國立臺灣大學社會科學院政治學系

Department of Political Science

College of Social Sciences

National Taiwan University

Master Thesis

台灣中華民國作為地緣經濟參與者的分析：

台灣半導體產業案例分析

Analysis of Taiwan ROC as a Geoeconomic Actor:

A Case Study of the Taiwanese Semiconductor Industry

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中華民國 112 年 11 月

November, 2023

doi:10.6342/NTU202304268

國立臺灣大學碩士學位論文
口試委員會審定書

台灣中華民國作為地緣經濟參與者的分析：
台灣半導體產業案例分析

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本論文係 Otto Van Malderen（學號：R11322034）在國立臺灣大學政治學系完成之碩士學位論文，於民國 112 年 9 月 15 日承下列考試委員審查通過及口試及格，特此證明

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doi:10.6342/NTU202304268

doi:10.6342/NTU202304268

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In Prague on 30 July, 2023 Otto van Malderen

doi:10.6342/NTU202304268

References

VAN MALDEREN, Otto. *Analysis of Taiwan ROC as a Geoeconomic Actor: A Case Study of the Taiwanese Semiconductor Industry.* Praha, 2023. Master's thesis (Mgr.). Charles University, Faculty of Social Sciences, Institute of Political Studies. Department of Political Science. Supervisor PhDr. Michael Romancov, Ph.D.

Length of the thesis: 162.046 characters including spaces, without abstract or appendices

doi:10.6342/NTU202304268

Abstract

This thesis contains a geo-economic analysis of the Taiwanese Semiconductor industry from the perspective of the government of Taiwan ROC. Its goal is to expand the current literature on geoeconomics by proposing a model, taking into account the state's capacity to control its economy, and applying it to the case of the Taiwanese semiconductor industry. Specific consideration has gone into defining geo-economics so that it combines both internal coherence with external differentiation. The model applies developmental theory to the geoeconomic framework to incorporate structural constraints by political and economic interest groups on state-led geo-economic policy. The case study contains an in-depth analysis on the global semi-conductor industry, as well as Taiwan ROC's place within it and recent examples of its geo-economic use. While Taiwan ROC occupies a prominent place in the world of semiconductors, it is limited in its capacity to use it due to the contested identity of the Taiwanese people. This contested identity leads to a fractured political scene with distinct political goals between the two biggest parties, making long term strategic policy unattainable. This identity is moving closer and closer together over time, which might eventually increase the Taiwanese capacity to use its industry in geo-economic strategy.

Keywords English

Geopolitics, Geo-economics, Semiconductors, Taiwan ROC, Supply Chains, State-Industry Relations, Developmental Theory

Keywords Chinese

地缘政治、地缘经济、半导体、中国台湾、供应链、国家与产业关系、发展理论

doi:10.6342/NTU202304268

Acknowledgement

I would like to express my gratitude towards Mar van der Kooij Martìnez, whose unwavering patience, trust and inspiration have been instrumental in bringing this work to its conclusion and without whom it would have been devoid of purpose and purposeless in meaning.

doi:10.6342/NTU202304268

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doi:10.6342/NTU202304268

Introduction

This thesis is a part of the dual degree of Geopolitical Studies (GPS) at the Charles University in Prague and East Asian Studies at the National Taiwan University in Tapei. Its goal is to apply geo-economic theory to a real-world case study, in the form of the Taiwanese semiconductor industry. Through this analysis, a set of current uncertainties surrounding geo-economic thought are addressed, such as the problematic lack of a single definition, the unaddressed aspects of state-industry relations, and the distinction between economic and geo-economic power. All these are discussed extensively in the literature review.

To accommodate this research, the following research question is used: *What geo-economic power does the semiconductor industry generate for Taiwan ROC and how does it use that power?* The initial goal of the thesis would have been to provide a total view of Taiwanese geo-economic behaviour, but throughout the process, the scope was limited to the semiconductor industry in specific. This is first of all because it is the biggest single industry contributing to the Taiwanese GDP, and arguably the most strategic one too. Secondly, a significant part of the thesis goes into the foundation of a theoretical framework that could fill the gaps mentioned earlier.

To take into account the dynamic state-industry relations, developmental theory is referenced throughout the thesis. Developmental theory is a form of political economy that is most often applied to East Asia and provides a workable model for state-industry power dynamics over time. It has been applied to Taiwan ROC on many occasions and should be a good addition to geo-economic theory for this subject.

doi:10.6342/NTU202304268

The structure of the thesis is as follows: After the literature review, the research question and methodology are presented. They contain the full outline of the research design and sub-questions, as well as some notes on the choice of the case study. To come to a useable model combining geo-economic and developmental theory, the next section provides the foundation of a joint theoretical framework. With this model, the role of the state in the development of the Taiwanese semiconductor industry can be analysed, together with its current geo-economic status.

Based on this model of 'developmental geo-economics', the case study is divided into three parts. The first part aims to provide an outline of the economic power in the industry, together with a basic understanding of the structural constraints by economic and political interest groups on state policy. The second part analyses the strategic potential in the industry, effectively moving from economics to geo-economics, and then applies these constraints to come to an overview of the geoeconomic power in the Taiwanese semiconductor industry. The third and final step looks at recent initiatives by the Taiwanese government to use this industry politically.

A summary of the findings, together with a future outlook can be found in the conclusion. In the end, this thesis hopes to provide a combination of both theory and practice, a model and a case study, with the aim to refine them in further research.

doi:10.6342/NTU202304268

1 Literature Review

1.1 Origin & Evolution of Geo-Economics

While associations between trade and politics have been practised for centuries, the term geo-economics has only been around for a few decades. It was coined during the early 1990s, during a period of geopolitical turmoil that eventually culminated in the fall of the Soviet Union. During this period in time, two streams of thought emerged. The first one believed in the gradual end of global conflict, symbolised by the famous book *"The End Of History*" by Francis Fukuyama. For these scholars, the consensus was that the US-led liberal world order had prevailed, and major ideological conflict would be over for good. Yet, this was opposed by the second group of thinkers. They believed that the post-Cold War Period would show an increasing trend in conflict, with great thinkers such as Samuel Huntington stressing the potential of intercultural conflict, or Robert Kaplan's "The Coming Anarchy" in which he implores a more interventionist United States (US) stance to stop the developing world from falling into anarchy (Huntington 1993; Kaplan 1994). Another scholar in this group was Edward Luttwak, a Romanian-born American scholar who in the year 1990 wrote an article titled *"From Geopolitics to Geo-Economics: Logic of Conflict, Grammar of Commerce"*. It is considered to be the first-ever use of the word geo-economics and in the article, he proposes it as a new defining theory for global interaction. States would ever more rely on economic strategies rather than military means to conduct their international strategies. To answer the question of why states act geo-economically, he proposes that states inherently are spatially-defined entities structured to outdo each other on the global stage (Luttwak 1990, 19). He defines two domestic forces that motivate geo-economic action: bureaucracies that strive towards what is perceived as

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success in the international economic arena, and economic interest groups striving to instrumentalise state policy for their own benefit.

In a broader spectrum, Edward Luttwak's theory of geo-economics can be seen as part of the realist tradition in international relations. Realism is a broad perspective that emphasises the role of power and national interest in shaping international relations. Realists believe that states are motivated primarily by self-interest and that they seek to maximise their power and security in an anarchic international system (Korab-Karpowicz 2018). Realists also tend to view international relations as a competition for power, with states seeking to gain an advantage over one another through various means, including military force, economic coercion, and diplomatic manoeuvring. Luttwak's theory of geo-economics can be seen as a realist approach to foreign policy, as it emphasises the use of economic tools to achieve strategic objectives and suggests that states can use economic coercion to influence the behaviour of other states. Luttwak's emphasis on the role of power in shaping international relations and his view of international relations as a competition for advantage also align with realist perspectives. This realist background caused the theory to be scarcely used by academics during the 90s, as liberal theory seemed far better at explaining the current phenomena of integration and cooperation. However, this integration eventually led to interdependence, which pressured states into a more strategic way of thinking about trade (Scholvin and Wigell 2018). Some scholars propose that international economic connections are broader than simply international trade and that conflict resolution between states is mainly dependent on capital interdependence, rather than bilateral trade (Gartzke, Li, and Boehmer 2001). Others have described the perceived combination of security and trade relations in Asia since the 2008 financial crisis (Wright 2013).

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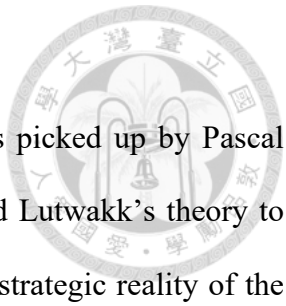

Lutwakk's initial theory did find resonance in France where it was picked up by Pascal Lorot, director of the *Revue française de géoéconomie.* He criticised Lutwakk's theory to be too narrow and somewhat outdated to explain the economic and strategic reality of the 21st century. While he agrees that the majority of geo-economic power finds itself in the hands of the US, Europe and Japan, nations do not necessarily need to be great economic players to act geo-economically. Additionally, he questions the exclusive position of the state as a geo-economic policy maker and draws attention to the abilities of large enterprises to steer state policy. His definition of geo-economics is two-pronged. According to him, it is the analysis of economic strategies to protect the national economy, decided by states aiming to: (1) protect their national economy or certain well-identified parts of it; (2) to help their "national companies" to acquire the mastery of key technologies and/or to conquer certain segments of the world market relating to the production or marketing of a product or a range of sensitive products, in that, their possession or control confers on its holder - State or "national" company - an element of power and international influence and contributes to the reinforcement of its economic and social potential (Lorot 1997). This idea prompts the dual status of geo-economics, in that the economy is both a tool used by the state to assert power and influence and a vital part of the national fabric that ought to be protected by the state. In an interview in the same issue the founder of the geopolitical magazine Hérodote Yves Lacoste positions geo-economics as a valuable addition to geopolitics, but not a replacement. He also underlines the central role of the state to develop its society and economy to attract international capital flows (Lacoste 1997). Harbulot & Lacoye argue that it is the lack of geo-economic vision that caused France's economic and subsequent political decline in Indo-China, referencing the

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commercial historical rivalry between Portugal and Great Britain for the need for a state-led geo-economic policy (Harbulot and Lacoye 2008).

