreliable.

The fourth challenge is related to what is known as a "Black Swan event". Black Swan events are events with very low probability but very high costs. This could include for instance pandemics or a meteorite falling on Earth. A full-scale invasion of Taiwan could fall into this category. Black Swan events' consequences are hard to predict, because they lack historical precedents. Markets are also bad at pricing them, since prices are usually based on averages and not on extreme cases.

Forecasting Exercises

Available Data

The total market size of the chip market is forecasted to almost quadruple in the current decade (Figure 4). This is due to the rise in demand for computer chips, notably to produce a rising number of computers and smartphones, but also for military equipment and overall a large share of electronic equipment worldwide. The need for chips has risen in 2023 due to the emergence of Large Language Models used for artificial intelligence systems such as ChatGPT. We can start by having a look at the main indicators concerning Taiwan's chip industry and world demand from the 2000s, as well as at existing forecasting exercises. Precedence Research has estimated the evolution of the global semiconductor market size from 2022 to 2032, which shows a steady linear rise. The market would be set to quadruple in size.



Figure 5. Forecast rise in global semiconductor market size in US dollar from 2022 to 2032 (forecast), from Precedence Research.

It is projected that Taiwan experiences constant and steady growth into the future.

A main indicator of interest is the total revenue of Taiwan’s semiconductor industry in the past decade (Figure 5). After a steady growth from 2010 to 2020, there has been an exponential growth phase in 2020. This could be explained by the decrease in Chinese exports after COVID-19, as well as a chip-hoarding reflex of developed countries. Since 2022 however, this phase seems to have transformed into a slight fall. This could be linked to the end of the post-COVID phase, but also to rising tensions in the Taiwan Strait.

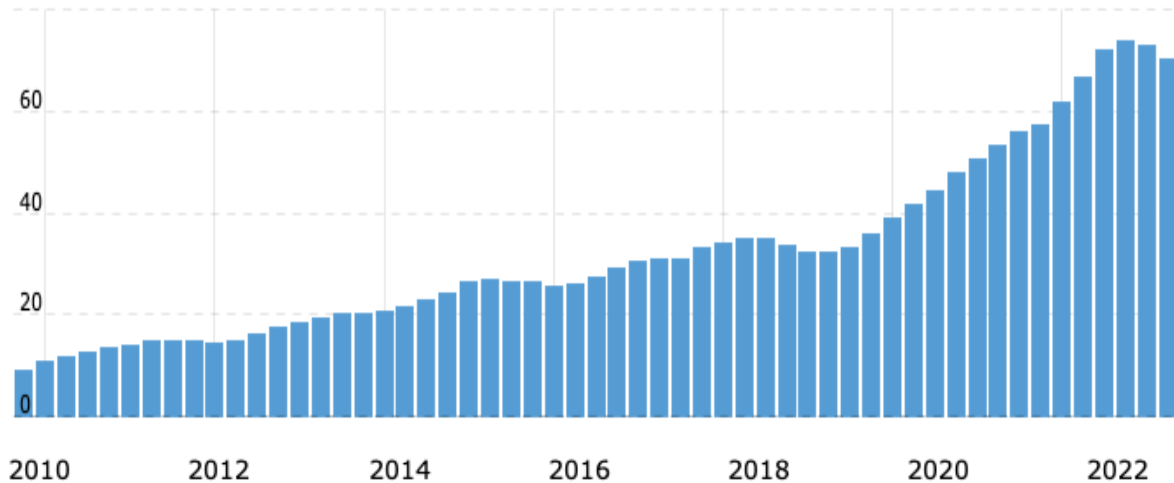


Figure 6. Total revenue of Taiwan’s semiconductor industry in billion US dollars, 2010-2023, from Macro-trends.

Taiwan experienced incremental stable growth from 2010 to 2020 but a significant increase from 2020 to 2022.

Most of Taiwan’s chip production during this period was exported to developed countries. This has led to an almost constant growth in chip exports from 2004 to 2022 of around 15-20% (Figure 6). However, one can observe the influence of economic cycles. Export growth became negative after the 2008 crisis and after the Euro area sovereign debt crisis.