1.2 Debates in Geo-Economics

1.2.1 Defining Geo-Economics

As the name betrays, geo-economics finds itself at the collision of geopolitics and economics. This has made it so that proposed definitions for the term differ in positioning within the two fields of thought. Simultaneously, there is no consensus on whether and to what degree geo-economics has replaced military power competition. This gives way to a diverse collection of definitions for the term depending on where the authors place it within the two aforementioned spectrums. In the book "War by Other Means", Blackwill and Harris propose economic and military means of power competition coexist and are mutually reinforcing to shape a national strategy (Blackwill and Harris 2016). Other authors consider geo-economics and geopolitics, and subsequently economic and military strategies, to be overlapping. Huntington describes economic power as an enabling force for military power, specifically in regards to China (Huntington 1993). Grosse sees geo-economics as a new cognitive perspective in political economy, defining it as the subordination of economic policy and its instruments to primary goals of geopolitical strategy (Grosse 2014). Søilen on the other hand sees in geo-economics a Chinese version of grand strategy, similar to that of MacKinders's Heartland or Spykman's Rimland. This Chinese strategy then resembles more the thinking of ancient Chinese strategist Sun-Tsu, who considered a victory without fighting the highest form of strategy. He considered geo-economics to be the study of factors of power that are directly related to the Competitive Advantage of a nation. These factors could be *"a series of variables like sufficient economic size, economic growth, skills necessary to master vital scientific or commercial*

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progress and the ability to force others to comply with your interests" (Søilen 2010). Despite the plethora of definitions it is not often clear how geo-economic power is differentiated from geopolitical power, or when precisely economic power becomes geo-economic. The latter is revisited later in this chapter.

In recent years efforts have been made to develop a more rigorous definition of geo-economics. Director of the Geneva Institute of Geopolitical Studies, Gyula Csurgai, provides the following encompassing definition: *"geo-economics is an interdisciplinary analysis that includes geopolitical factors, economic intelligence, strategic analysis and foresight and has the objective to provide a tool for states and businesses to develop and implement successful strategies to conquer markets, and protect strategic segments of the domestic economy, among other things."* (Csurgai 2018) Yet, the case remains that any encompassing definition fails to fully incorporate the different ways of understanding and applying the concept, leading to a lack of analytical power (Vihma 2018b). Scholvin and Wigell attempt to solve this by separating the concept into practical and theoretical geo-economics. Proposing geo-economics should be seen as both a foreign policy strategy and an analytical framework. The foreign policy aspect constitutes the application of economic power to realise strategic objectives. As an analytical framework it is positioned within international relations (IR) realism, where it analyses economic bases of power that are defined by geographical dimensions. They also state this conception of geo-economics does not lead to a fundamental shift in the international system. *"The logic is still interstate rivalry; superiority over others is still the end."* (Scholvin and Wigell 2018). Should geo-economics be something broad, with the potential of losing its explanatory power? Or should it be defined as specifically as possible, setting it apart from geopolitics and political economy, yet making it irrelevant for many cases. As Vihma noted, using this

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broad definition for geo-economics has benefits, but also leads to a loss of explanatory power of the concept (Vihma 2018b).

Since this thesis uses a case study of Taiwan ROC 's semiconductor industry to determine in what sense political actors generate, develop and use geo-economic power, and as this process in and of itself is a practical matter, it seems useful to apply a practical definition for geo-economics. For this purpose the definition put forth by Robert D. Blackwill and Jennifer M. Harris (2016, 20) in their book "War by Other Means: geo-economics and Statecraft." fits well. They present geo-economics as:

“The use of economic instruments to promote and defend national interests, and to produce beneficial geopolitical results; and the effects on other nation’s economic actions on a country’s geopolitical goals.”

The choice for this theory of geo-economics is based on a number of factors. First of all, the various arguments and concepts within the book support a cohesive framework for understanding the modern role for geo-economics in international relations, demonstrating a high level of internal coherence. Concerning external differentiation, the focus on economic statecraft distinguishes it from geopolitics, which is more focussed on military strength, and its attitude towards practical application and tools for geo-economics sets it apart from more theoretical political economy (Blackwill and Harris 2016, 8). Finally, it gains theoretical utility through the integration of interdisciplinary perspectives of geopolitical competition, international trade, technological advancement and monetary policy. In summary, this theory for geo-economics should be able to aptly explain the

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actions and deliberations of Taiwan ROC 's government in designing a strategic semiconductor policy.

This definition does lead to some further questions. First of all, how is the ‘geo’ in geo-economics represented? If it applies to the promotion of national interests, then what sets it apart from international political economy? If it originates from producing beneficial geopolitical results, then it is merely the economic component of geopolitics. Both answers are not satisfactory. Rather, the author prefers to supplement the definition with that of Scholvin and Wigell (2018, 81), which reads:

“Just like for geopolitics and military bases of national power, the geo-dimension in geo-economics means that the economic bases of national power must have decisive geographical features. … The mere use of monetary and financial policies in pursuit of strategic objectives does not qualify as geo-economics.”

This understanding of geo-economics as not only the strategic use of the domestic economy, but as the strategic use of the domestic economy that is geographically connected to the nation adds to the external differentiation.

1.2.2 From Economic to Geo-Economic

Still problematic however is the distinction between economic, geo-economic and geopolitical power. Since there is no widely accepted definition for geo-economics, there is also no consensus on the definition of geo-economic power and what it corresponds to. Authors will use different terms to describe similar phenomena or provide vague definitions. Still, it is unclear how a state moves from an economic policy to a geo-

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economic policy. Blackwill and Harris define geo-economics as *"the use of economic instruments to shape the external environment in ways that advance a state's national interests."*. These instruments can be trade policy, investment, aid, financial levers, export controls, intellectual property and export controls. When these instruments, which are economic, are used for political purposes, they become geo-economic. Furthermore, key factors are provided that dictate the geo-economic capacity of states: Economic size and strength, trade and investment patterns, financial leverage, technological leadership, energy resources, and political and diplomatic influence (Blackwill and Harris 2016). While these factors are only briefly mentioned here, they are elaborated upon in the later section on a theoretical framework. On the distinction between geo-economics and geopolitics, Blackwill and Harris focus on the means rather than the ends. They use the example of a cruise missile hitting a library, which would not be considered cultural warfare. For them, it is the tools used by the actor that define the types of power politics. On the other hand, Grosse introduces the concept of a country's economic potential. The key indicator for this potential is wealth, which in turn is defined by the size of financial assets and by the ability to accumulate capital. Subsequently, Industrial production and trade exchange are used by states to accumulate capital and leverage it on the international market. Thus, a state's economic policy is subordinate to the goal of improving its geo-economic potential, using tools of economic policy to maximise benefits in external relations (Grosse 2014). It is obvious that the various structuring of economic, geo-economic and geopolitical policy between authors has had a major effect on their perception of moving from economic to geo-economic power. However, there are also some striking similarities across the existing literature. When combining Scholvin and Wigell's distinction between practical and theoretical geo-economics with the proposed relations between geopolitics and geo-economics we can see a clear overview of current geo-economic thought (Figure 1).

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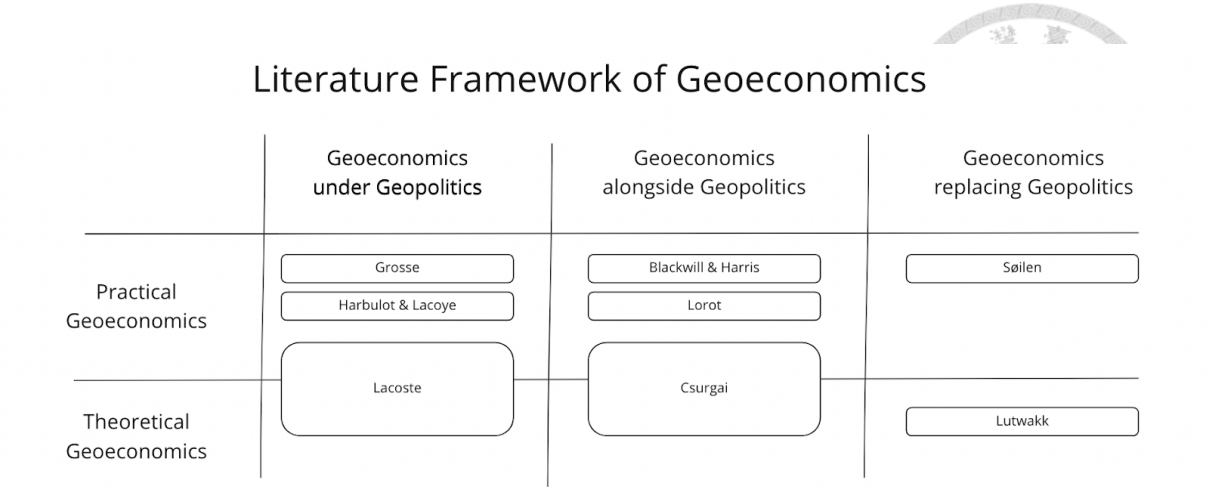

Figure 1 - Matrix Typology based on Geoeconomic Thinkers (Otto van Malderen)

1.2.3 Geo-Economics and Critical Theory

Due to its realist background, there has been a strong critical opposition towards geo-economics. O. Tuathail stresses Lutwakk's original background and his vision of the US as in a constant power struggle. In his perception, geo-economics is the American reaction to state-led development in Japan, a topic which is touched upon later in the section on developmental state theory. Another point of criticism is Lutwakk's state-centric approach which is typical of realist theory. Lutwakk ignores that globalisation leads to the concentration of wealth in certain zones and poverty and crime in others, a global trend happening within and throughout nation-states. Finally, he states that the significance of Lutwakk's book is not found in the explanatory power of his geo-economic theory, but in the anxiety, it represents of a faltering neoconservative caste in a changing world. *"As such, it is a record of a significant structure of feeling within an important strata of the U.S. foreign policy establishment, a feeling of loss and resentment at a world that has become uncomfortably deterritorialized and is in urgent need of the disciplinarity of a new geo-economic cold war."* (Tuathail 1996). Expanding on this Sparke and Lawson argue that geo-economics maps places, political communities, and the protocols of political accountability on a global vs local scale. This creates a political geography that favours the political interests of those groups that dominate the commercial sphere, such as

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entrepreneurial elites. This also inevitably leads to a disintegration of state power, as it loses authority to transnational organisations and public-private consortia (Sparke and Lawson 2003).