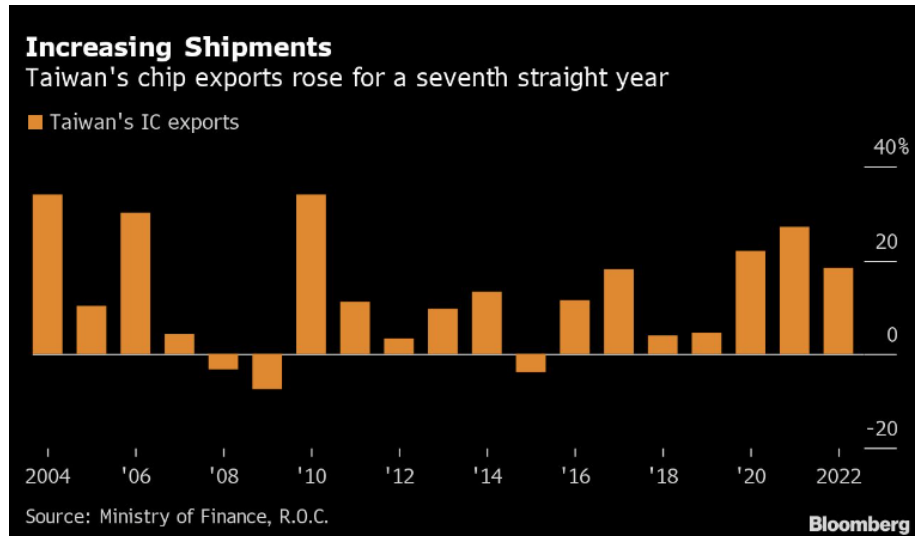


Figure 7. Growth of Taiwan’s chip exports from 2004 to 2022, from Bloomberg.

The x-axis represents a timeline of the past 18 years, and the y-axis represents the percentage of chip exports in a specified year.

Looking at market shares, Taiwan fundamentally ate half of the US market share in the 1990s but has actually remained constant since 2000 (Figure 7). The only major forecasted change in the country's distribution will be the rise of China in the next decade. However, estimates vary wildly. This broad picture also does not distinguish between types of chips. Taiwan has an advantage in the production of the most miniaturized, advanced chips. In most cases, Taiwan’s share is forecast to stay about the same.

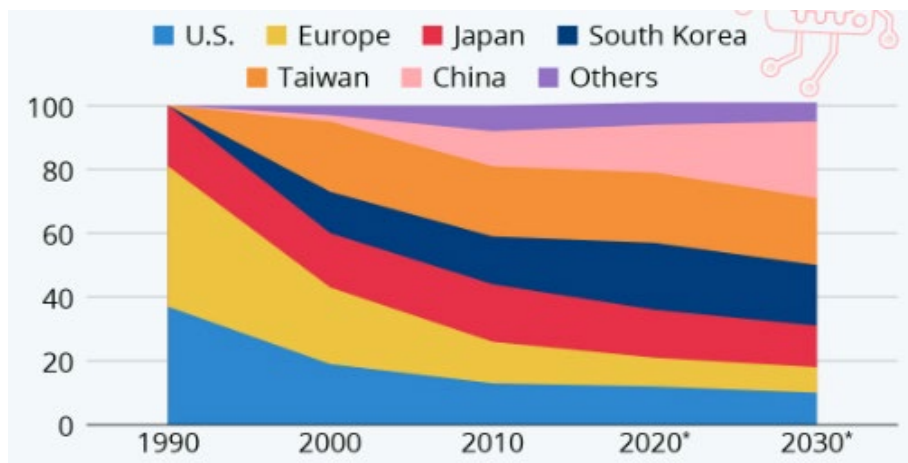


Figure 8. Market share of the semiconductor market from 1990 to 2030 (forecast), from Semiconductor Industry Association and Boston Consulting Group.