The broader concept of geopolitics, and later geo-economics, not only as a form of analysis but also as an enabler of imperialist policies led to the conceptualisation of anti-geopolitics. This thinking demonstrates the local opposition of certain groups and societies that are negatively affected by geopolitical or geo-economic actions of states (Routledge 2003). On the other hand, Moiso criticises the practical application of geo-economics in state policy. If we consider geo-economics and geopolitics to be two of the tools on a state's belt to achieve its policy goals, which is a practical approach (vs the theoretical one) then there are limitations to these concepts. First of all, strategic geopolitics is a far wider phenomenon than military power, as it involves mastering different forms of space through various means and by various actors. Thus, geopolitics and economy in this regard are inseparable. Second, from the strategic perspective, the state is taken for granted as a coherent agent operating rationally. Third, this strategic vision of geo-economics neglects the role of economizing actors such as large business firms, consultant companies, etc… *(Moisio 2019).* While there is value in the critical approach to geo-economics, such as providing an understanding of the use of the term by actors to further their own interests, it lacks a breakthrough in the previously mentioned debates. It does provide some good arguments on states as sole actors in the theory, which will be touched upon in the section on developmental state theory.

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1.3 Current State of Geoeconomics

Currently, the state of geo-economic theory remains divided. The main factors contributing to this are its interdisciplinary nature, the changing dynamics of global systems and the distinction between theory and practice. In recent years more attention has been drawn to the development of practical geo-economic hypotheses, and an analysis of what features of the strategic environment affect the incentives for policymakers to turn to geo-economics in the first place (Vihma 2018a). A recent analysis of inter-state rivalry and geo-economic policies does exist, such as the geo-economic analysis of China and Japan's high-speed rail competition. The authors discuss the economic rivalry between China and Japan in the high-speed rail industry and the potential risks and consequences of this competition. They argue that this competition is fuelled by a geo-economic context, as both countries seek to expand their economic influence through the development and export of high-speed rail technology. However, they also caution that this competition is being fuelled by easy money, as both countries are using large amounts of government funding to support their respective industries. The authors also discuss the potential for political opportunism, as leaders in both countries may be using the high-speed rail competition to further their political agendas. Overall, the authors argue that this competition carries significant risks and could have negative consequences for both countries (Liao and Katada 2021). Another example is the potential application of geo-economics in the operations of seaports, particularly in the context of post-Covid-19 recovery strategies. The authors propose a theoretical framework for using geo-economic strategies in seaport operations, to improve the efficiency and competitiveness of these ports. The framework consists of four main components: (1) analysis of the geopolitical and economic environment, (2) identification of key stakeholders and their interests, (3) development of a strategic vision for the port, and (4) implementation of this vision through the use of specific geo-economic tools and

doi:10.6342/NTU202304268

measures. The authors argue that this framework can be used to guide the development of effective recovery strategies for seaports in the aftermath of the Covid-19 pandemic (Jeevan et al. 2020). Another recent and exhaustive book titled *"Japan's Effectiveness as a Geo-economic Actor: Navigating Great-power Competition"* examines Japan's role as a geo-economic actor in the context of great-power competition. The authors, Yuka Koshino and Robert Ward analyse Japan's efforts to navigate the challenges and opportunities presented by the changing global landscape, particularly with regards to its relations with other major powers such as China and the United States. The book discusses a range of topics related to Japan's geo-economic activities, including its trade and investment policies, its infrastructure development initiatives, and its efforts to shape regional and global governance institutions. The authors argue that Japan has been effective in leveraging its economic strengths to pursue its strategic interests, but also faces significant challenges and constraints in the current international environment. The book aims to provide a comprehensive and nuanced understanding of Japan's role as a geo-economic actor and its efforts to navigate great-power competition (Koshino and Ward 2022).

1.4 Developmental State Theory

When it comes to the developmental state, there is a large body of research, with many authors applying different nuances. The overall idea is that the state plays an important role in the economic development of the country. The concept originated from American Political scientist Chalmers Johnson (1982) who used the term “capitalist developmental state” to describe the Japanese political configuration that contributed to its rapid development. The concept is mostly applied to the rapid development seen in East Asia over the second half of the 20th century and has since been extended by him and other

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scholars to also apply to South Korea, Taiwan & Singapore (Johnson 1989) (Haggard et al. 1992). In short, developmental state theory explains the ways the state can affect industries to facilitate development. This gives rise to major issues when studying East Asian development: what is the role of the government; why has intervention worked relatively well; and what is the relation between government and business?

1.4.1 The Position of the State in Development

The first debate takes place in the broader context of third-world development, and the driving forces behind it. The prevalent idea pushed by neoclassical economists when applied to state intervention is that they are generally associated with distortions, inefficiency, and rent-seeking. This theory was championed by the World Bank and pushed mainly by Western-trained economists (Lal 1986). In a report by the World Bank, East Asian development is defined as 'market friendly', stating that the rapid development can be attributed to factors such as high savings in the region and the development of a positive business climate, while the effectiveness of state-led resource allocation in certain industries is questioned (Birdsall et al. 1993). However, more state-centric theories emerged with the rapid development of East Asian states Japan, Korea, Singapore and Taiwan. These states were very present in the rapid development of their respective industries. If state intervention was not contributing to but rather obstructing development as the neoliberal theory proposes, then development should have been even greater without state intervention which is unlikely (Wade 1990). Statist thinkers instead propose that the region did not follow a "market-friendly" approach, but rather an "East Asian" approach, which focuses more on the benefits and drawbacks of an intervening state (Amsden 1994). Since the debate took place in a broader sphere, the neoclassical theory was also criticised from other perspectives. A critical argument is that by promoting an Occidental-based

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development for the third world as the desired parcours, it fulfils a geopolitical role of maintaining the power balance between North and South (Slater 1993). The idea of Asian developmental theory as an alternative to Western neoliberalism is summarised by the title of an article on the subject: *"Against the economic orthodoxy: on the making of the East Asian miracle"* (Henderson 2006).

Attempting to mend the two opposing theories, Gustav Ranis proposes a detailed view of the role of institutions in transition growth (Ranis 1989). He states that the transition growth process is a metamorphic phenomenon, with subphases happening in a rather fixed order. The success of a nation in navigating these phases is dependent on two main groups of constraints: exogenous factors such as the national physical endowment and the world economic environment, and the institutional dimension. As the exogenous factors will vary throughout the process of transformation, the structural characteristics of every development phase will differ too. This makes that there is no one horizontal path towards development. Institutions are not only an integral part of the initial conditions, but they can also be classified as either accommodating or obstructing the system's ability to develop. The first debate ended with the outcome that active governments that engage in strategic policy-making are an important component of East Asian developmental success.

1.4.2 He's Developmental State Framework

More recently, a definition is proposed that tries to account for the diversity of state-business relations while maintaining explanatory power: *"In sum, the essence of the developmental state is a type of state-business alliance in which the state can play a leadership role in formulating national economic strategies and incorporating the business class into an overall development plan."* (He 2021, 8). The defining factor of a

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developmental state is the relationship between the state and businesses, usually in the form where the former incorporates the latter in its national economic strategies. Most often this happens when the state achieves its political survival through performance-based legitimacy (He 2021). As proposed by Ranis in the previous paragraph, the developmental process is metamorphic. Yet the exact process of this metamorphosis is dependent on many factors that differ from country to country. In all developmental states in East Asia, different political, geostrategic and economic conditions led to different industrial policies. As the creation of an industrial policy is the first step in the developmental process, differences here will have a major effect on the type of state at the end of the transformation. The Industrial policy will set in motion two processes. First of all, it will create the industrial structure on which economic interest groups will form. As the domestic industry grows more and more, these will try to introduce more constraints on government policy, and their success is partially dependent on the initial industrial structure. Secondly, the industrial policy, when effective, will lead to economic development that in its turn will lead to the formation of political interest groups. As time progresses, these will push for democratic reforms. Their composition and demands will also be dependent on the initial industrial policy.