Each colour represents a country’s global market share. It can be observed for example Europe’s market share is expected to shrink as there is less color yellow, and vice versa for China which is expected to increase as there is more color orange.

Finally, we need to find a good indicator of the tensions in the Taiwan Strait. In our case, the number of air incursions - or *sorties* - crossing the middle line of the Taiwan Strait stands out as the key indicator

(Figures 8 and 10). From 2020, as Chinese air incursions increase and become a major concern, data collection becomes accessible on a daily basis (Figure 9).

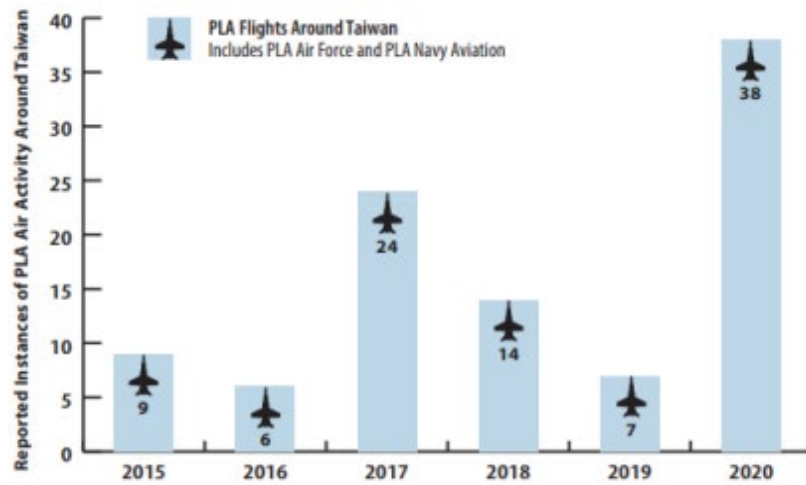


Figure 9. Number of Chinese air incursions into Taiwan’s airspace from 2015 to 2020, from Grieger (2021)

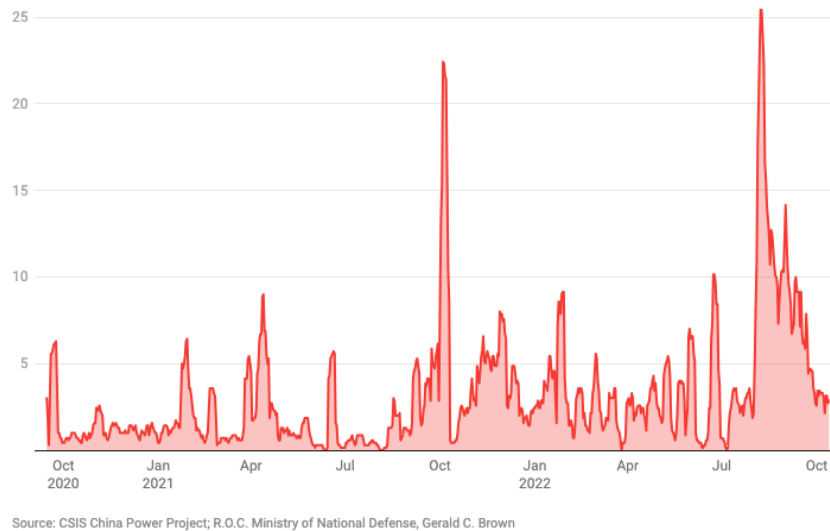


Figure 10. Seven-day running average of Chinese air incursions into Taiwan's Air Defense Identification Zone from October 2020 to October 2022, from ChinaPower.

The x-axis is the timeline, divided into months. The y-axis measures the average of incursions in 7 days. It is observed that incursion peaks around the August of 2022.