1.4.3 Economic Interests

When it comes to economic interests, He proposes two societal interest groups from which they can originate. On the one hand, there are business elites, on the other there is organised labour. These groups are dependent on three factors: the level of Domestic Private Capital Concentration (DPCC), Foreign Direct Investment (FDI), and the number of State Owned Enterprises (SOE). The combination of these three factors will enhance or restrain interest groups' ability to set up policy constraints for the state. It should be clear

doi:10.6342/NTU202304268

that at the start of the developmental process, a large aspect of these factors is already given. While the state can influence them through industrial policy, its development will be shaped by its presence in the economy and the subsequent effect on state policy constraints. (1) DPCC: When the concentration of domestic private capital is high, this corresponds to a concentration of business interests. The higher the concentration of capital, the more unified will be business and labour interests, either in the form of industry lobbyists or labour unions. This results in a positive relation between DPCC and structural constraints. (2) FDI: A high level of FDI indicates less structural constraints for the state, as there is a mutual benefit for both the state and investors. Foreign investors can withdraw their capital relatively easily and are not necessarily interested in the domestic political situation. The state on the other hand will look after the investor's interest. This translates into a negative relation between FDI and structural constraints. (3) SOE: As in state-owned enterprises the business interests are highly linked to the state, these do not generally pose significant structural constraints. However, the push for sector-wide labour reforms can still occur through organised labour. Here the effect of SOE on structural constraints depends on the interest groups, where only organised labour is constraining. To summarise states with low levels of DPCC and high levels of FDI will face few policy constraints from both business elites and organised labour. A state industry that is highly reliant on SOEs will face some constraints coming from organised labour groups, but not from business elites, as their interests are incorporated into those of the state.

1.5 Conclusion

To summarise, although there is a renewed interest in applying the concept of geo-economics as a guiding principle in international relations, it lacks a clear and distinct definition setting it apart from political economy or geopolitics. Further empirical analysis

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is needed to improve the robustness of the concept, and in these analyses, substantial attention should go to the theoretical background of the hypothesis. Additionally, specific attention should go to the differences between economic, geo-economic and geopolitical power. Furthermore, the underlying causes that lead states to act geo-economically remain underexplored. These factors can be found both within the domestic economic and political spheres as without in global strategy. Research combining both elements into a framework of geo-economic behaviour could prove insurmountable in understanding modern case studies of geo-economics. Thirdly, a structuring analysis on the different uses of geo-economic tools, their effectiveness and drawbacks would provide some much-needed uniformization in the literature. This notwithstanding, in 2023 geo-economics is still very much alive, with a steady stream of publications explaining the complicated reality of international relations in the 21st Century.

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2 Research Question and Methodology

2.1 Research Question

As demonstrated, current geo-economic thought remains divided in its definition, use, and theoretical background of the concept. For this reason, this thesis uses a rather simple descriptive research question, based on a single case study. This leaves enough space for the theoretic development of the arguments, and their empirical confirmations. With this in mind, the main goals of the paper are the following: demonstrate the distinction between economic and geo-economic power, analyse the geo-economic behaviour of a political entity, and do this through an empirical case study. By combining geo-economic and developmental state theories, an attempt is made to answer these key questions:

- What factors make up the geo-economic potential of a specific industry?
- Through which process does the state turn this potential into geo-economic power
- What tools are at the state's disposal to execute this power?

The state addressed in this study is Taiwan ROC and its semiconductor industry. While the specific reasoning behind this choice is explored later in this section, the complex nature of Taiwan ROC's international status and the widespread use in semiconductors from kitchenware materials to ballistic rockets allow us to explore the previously mentioned goals in this thesis. Adjusted to the case study, the main research question then is: **"What geo-economic power does the semiconductor industry generate for Taiwan ROC and how does it use that power?"** To provide a structured answer to this research question there are several concepts that need to be developed first. As the goal is to describe the process of transformation from economic to geo-economic, first and foremost the dynamics of this process ought to be addressed. As this process is expanded upon more

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deeply in the subchapter on Methodology, the guiding sub-questions are presented here for your reference: *1. What factors make up the geo-economic potential of the Taiwanese Semiconductor industry?; 2. What capacity does the Taiwanese state have to turn this potential into actual geo-economic power?* These sub-questions are answered in chapters 4.2 and 4.3 respectively. Ultimately, it is of interest to not only study what theoretical geo-economic power the semiconductor industry generates for Taiwan ROC but perhaps more importantly how it has used it to achieve benefits in its international relations. This aspect of the research question is handled in chapter 4.4, and is guided by the following sub-question: *How does the state use this tool in international relations?* In the following paragraphs, certain terms and concepts used in the research questions are explained, as well as the choice of the case study and definition of geo-economics.

The scope of this thesis is limited to the empirical analysis of a single political entity and a single industry for several reasons. First, the main goal of this paper is to provide a clear empirical analysis of geo-economic behaviour by a political entity. Limiting the scope of the research allows for the necessary space to develop the theory and apply it properly to the chosen case study. Second, it allows for a deep dive into the specific context of the target country and its chosen industry. Both Taiwan ROC and the semiconductor industry function on complex interconnected systems. Research on these topics has to be based on a very broad range of literature. So, they are singled out to focus on their specific case, rather than generalisations by region or national economies. Third, a smaller scope allows for a study of internal state-society relations, as mentioned to be missing in most geo-economic research by critical theorists. Since the political entity of interest is Taiwan R.O.C, developmental state theory is the preferred supplementary framework to analyse this domestic aspect of geo-economics. Timewise the scope of this thesis spans just under five

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decades, from 1974, which is the implicit start of the semiconductor industry in Taiwan, until 2023.

2.2 Methodology

This case study employs a historical analysis approach to examine the geo-economics of the Taiwanese semiconductor industry. The methodology utilised in this study involves a systematic investigation of historical events, policies, and economic factors that have shaped the development and dynamics of the industry over time. The following sections outline the key components of the methodology. This case study aims to provide a nuanced understanding of the geo-economics of the Taiwanese semiconductor industry, shedding light on the interplay between economic factors, government policies, and geopolitical dynamics.

2.2.1 Research Design

2.2.1.1 The Case of Taiwan

The choice of Taiwan ROC as the subject of this case study is based on two major arguments. First of all, it occupies a precarious position in international relations, as it is not recognised by any but 14 UN member states. This means it is barred from many traditional tools of international diplomacy. At the same time, it finds itself in the middle of a sovereignty conflict with the People's Republic of China (PRC), which contests its claim over Taiwan and the mainland. And yet it does boast a democratic government, independent trade relations and a passport. Thus, despite the need to manoeuvre on the international stage, Taiwan ROC's pool of actions is limited due to its inability to partake in bilateral relations with most nations. For this reason, it should be more likely to focus on geo-economics as a primary tool to achieve political goals. Matsanudo in his analysis of US policy-makers proposed that the more pressing the challenges to their preferred

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national security strategy, the stronger the push for integration of instruments of statecraft (2007). He also stated the study of any aspect of international relations should be integrated with that of domestic politics, specifically when it comes to economic statecraft. This ties into the critique of geo-economics by critical theory scholars such as Moiso which are mentioned in the literature review. To assume that the Taiwanese Government is a single actor with an all-powerful hold over the Taiwanese economy would be a gross oversimplification. On the other hand, developing a framework to analyse state-society relations in the detailed manner proposed by Mastanduno would be a thesis in and of itself. However, as Taiwan ROC is considered to have followed the developmental state model in its recent development, this framework can be used to seamlessly supplement geo-economics with domestic power dynamics.

2.2.1.2 The Choice of the Semiconductor Industry

Within Taiwan ROC, the industry of focus is the semiconductor industry. While the strategic aspects of the Taiwanese semiconductor industry are well established, think of concepts such as the silicon shield[1], they are not necessarily considered a geo-economic tool in the way that Blackwill and Harris envisioned. In their book, they identify seven main economic tools for geo-economic application: trade policy, investment policy, economic and financial sanctions, cyber, aid, financial and monetary policy, and energy and commodities (Blackwill and Harris 2016). While semiconductors do not fit into any one single category per se, both Taiwan's unique centrality in the supply chain of more advanced microchips and the importance of these chips in a plethora of appliances gives it the ability to steer where these chips should, and more importantly should not go. In this

1 The idea that due to both the US' and China's dependence on Taiwan for its semiconductors it is protected from a potential Chinese attack (G 2022)

doi:10.6342/NTU202304268

sense, the supply or restrictions of chips to certain countries, or the investment into local production capacities in third countries are only a few ways in which Taiwan ROC can use its industry for political leverage. While this already makes it interesting from a strategic perspective, the importance of this industry for third countries is even more apparent when the dual-use aspect of these chips is considered. For example, all major US defence systems operate on semiconductors. Combined with their importance in the development of artificial intelligence (AI), the US perceives semiconductor dominance not simply as a technological, but also as a military challenge for dominance. Unsurprisingly, both the United States and The PRC have designated technology, and semiconductors in specific, as the main sphere of competition between both nations (Lewis 2020). This has led to further securitisation of the supply chain, as the US published its *Creating Helpful Incentives to Produce Semiconductors* (CHIPS) for America Act (now merged in the National Defense Authorization Act with the American Foundries Act) (Badlam et al. 2022). The PRC published its guiding document for domestic semiconductor development titled *Notice on Several Policies to Promote the High-quality Development of the Integrated Circuit Industry and Software Industry in the New Era* only a few days prior ('China to Promote Integrated Circuit and Software Industry' 2022). In this document, they outline the different aspects of semiconductor stimulation, in the forms of fiscal and taxation policies, investment, Research and Development, Import and Export policies, Talent policies, Intellectual Property policies, Market Application policies and International collaboration ('Several Policies to Promote the High-Quality Development of the Integrated Circuit Industry and Software Industry in the New Era' 2020).

Finally, let's determine if the definition of geo-economics fits with the chosen case study. Semiconductors are indeed economic instruments that could be used by the state to

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promote national interests to achieve geopolitical goals. They are geo-economic as they are tied to the specific geography of the island of Taiwan, and strategic due to their widespread use and dual-use capacities. Their current prevalence in national strategic documents makes them relevant for current research and the development of this case study should improve our understanding of how states act geo-economically.