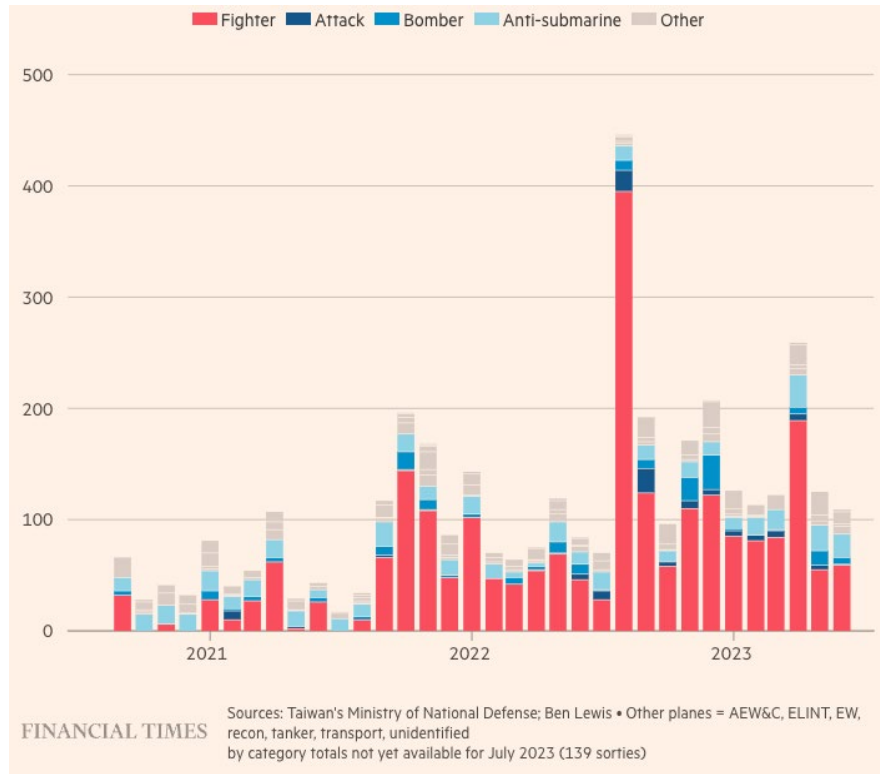


Figure 11. Chinese sorties into Taiwan’s Air Defense Identification buffer zone per month, by type of aircraft, from October 2020 to June 2023, from the Financial Times.

The x-axis represents a timeline. The y-axis represents the number of aircraft. The different colouring indicates different types of aircraft. It can be again observed that the incursion peaked in the late of 2022.

Another sign of growing tensions can be found in online Google searches. The Google Trend Index for the search “Taiwan China war” clearly spiked in recent years (Figure 11). Our Google index is really a Google Taiwan Crisis Index which captures tensions across the Taiwan Strait.

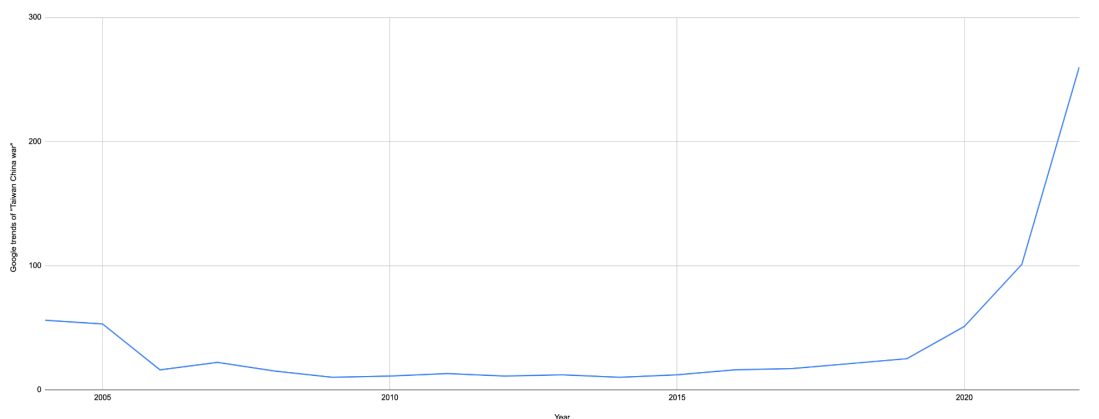


Figure 12. Google trend index of the search “Taiwan China war” from 2004 to 2023, from Google.

We can plot this Google Taiwan Crisis Index against the growth of chip exports of the island (Figure 12). This reveals a “Chinese hat” whereby periods with higher or lower growth of exports happened alongside

decreased tensions. On the opposite, periods of heightened tensions happened when growth rates were in the middle range of between 5 and 30%. This is the case for the last two years of 2021 and 2022. This “Chinese hat” reveals underlying logic in terms of political economy. Chip exports are one of the main indicators of the strength of Taiwan’s economy and its geopolitical power. Low export rates mean Taiwan loses economic interest in terms of Chinese expansion. High export rates mean Taiwan’s economy is booming and invading it would present challenges in terms of interventions from the West. Average economic growth rates mean there is an economic rationale for an invasion with lower risks of Western intervention.

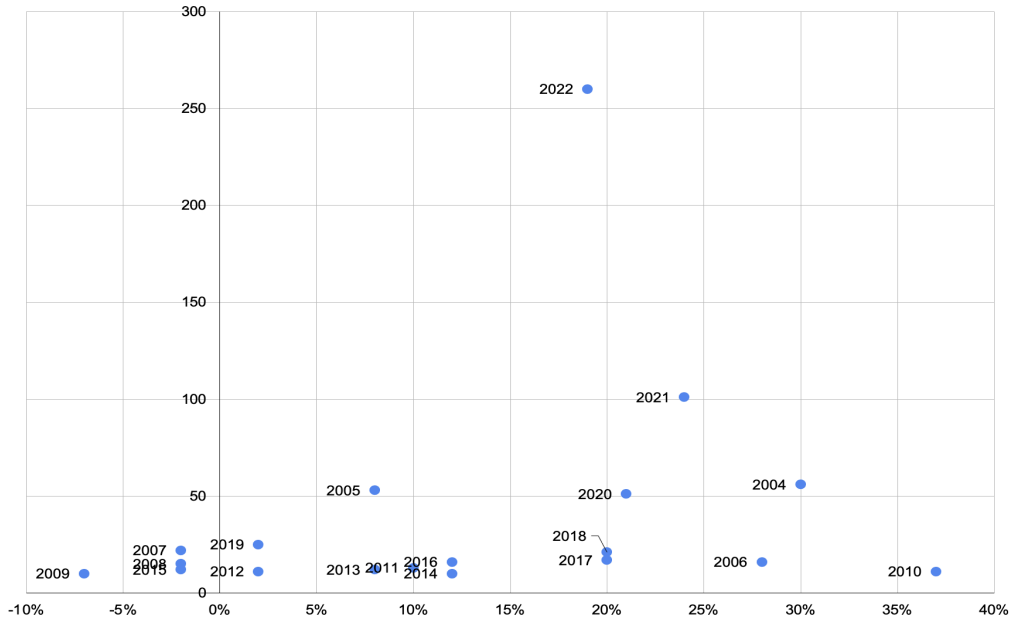


Figure 13. Scatter plot of export growth vs Google trend index of the search “Taiwan China war” from 2004 to 2023, from Google and Bloomberg.

The x-axis is Taiwan’s chips yearly export growth. The y-axis represents our Google Taiwan Crisis Index.

In order to assess the consequences of war in the Taiwan Strait, we need to access more detailed data on the locations of chip production facilities in Taiwan. To this end, we use raw Wikipedia data to build a dataset of the cost of construction of chip plants in Taiwan, then aggregate them by main locations. This allows to draw a graph of where the main chip production assets are located on the island (Figure 13) and to map it (Figure 14). The available values of Taiwanese chip plants total 150 billion USD, i.e. almost 20% of Taiwan’s GDP. Their destruction would yield a major economic disaster for the island, as well as a major economic cost for the world.