2.2.2 Data Collection & Analysis

The study relies on primary sources such as government reports, policy documents, official statements, and archival records related to the Taiwanese semiconductor industry. These sources provide direct insights into the economic policies, strategies, and decision-making processes implemented by the Taiwanese government. Despite their original language often being Chinese, they are often translated by the author in English to accommodate for non-Chinese audiences. Secondary Sources such as relevant academic literature, books, scholarly articles, industry reports, and reputable media sources are consulted to gather secondary data. These sources contribute to a comprehensive understanding of the industry's historical context, global trends, and theoretical frameworks related to geo-economics. This research relies more on native-Chinese sources, which are often not translated. For this a basic knowledge of Chinese is required, preferably supplemented with a good translator. The data collected from primary and secondary sources are systematically analysed using qualitative research methods. The analysis involves identifying patterns, themes, and key factors that influenced the geo-economics of the Taiwanese semiconductor industry. Theoretical frameworks related to geo-economics, such as developmental state theory, are applied to interpret the findings and provide a comprehensive analysis.

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3 Theoretical Framework

Geo-economics, in the context of an analytical framework, belongs to the family of International Relations (IR) Realism, as it provides a theory for how state behaviour is guided by relative power competition. It is different from International Political Economy in the sense that it is focused on the economic aspect of the geographic dimension. Economic power is analysed from a geographical and strategic viewpoint (Scholvin and Wigell 2018). Despite this limitation, geo-economics transcends IR Realism, as the latter will always prioritise military over economic considerations when it comes to strategy. In other words, geo-economic analysis allows for a strategic reading of the geo-dimension that does not necessarily involve or even focus on military conflict, but rather bases itself on the dynamics between strategy and economy. As mentioned in the previous chapter, there is a gap when it comes to the interplay between domestic state-society interaction and international geo-economic policy. While in Realism the state is perceived to be undivided and in complete sovereignty, many modern states do not have absolute power to steer their respective economies. While this critique fits in the wider critical argument against Realism, the state-industry dynamic in East Asia can be introduced through the addition of Developmental State Theory. Rather than taking the domestic economy as-is, developmental theory takes industrial policy into account, identifying economic factors such as FDI and DPCC and tying them to the domestic division of power between interest groups and the state. In this chapter, the two frameworks are presented separately first, and then combined into a single framework.

3.1 Geo-economics as a Framework

Much like the lack of a single definition, there is no consensus on a single geo-economic framework of analysis. Thus, for this paper, the appended definition in the subchapter

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"Defining Geopolitics" is used as a guide. As geo-economics has been defined as the use of geographical economic instruments to promote and defend national interests and to produce beneficial geopolitical results; and the effects of other nations' economic actions on a country's geopolitical goals (Scholvin and Wigell 2018; Blackwill and Harris 2016), we can identify the following structure (See Figure 2). The explanations here serve as an introduction to the framework and are thus intentionally short. For a more complete explanation please find the final model in the section 'Combining the Two Models' later in this chapter.

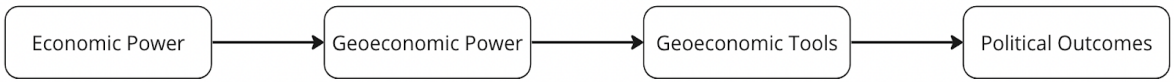

Figure 2 - Framework of Geoeconomic Analysis (by Otto van Malderen)

3.1.1 Economic Power

Quite unsurprisingly, geo-economic analysis starts with the study of the economy. It provides the baseline from which strategic actions can be undertaken and is one of the limiting factors of geo-economic capacity. Thus, the first step in the framework is to analyse the size, composition and development of these economies. Not all nations are created equal, and a major component in determining the geo-economic ability of any entity[2] is to identify key characteristics of their economies. According to Blackwill and Harris (2016), factors contributing to economic power include, amongst other things: market scale and size, technological innovation and competitiveness, natural resources and energy, financial and monetary strength, trade and investment, intellectual property and innovation, infrastructure and connectivity.

[2] As geo-economic behaviour preceded the global dominance of nation states, we can say that geo-economic analysis is not limited to nations (Csurgai 2021, 247)

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3.1.2 Geo-economic Power

The collective of the domestic economy provides the entity with a certain level of geo-economic power. However, when making the jump from economic to geo-economic, there are two specific matters to take into account. First of all, there are no easily quantifiable ways to precisely determine the geo-economic power of a state. It is, in other words, not a precise statement, but rather a general approach to the strategic capacity of a given state or entity's economy. The geo-economic power generated by Russian gas for example is dependent on factors such as the global price for LNG, US-China relations, climate change, the use of renewables, etc…. In other words, assessing the power of a given tool for a given country depends on the context and can fluctuate over time (Blackwill and Harris 2016, 91). Secondly, there is the question of how much power the state has over its economy in the first place. If the biggest economy in the world has no capacity to steer its enterprises in a geo-economic strategy, then its geo-economic power is still considered to be limited. This is one of the big distinctions between economic power and geo-economic power. As strategic goals are not necessarily financially attractive, the domestic economy needs to be convinced to adhere to government policy. The coercive capacity of states to do so is affected by many underlying factors. For example, an authoritarian state will have an easier time convincing one of its SOEs to partake in strategic actions than one that is based on a liberal democracy. While many of these factors are case-specific, Blackwill and Harris (2016, 87) mention four specific 'endowments' that can affect a state's effectiveness in geo-economics. They are the ability to control outbound investment, domestic market features, influence over commodity and energy flows, and centrality to the global financial system.

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The first factor is the ability (and willingness) to control outbound investment. This ability is affected by a broad range of societal traits, such as the legal system, ideology, culture and economy. In general, outbound investment can be split into two groups, direct and indirect. While direct, think SOEs and sovereign wealth funds (SWF), are directly controlled by the state, indirect investments such as Free Trade Agreements (FTA) are less easy to control once they have been put into place (Blackwill and Harris 2016, 88). Second, there are the domestic market features. Apart from factors like size, monetary value, and growth rates, three additional variables play a role in elucidating a country's capacity to transform its domestic market into geopolitical influence. These variables include the ability to tightly control access to domestic markets, the capability to redirect domestic import preferences to convey geopolitical messages, and a growth trajectory that compels other nations to anticipate higher costs in opposing their foreign policy interests in the future. Among the array of geo-economic instruments currently employed, these features related to the domestic market are likely the most pertinent in determining the effectiveness of specific trade, investment, policy, and sanctions efforts in yielding geopolitical advantages (Blackwill and Harris 2016, 89). Third is the influence over commodity and energy flows. The successful influence of a country's geopolitical standing through energy policies depends on three key variables: monopoly power (market ownership), monopsony power (purchasing power), and centrality as a transit point between major buyers and sellers. Finally, there is the centrality to the global financial system. Countries with substantial and systemically important financial sectors generally have advantages in terms of accessing and mobilising capital at low borrowing expenses. They also possess a relatively greater capacity to influence the borrowing costs of other countries. However, it is important to recognize that the connection between financial sector size and geopolitical influence is not absolute. Other factors, such as policy

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decisions related to fiscal health and the presence of asymmetric dependencies like banking exposure, can significantly impact the geopolitical landscape as well (Blackwill and Harris 2016, 91).

3.1.3 Geo-economic Tools

It should be clear that the use of geo-economic tools according to our definition does not necessarily imply an economic outcome. Rather, the development and control of the domestic economy lead to its eventual use in achieving political goals. There are a number of factors to consider when it comes to geo-economic actions. Based on the geo-economic framework, the state is undivided and sovereign over its economy. This means that it can set out a certain set of strategic goals and a geo-economic policy to achieve them. In the execution of this policy, the state is only limited by the extent of its geo-economic power and its creativity, meaning that there is no exhaustive list of economic tools or practices that can be used in geo-economics. Rather, the use and success of economic tools are highly dependent on the context and skill of the actor. At the same time, according to geo-economics, the state is not constrained in any way in employing its domestic economy for strategic purposes. This seems to be an oversimplification of the often complex and two-sided nature of business-state relations. For this reason, developmental theory is added to the model for a more complete analysis of economic and geo-economic power.

3.2 Geo-economics and Developmental Theory

One of the key characteristics of geo-economics, setting it apart from International Political Economy, is that it is limited to geographic boundaries. However, within these boundaries, the state is but one actor among multiple, trying to gain and maintain as much control as possible. In its geo-economic strategy, the state can be opposed or supported by certain interest groups. It can be influenced, dissuaded or even barred from making certain

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policy choices that would make strategic sense but at the same time harm key interest groups in the country. The goal of adding developmental theory to geo-economics is to be able to analyse domestic factors during economic development alongside geo-economic state behaviour.

Developmental theory already provides a framework to accurately represent this dynamic and should be reconcilable with geo-economic theory. According to the former, South East Asian Developmental States, specifically Japan, South Korea and Taiwan ROC, developed rapidly since the 1960s due to a combination of strong administrative capacity, state intervention and a beneficial geopolitical context. Like geo-economics, it presents the state at the centre of the framework, but rather than working towards a relative security advantage over other states, developmental theory explains the domestic dynamic between the central government, middle & working class, business elites and organised labour groups. While He's developmental state framework is designed to illustrate the democratic transition of developing economies, in doing so it provides a solid base for internal state-economy power dynamics.