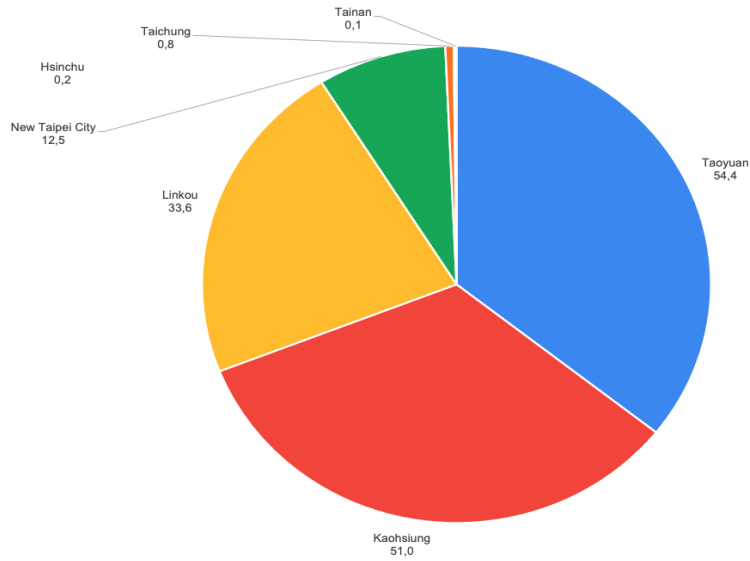


Figure 14. Total value of chip plants per city in Taiwan in billion USD, from Wikipedia.



Figure 15. Total value of chip plants (“fabs”) per city in Taiwan in billion USD, from Wikipedia. Circles proportional to the value of the plant.

Econometric Analysis

As a second step, we examine historical correlations between those variables in order to find patterns of determination which could be used for future forecasting. We first regress the yearly revenues of TSMC on our Google Taiwan Crisis Index and the number of air incursions into Taiwan.

We first use a simple Ordinary Least Square regression. We find a weak correlation coefficient (R^2) of 0,21. The Google index is very weakly correlated to TSMC’s revenues (coefficient of 0,0002). Air incursions are more correlated (coefficient of 0,16), but the p-value is insignificant. This might be due to the exponential functional forms of our data series. In order to address this issue, we use first-differences. This increases slightly

our correlation coefficient to 0,23. Coefficients of the Google index (0,003) and air incursions (0,42) are higher, but p-values are still insignificant.

These insignificant results might be due to the wide yearly time interval of our data. Additionally, turnover is by construction less sensitive to external geopolitical events compared to, for instance, share prices. In general, finding correlations between very different variables, pertaining to firm-level financials and geopolitical events, is generally hard.

We hence turn to the weekly correlation between TSMC's share prices and our Google Taiwan Crisis index in the past three years. As we can see in Figure 15, there is an observable correlation. The correlation coefficient is quite low. Indeed, there are many issues which influence the price of a stock. Additionally, heightened geopolitical tensions tended to be a rare occurrence over the long run. The p-value is of 0,02, meaning the correlation is significant at the 95% level.

We extend the time window of our analysis to 2018-2023 in order to encompass the pre-pandemic period. We find that the correlation is inverted (Figure 16). The correlation coefficient is about the same, and is significant as well. This means that the geopolitical tensions between China and Taiwan started having a significant negative consequences on TSMC's share prices after the pandemic. Between 2020 and 2023, an increase 1 percentage point in our Google Taiwan Crisis index decreases TSMC's share prices by 0,28%, i.e. 2% of the standard deviation of the share price. These variations may appear quite small as such. However, this means that, for instance, in a case of crisis where the Google Index jumps by 10 percentage points, TSMC's share price would plunge by almost 3%, which is very sizable for a stock price. This supports our initial assumptions. It also means that TSMC's share prices and future evolutions are highly dependent on the Taiwan Straits crisis.