The model identifies two ways in which developing states can be pushed towards democratisation over the course of economic development. First of all, the state is set to pick an industrial policy on which to base its economic development. This choice is the starting point of the framework and is composed of a mix of factors such as the level of DPCC, FDI and SOE. Out of the industrial policy, two processes are put into motion, on the one hand, the economy starts to develop, which leads to the rise of a middle class pushing for democratic reform. On the other hand, the industrial structure designed by the industrial policy leads to power distributions between the state, business elites and

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organised labour. These two processes will each affect the state transformation process, but more importantly for this thesis, will also affect the capacity of the state to use its economy in a geo-economic strategy (see Figure 3). As the scope of this thesis does not contain democratic transition, the focus lies on factor one and process one of He's developmental framework, in which the effects of economic development on the rise of economic interest groups and structural constraints on state behaviour are analysed.

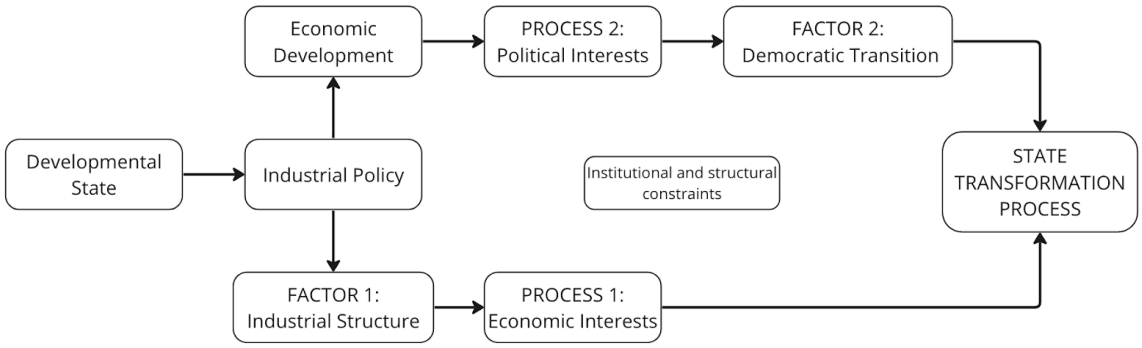

Figure 3 - He's Developmental State Framework

3.2.1 Industrial Policy

The first stage, which is that of industrial policy determination, is done by political elites motivated by regime survival. Examples of this can be found in Taiwan ROC, South Korea and Singapore. In Korea development happened through the Chaebol[3], which was the most effective form of economic organisation at the time (He 2021, 55). In Taiwan ROC the Kuomintang (KMT) was concerned with the survival of the Chinese Republic away from the mainland and had to resort to a Small to Medium Organisation (SMO) strategy complemented with strong SOE (He 2021, 159). Singapore on the other hand shifted away from domestic business elites and chose for an industrialisation strategy based on FDI (He 2021, 105). Each of these decisions was made with the survival of the current ruling class

[3] One of the several large, powerful groups of companies in South Korea that are involved in various different types of business (Cambridge Dictionary)

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in mind, but would greatly affect the power dynamics between domestic interest groups on one hand and the state on the other. Due to the different sources of capital in each of the economies, they were constrained by different factors and ended up becoming rather different economies by the end of their development in the 1980s (He 2021, 210).

3.2.2 Economic Interests

Successful development inevitably leads to the betterment and demise of certain groups in society. Due to the abundance of labour in East-Asian economies organised labour groups will soon emerge, as they hold one of the factors to economic development. As development takes place and industrial policy leads to industrial development, also clusters of capital will begin to form. Eventually, this process will empower both labourers and capitalists (or business elites in He's model) (Rogowski 1989, 5). In other words, throughout the course of the developmental process, both labourers and business elites reap the benefits of the development and become empowered to seek influence in the domestic political process (He 2021, 27). As these groups gain more influence, this eventually leads to the emergence of structural constraints. Business elites can put pressure on the state through the decision to advance or withhold capital, whereas organised labour can disrupt the programmes agreed upon by the state and business elites. He speaks of structural constraints from the moment "the interests of business elites and organised labour can shape the state's decision-making." (He 2021, 28). These structural constraints can be stimulated through democratic reforms, and this is mentioned by Blackwill and Harris (2016, 41) as one of the reasons why the PRC can outmatch US geo-economics: It has fewer constraints on the mobilisation of its industries and capital.

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According to He, the final outline of structural constraints is based on the composition of the industrial structure, based on a combination of FDI, DPCC and SOE. Each of these three factors will affect the interest groups differently, leading to different outcomes in the state-industry power relation (see Table 1). The rate of DPCC has similar effects on business elites and organised labour. For businesses, a high rate means more concentrated business interests in the form of fewer but large enterprises, with a better negotiating position towards the state for policy change. On the other hand, lower DPCC means more but smaller firms, who lack the desire and/or the means to mobilise their resources for policy change. The same goes for organised labour, which has a bigger capacity to influence policy decisions through mobilisation when concentrated. In this case, it will contest the state-business elite coalition to protect its material interests. In case of lower concentration, it has little capacity to develop an organised labour union, leading to less pressure on the state decision-making process (Horowitz and Heo 2001, 8).

State-owned enterprises (SOEs) and foreign direct investment (FDI) have a mostly negative effect on the restrictions put in place by business elites and organized labour. FDI and SOE have the ability to support corporate elite interests by promoting non-restrictive interests. The presence of foreign investors through FDI encourages the government to safeguard the interests of these non-native businesses. The government works to preserve good relations with foreign investors because they can simply move their assets across international borders. As a result, overseas investors are less likely to take part in activities that affect the state's development agendas than domestic private investors, whose cooperation frequently results in conflicts of interest. Similar to this, SOEs also have a detrimental impact on the emergence of commercial interests in the economy. Watchdogs in the state policymaking process are state-appointed corporate leaders who are close allies

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of the ruling class. It also lessens the reliance on indigenous capitalists in the private sector by having non-native/foreign and state-linked economic actors. Because of this, local private economic interests are powerless to compel changes in policy (He 2021, 31).

Let's take a look at how FDI and SOE affect the limitations imposed by organized labour. These restrictions are negatively impacted by FDI since increased FDI encourages the expansion of state-managed labour interests. The integration of workers into a corporatist framework including the state and business elites is important to create a favourable investment climate that will attract FDI. Their interests can only be carefully managed in accordance with the state's development objectives when the state successfully integrates organized labour. On the other hand, the existence of SOEs causes labour interests to emerge in the state sector. Differentiating between organized labour in the SOE sector and the private sector is essential. Due to the fact that they are employed by the state, SOE employees frequently have distinctive financial issues. Workers at SOE frequently organize to protect their material interests, which are very different from those of workers in the private sector. As a result, a sizable SOE workforce can undercut the general limitations placed on an economy by organized labour (He 2021, 32).

In conclusion, the rate of DPCC is positively related to the concentration of capital and labour interests, which means a higher level will lead to higher levels of structural constraints. On the other hand, the proportion of FDI and SOE in an economy is inversely related to the level of constraints imposed by business elites and organised labour. A higher proportion of FDI and SOE corresponds to lower levels of structural constraints on the state's policy-making process (He 2021).

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	DPCC	FDI	SOE
Business Elites	Concentrated/dispersed business interests	Non-indigenous (foreign) business interests	State-linked business interests
Organised Labour	Concentrated/dispersed labour interests	State-managed labour interests	State-sector labour interests

Table 1 - Variations in the types of economic interest groups (He 2021)

3.2.3 Political Interests

As mentioned earlier, the rise of political interest groups, while relevant in the broad sense of geo-economics, lies outside of the scope of this thesis. Therefore, the following paragraph is limited to a short summary. Next to economic development, democratisation is one of the major aspects of transformation in the developmental state. It originates in two distinct social classes that, affected by the changing composition of their industrialising society, will seek to safeguard their material wealth and seek representation in office (Moore 1966). The first is the middle class, which through urbanisation, education and increased income become infused with democratic ideals. However, Moore also states that the middle class is not always an agent of democratisation and will only promote it if its own perceived class benefits. Rueschmeyer, Stephens and Huber (2005, 59) stress the relative importance of the working class in the democratisation movement. As industrialization moves them from a dispersed and immobile agricultural setting to a concentrated urban setting, they gain more leverage in the decision-making process. According to He (He 2021, 19), this leads to a number of configurations depending on the two classes' positions. When the middle class is mobilised by opposition forces, the state will opt for democratic concessions, whether or not the working class is supporting them. When only the working class pushes for democratisation, the state will choose to repress the initiative. Finally, when neither class wants to change the system, the state will prefer to co-opt the middle class to reduce future conflict.

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3.3 Combining the Two Models

In order to properly analyse the geo-economic power generated by industry for a state or entity, these two models have to be combined. Through this combination, a new model is formed that takes into account economics, strategic imperatives, domestic power dynamics and industrial policies (see Figure 4). It has to be noted that this model describes a very complex system over a period of time. Thus, any model, especially a relatively simple one such as the one provided here is a great abstraction from the often-chaotic reality. However, its value lies in the new and structured way of understanding the geo-economic behaviour of developmental states, especially through the lens of domestic power dynamics. In summary, this framework can be considered a developmental framework for geo-economic analysis and is roughly divided into three main sections or steps. The first step starts with the industrial policy, similar to the developmental state model. From there it will describe the gradual acceleration in economic development on the one hand, and the rise in political and economic interests on the other. It ends with what can be considered the geo-economic landscape of a state or entity: the economic power and the structural constraints imposed on the state over it. The second step revolves around the capacity of the state to turn its economic power, up until this point devoid of 'strategic' imperatives, into its geo-economic power. For this, an analysis is made of key traits such as the state's ability to control outbound investment, domestic market features, influence over commodity and energy flows, and centrality to the global financial system. The third and final step analyses how this geo-economic power is used in the form of geo-economic 'tools' to achieve political goals, but also how the state forms these goals in the first place, and how they are affected by the domestic political situation.