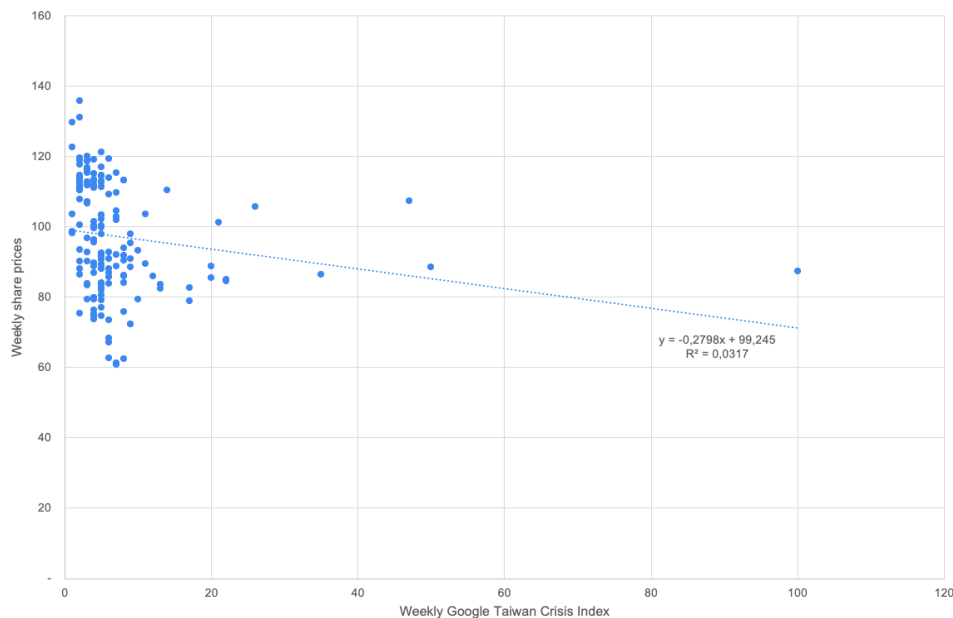


Figure 16. Correlation between weekly TSMC share prices and Google Taiwan Crisis Index, from 09/2020 to 11/2023, by author.

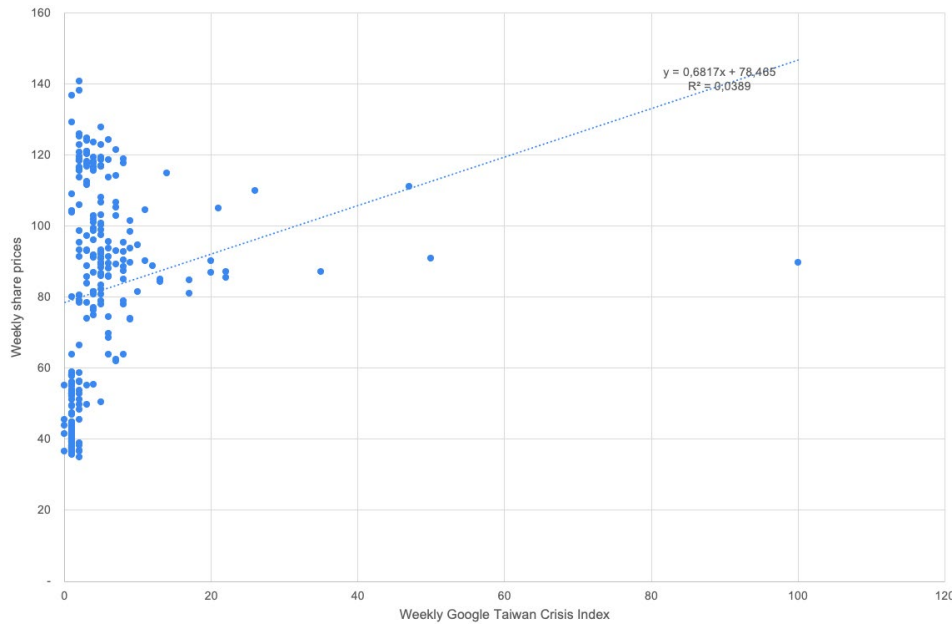


Figure 17. Correlation between weekly TSMC share prices and Google Taiwan Crisis Index, from 11/2018 to 11/2023, by author.

These results are interesting as such. It would be possible to add air incursions as an additional variable. However, issues with data accessibility mean that a manual, time-consuming collection period would be needed. It could also be useful to add other variables as controls, such as concerning other economic phenomena which affect share prices. This could be done in a broader research agenda.