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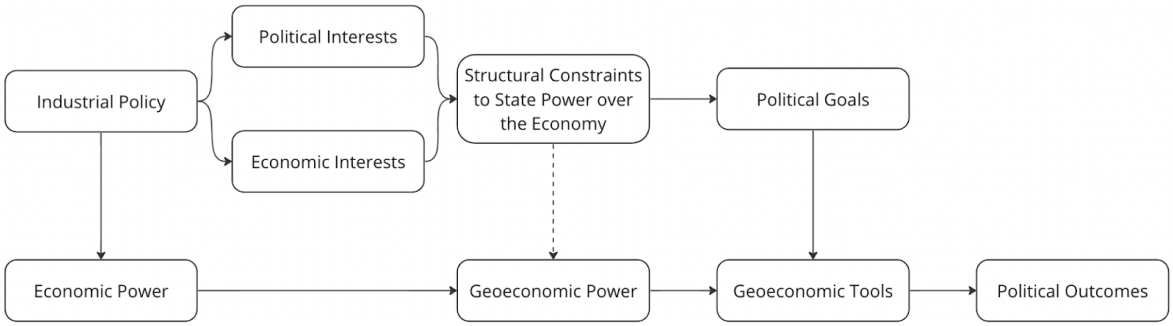

Figure 4 - Developmental Framework for Geoeconomic Analysis (Based on He 2021 & Blackwill & Harris 2016)

3.3.1 Step 1 - Industrial Policy and Economic Power

Initially, the state or entity of analysis will set forth a specific industrial policy for its domestic economy. Even though the outlines of this policy can be complex and range across many different factors and decennia, its effects on the three main parameters of interest in our model should be observable. Similar to He's developmental model the industrial policy will produce a specific level of DPCC, FDI and SOE in the domestic economy. Based on these factors, economic and political interest groups start to form[4] that will gradually produce the structural constraints within which a state must operate its geo-economic strategies. The extent of these structural constraints remains abstract in the model but varies between the three interest groups. When it comes to political interests, a developing middle class will become more vocal and demand more democratic feedback in the decision-making process in order to preserve its own interests (Moore 1966). For economic interests on the other hand, business elites can use this democratic impulse to insert their own interests in the state policy creation process. Organised labour groups do not have access to this process, and thus protect their interests by threatening to disrupt the state's economic programs (He 2021, 28). Simultaneous to the effect on structural

[4] For an in depth explanation of this process please refer to the section on 'Geo-economics and Developmental Theory' earlier in this chapter

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constraints, the choice of industrial policy and mix of DPCC, FDI and SOE will give way to economic development, which over time provides the base for economic power. Thus, the industrial policy sets in motion a range of processes that affect geo-economic power in a two-pronged way, one direct and one indirect. On the one hand, it sets the stage for a domestic power relation between the central authority and interest groups in the form of business elites, organised labour and a modernising middle class. This effect is indirect as the industrial policy affects societal dynamics which in turn affect the structural constraints on the state. On the other hand, it directly shapes the economic base out of which later geo-economic power will flow. This process is direct, as it simply describes the cascading effects of industrial policy on economic development and the gradual evolution of economic power over time.

3.3.2 Step 2 - From Interests to Constraints on Geo-economic Power

In the second step, the model makes an abstraction of a state's geo-economic power based on the analysis of the two 'prongs' from step one. More specifically, it analyses how the composition of the domestic economy combined with the structural constraints on state power combine into a collective of geo-economic power. As geo-economics is defined as the strategic use of economic tools to achieve political goals, the first task should be to determine the strategic components of the domestic economy. This involves mapping the crucial components in the domestic economy for the rest of the world, but also what critical dependencies exist within the domestic economy on others. While size plays an obvious role in this regard, it is definitely not the only factor in determining strategic importance. Blackwill and Harris (2016) propose a non-exhaustive list of what they consider to be the most important 'geo-economic endowments', factors determining the geo-economic capacity of a state: the ability to control outbound investment, domestic

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market features, influence over commodity and energy flows, and centrality to the global financial system[5].

Second, there is the question of how strong the grip of the state is on these industries. As mentioned before, there is no use in having the most powerful economy if the state is unable to steer it in any meaningful way. This part of the analysis is based on the structural constraints from step 1 and aims to provide an idea of the capacity of the state to wield its geo-economic tools. However, it has to be stressed that there is no one level of constraint for a given entity, as these constraints can vary between different tools. For example, the democratic process for passing new trade legislation is very different from the opening of new high-tech labs in a third country by a domestic company. For this reason, analyses of structural constraints and their effect on geo-economic power should be handled case by case.

In Summary, the second step of the framework is the first attempt at a geo-economic aspect in the model. It provides an overview of the strategic components of the domestic economy and adds to them the respective structural constraints. Based on this we are left with a workable overview of the domestic geo-economic power. Finally, it has to be mentioned that while the model does take into account more factors than the basic geo-economic framework, it leaves no space for potential cognitive factors such as culture, history and religion, or external factors such as third-party interests.

[5] These are explained separately in the section 'Geo-economics as a Framework'

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3.3.3 Step 3 - From Power to Tools to Outcomes

Finally, the model reaches the third stage, in which geo-economic power is transferred through geo-economic tools to eventual political outcomes. However, to use tools for political outcomes implies the existence of political goals. In the model, they are once again affected by the structural constraints placed on the state by interest groups. As was determined earlier the strength of a geo-economic tool is dependent on the context in which it is used. At the same time, the overall geo-economic strategy is dependent on the strategic goals voiced by the state. While in an authoritarian regime, these might be rather straightforward (at least internally), the higher turnover in democratic regimes might lead to changes in the geo-economic strategies pursued by a state. Thus, this stage should link the political policy process with empirical actions of economic statecraft. The main questions are: What does the state do? Why does it do it? What was the effect?

doi:10.6342/NTU202304268

4 Case Study: Taiwan ROC Semiconductor Industry

4.1 Introduction to Semiconductors

To start this chapter, it is good to take away some misconceptions about the semiconductor industry. First of all, a quick note on the distinction between chips and semiconductors. A semiconductor is defined as any of a class of crystalline solids intermediate in electrical conductivity between a conductor and an insulator (Britannica 2023). In practical terms, this means it applies to any material that conducts energy better than an insulator such as glass, but not as well as a conductor such as copper (Thornton 2022). Many different materials have this quality, but silicon is the most widely available and easiest to manipulate. This silicon is then used to house transistors which are patterns that control the flow of current using electrical switches. In general, the higher the density of transistors, the stronger the computing power of the eventual chip. The progress of this increase in transistors has been predicted relatively accurately by what is called Moore's Law, which observes that the number of transistors per chip should double every two years with a minimal rise in costs (Intel n.d.). This has led to some ground-breaking evolutions in computing capacity, but progress is becoming ever more complex with semiconductors reaching the 2 nm[6] levels.

4.1.1 The Supply Chain

Despite the recent trend of nationalisation, the production of semiconductors remains an inherently international process. In each stage of the value chain, encompassing both direct and supporting functions, an average of 24 countries participate. Throughout its journey, a semiconductor product typically traverses an average of 70 borders. The reasons for this

[6] Nanometre, 1 nm = 0.000000001 m

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extensive sourcing are multifaceted, with the need for high specialisation at each stage of production and risk mitigation being among them. The following paragraph introduces the semiconductor supply chain in a very rudimentary fashion, as a full analysis of every step would span many pages, and be far too technical for this thesis. There are roughly four steps in chip production, chip design, wafer manufacturing, wafer fabrication, and packaging and testing. There are three supplementary steps, each about a critical component or aspect of the supply chain that increases its strategic complexity. They are the sourcing and preparation of critical minerals, the use of Intellectual Property (IP), and the need for specific infrastructure in the production process. Each of these factors is dependent on a few or even a single actor(s), which is one of the reasons for its high interdependence. The unique position of the Taiwan Semiconductor Manufacturing Company (TSMC) in the large-scale production of <5 nm semiconductors could be considered to be among the supplementary steps, but it will be handled thoroughly and with more detail later in this chapter.

4.1.1.1 Chip Design

The initial step in chip production is chip design and should be imagined as drawing the blueprint of a chip before its production. This process involves creating closed circuits tailored to the specific end-use requirements of the semiconductor, and the design will greatly affect the capacities and the end-use of the chip once it's created. This process is highly dependent on specific designing technology and programming language, which are governed by IP laws. Specialised companies are typically responsible for chip architecture, considering factors such as end-user needs, market potential, and feasibility. The architecture defines the foundational structure, goals, and principles of the chip. At this stage, only a digital version of the chip exists. A small batch, known as "first silicon," is manufactured from the design and subjected to extensive testing. If the tests are

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successfully passed, the design is then transferred to wafer fabricators for mass production. This design requires the intensive use of electronic device automation (EDA) software, 85% of which is based on three American companies: Cadence Design Systems, Synopsys, and Mentor (Crivellaro 2022). It is worth noting that despite the overall dominance of the US in this step of the supply chain, few chip design companies possess in-house wafer fabrication capabilities extensive enough to enable full-scale production. They are considered "fab-less", as they do not fabricate their own chips in-house, but use third-party foundries[7] to produce their chips.

4.1.1.2 Wafer Manufacturing

Wafer manufacturing means the production, cutting, polishing and testing of the circular silicon slabs (wafers) out of which the chips will be made. The process starts with the second most abundant chemical element on earth after oxygen, silicon. It is widely available and can be found on ordinary beaches. However, before it can be transformed into a wafer, it undergoes a process to align its atoms consistently and predictably. This is achieved by heating and spinning the silicon while introducing a single aligned silicon crystal. The result is a cylindrical silicon ingot, which is subsequently sliced into thin pieces. These slices are then coated with photosensitive material, forming the foundation on which the chips are printed. Any irregularities in the material are then removed before moving on to the fabrication process. For reference, the wafer has to be so smooth that if a wafer were to be as large as Taiwan, particles the size of a coin can be traced and removed[8].