As a second step, we now turn to adopting a higher-level view by proposing a scenario-based analysis.

Three Scenarios: A China-Taiwan War, A Grey Zone, Improvement and Stabilization

In the case of a major China-Taiwan war in the Taiwan Straits, we can propose a range of possibilities. The worst-case scenario would be a complete interruption of Taiwan’s chip turnover and exports. To obtain our upper estimate, we take 90% of the average 2004-2022 turnover, and then divide it by two. In other words, we take the likely evolution of the industry in the current context and consider that a major disruption would divide its production and exports in half. In this scenario, Taiwan’s chip industry would have a maximum yearly turnover of 3.5%, and exports would grow at an average of 5% (Figure 15). This choice is in part to reflect the high probability that China, in the event of a significant conflict, would still likely try to spare part of Taiwan’s chip industry. Indeed, China would have an interest in preserving the main economic asset of the island, as well as supply chains linked to chip production in China itself.

		Yearly growth rates	
		Turnover	Exports
Actual	2004-2009		12%
	2010-2020	8%	11%
	2020-2022	34%	21%
Forecast	2023-2032	Scenario 1 : Taiwan-China war	0 - 3.5%
		Scenario 2 : "Grey zone" of wary peace	7%
		Scenario 3 : "Improvement and stabilization"	21%
		0 - 5%	10%
		16%	

Figure 18. Forecasts of the yearly growth rates of Taiwan’s chip industry over 2023-2032, from the author.

Our second scenario corresponds to a continuation of the current “grey zone” of wary peace in the Taiwan Straits. In this scenario, the heightened 2021-2022 tensions would become the new normal. In this context, we consider that the Taiwan chip industry would durably be diminished by about 10% in terms of turnover and exports compared to the 2010-2020 period. In this context, turnover should average a yearly growth of 7%, and exports about 10%. This would still remain a high-growth industry, but the very high growth rates of the post-COVID catch-up period would be gone. In both scenarios and contrary to previous estimates such as SIA’s and BCG’s, the share of Taiwan’s chip production among the world’s production would likely fall.

In our third scenario, which currently seems far off, the geopolitical situation would significantly improve. Part of the high-growth period of the industry after 2020 would even endure. In this context, we take the average of the 2004-2022 period as our ballpark estimate of yearly growth. Overall, our estimates range between 0 and 21% yearly growth of turnover over the next decade, and 0 to 16% of export growth. This large ballpark reflects the high uncertainty inherent in forecasting economic variables in a volatile geopolitical context.

Conclusion

We have shown the unique specificities of Taiwan’s chip industry at the world level. The sector embodies the success of Asian Tigers from the 1970s and has significantly contributed to world growth. In this context, the current geopolitical predicament risks severely impeding the industry and having a global impact. We have tried to enlighten the major role of the industry for the West as well as for China. The statistics we gathered point to a post-COVID uptick.

We find that the geopolitical tensions between China and Taiwan started having a significant negative consequences on TSMC’s share prices after the pandemic. Between 2020 and 2023, an increase 1 percentage point in our Google Taiwan Crisis index decreases TSMC’s share prices by 0,28%, i.e. 2% of the standard deviation of the share price. These variations may appear quite small as such. However, this means that, for instance, in a case of crisis where the Google Index jumps by 10 percentage points, TSMC’s share price would plunge by almost 3%, which is very sizable for a stock price. This supports our initial assumptions.

We develop three major scenarios describing the likeliest potential outcomes of the current tensions in the Taiwan Strait. This exercise allows us to highlight the major differences in growth depending on the future evolution of the protracted conflict.

This is relevant for policy-making. Indeed, all parts of the tensions, the West, China, and Taiwan, need to better understand the width of the impact of a deterioration of the situation in the Taiwan Straits. This is indispensable in order to prepare for the downside scenarios, to adequately forecast the consequences of wary moves, and, worst case, to adapt swiftly and appropriately to any significant worsening of the situation.

Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

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