[7] Foundry is a term used for semiconductor production facilities, many of which are located in East-Asia

[8] This expression was used as a sales pitch for a famous wafer-producing company, and should thus be taken with a grain of salt

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4.1.1.3 Wafer Fabrication

Wafer fabrication, not to be confused with wafer manufacturing, is the actual chip creation process. This process is even more complicated than the previous one and happens in specialised rooms where the composition of the air can be controlled, and atmospheric dust minimised. For the most advanced chips, the only way etchings can be precise enough is by turning the original chip design into a blueprint through which a beam of light is projected onto the chip surface. This affects the coating, creating small changes to the surface of the chip, giving transistor properties. To produce one single chip, this process is repeated about 100 times, with intermediate testing, cleaning and calibration. To further increase the number of transistors on the surface of the chip, a move has been made from two-dimensional layering to three-dimensional. While this has allowed chip manufacturers to keep up with Moore's Law, it has also greatly increased the complexity of chip production facilities, making it even more difficult for new players to enter the market. This step is mainly located in Taiwan, with 4 Taiwanese firms occupying the top 10 biggest foundries in terms of revenue, and the largest (TSMC) having an estimated revenue in Q1 2021 larger than the other 9 combined (King, Wu, and Pogkas 2021).

4.1.1.4 Packaging and Testing

This stage is composed of two steps: packaging and testing. When a chip is printed on a wafer, it is then cut out with a diamond cutter and placed on a lead frame. The semiconductor and the frame are connected through fine gold wires in a process called wire bonding. Once this is done, a heated epoxy moulding compound is shaped into the desired form to shield the chip from any dust or humidity (Samsung Newsroom 2015). Once the chip is properly packaged, it needs to be tested. The exact testing process depends on the manufacturer and the type of chip produced, but generally, the chips are tested against different levels of voltage, electrical signals and temperature. This way the

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performance can be measured, defects can be detected, and potential new insights can be shared with the teams to improve the production process. This final step in the semiconductor supply chain is mainly concentrated in Asia. The choice of location for this stage of semiconductor production is significantly influenced by labour costs, as it is considered less capital-intensive compared to other steps. This stage involves cutting wafers, each containing multiple chips, separating and mounting individual chips onto frames with connecting wires, enclosing them in protective casings, and conducting final testing. In terms of industry statistics, this activity accounted for 13% of the total capital expenditure in 2019 and contributed 6% to the overall value added by the industry (Crivellaro 2022).

4.1.1.5 Extra: Critical Materials

Semiconductor manufacturing companies heavily rely on specialised material sources for their operations. The fabrication process of semiconductors involves the utilisation of approximately 300 different inputs, many of which necessitate cutting-edge technology for production. It is noteworthy that a limited number of providers exist for certain inputs. For instance, only four companies, collectively holding a global market share exceeding 90%, supply the majority of the polysilicon used in manufacturing the silicon ingots that are subsequently sliced into wafers. These polysilicon suppliers must ensure an exceptional purity level, approximately 1,000 times higher than that required for solar energy panels. The front end of semiconductor manufacturing refers to the process of creating a wafer from scratch until the microchips are formed but remain on the wafer. Conversely, the subsequent stages following the design of features and circuits on the wafer are referred to as the "back end" of semiconductor manufacturing. To illustrate the scale of the semiconductor materials market, the front-end materials alone accounted for a market value of $33 billion, while the back-end materials represented $19 billion in 2019. This

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cumulative market size of $52 billion exemplifies the complexity of the semiconductor industry and the challenges that need to be addressed to establish a more resilient supply chain (Crivellaro 2022).

4.1.1.6 Extra: Critical Software

There are two crucial components in the design stage of any chip: reusable IP cores and EDA software. When applied to semiconductor design, an IP core often refers to a reusable unit of logic, functionality, cell, or layout design that is typically created to license it to multiple vendors. These IP cores serve as fundamental building blocks incorporated into various chip designs ('What Is an IP Core in Semiconductors?' 2017). The US and the UK are the global leading producers of these IP cores, with a combined market share of over 90% in 2019. In contrast, China only represented 1.8% of the core IP market share in 2019 (Khan 2021). For EDA software, the concentration is even stronger, with the US being the sole provider of software with the capacity for full-scale production necessary to design advanced chips. Chinese chip designers heavily rely on U.S. Electronic Design Automation (EDA) tools, particularly Synopsys and Cadence, for all their chip designs. While China does have some EDA tools available, they primarily support specific stages of the chip design process or supplement the leading U.S. tools. However, these Chinese capabilities often do not extend to supporting advanced fabrication processes, such as those involving technology nodes of 14 nanometres or less (Randall 2019a).

Leading chipmakers like Intel, Samsung, and TSMC provide preferential access to process intellectual property (IP) to top U.S. EDA firms like Synopsys and Cadence during the development of new manufacturing processes. This access grants these U.S. firms an advantage in terms of chip design options, as each chipmaker's manufacturing process imposes unique constraints. On the other hand, Chinese EDA firms may gain access to

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incomplete or insufficiently supported process IP at a later stage. Consequently, as long as this tiered-access structure persists, Chinese EDA firms will face limitations in supporting chip designs at cutting-edge nodes and competing with the leading U.S. EDA firms (Randall 2019b). However, the situation is gradually changing. Chinese EDA startups have been able to attract experienced professionals and technologists from prominent U.S. industry leaders. Additionally, programs like those by the Defense Advanced Research Projects Agency (DARPA) are developing open-source EDA tools capable of running full design flows for specific applications. These tools can be utilised by chip designers worldwide, presenting new possibilities and alternatives (Merritt 2018).

4.1.1.7 Extra: Critical Infrastructure

ASML, which stands for Advanced Semiconductor Materials Lithography, is a Dutch company specialising in the manufacturing of intricate lithography systems crucial for the production of advanced microchips. It holds a prominent position in the global market as a leading supplier and is the sole supplier in the domain of extreme ultra-violet (EUV) lithography equipment. Without producing even a single chip, they are a crucial player in the semiconductor supply chain, and currently, ASML is restricted by the Dutch government in its trade with Chinese companies under the Wassenaar Arrangement (Kimbal 2022). This arrangement was formalised in 1996 and renewed in 2010. It's a voluntary export control regime, where member states agree to share information on the exchanges and exports of weapons and dual-use technology. At the same time, trade in these goods with so-called "states of concern" is heavily restricted. Every participant in the agreement has the right to attribute this concern status for itself, leading to complications. For example, the US is the only country that considers the trade of semiconductor manufacturing equipment as a cause for concern (Lord et al. 2002; Sauvage 2019).

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4.1.2 TSMC's Fabless Business Model

Where does Taiwan ROC fit in all of this? Its fame as a semiconductor powerhouse is mainly based on a single company: TSMC. Founded in 1987 by Morris Chang, it was the first company to use the semiconductor Dedicated IC Foundry business model. This business model was first pitched to the ROC Government in 1985 in a presentation titled "Business Brief for Developing Very Large Scale Integrated Circuit (VLSI) Industry"[9]. Up until this moment, any company that used integrated circuits in one of its products would make them in-house. However, as the technology of these circuits progressed, so did the costs and know-how required to create them. Dr Chang realised that there was space in the market for a company specialising in the production of these circuits on demand for other players. Economies of scale would make the model competitive, and state investment would help overcome the massive initial costs in the form of financial assistance and attraction of human capital. Since 1987, TSMC has kept the lead over its competitors thanks to the continuous focus on quality and technological advancement, as well as adherence to the key principle of non-competition with its customers[10] ('History and Milestones of TSMC' 2019).

Decades later, TSMC solidified its position as the leading semiconductor manufacturer in the world. In 2022 it generated a net income of USD 34.07 billion, and yearly R&D spending reached levels of USD 5.47 billion. Over the course of this year, the first 4 and 3-nanometer plants started volume production in the Hsinchu Science Park. Outside of Taiwan ROC, it has built a plant in Japan, has started building a plant in Arizona (US) to

[9] The original handouts of this pitch can still be found at the TSMC Museum of Innovation at the TSMC Headquarters in Hsinchu

[10] This is not the case for many of TSMC's competitors such as Samsung, who fabricate semiconductors in-house but also for other companies. Since TSMC does not produce any products themselves there is no risk of competition between TSMC and its customers.

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be producing 4-nanometer process technology in 2024, and has announced a second plant in Arizona to be producing 3-nanometer technology in 2026. In 2022, TSMC alone accounted for 30% of the worldwide semiconductor market excluding memory ('TSMC 2022 Annual Report' 2022).

4.2 Step 1 - Industrial Policy and Economic Power

The first stage in the framework of analysis aims to analyse how the choice of industrial policy shaped the economic development of the industry, as well as how it led to the presence or absence of structural constraints on the state policy-making process. This is done through a historical analysis of the Taiwanese semiconductor industry since 1974, using aspects of the political changes during that time, economic development and scientific progress. By the end of this chapter, the first sub-question is answered: "What factors make up the geo-economic potential of the Taiwanese Semiconductor industry?"

4.2.1 History of Taiwanese Semiconductor Development

This subchapter runs through the history and development of the Taiwanese Semiconductor industry to better understand its position today within Taiwan ROC as well as the rest of the world. It brings together three different perspectives, the economic, the scientific, and the political. In doing so the goal is to get a more complete view of the industry, what strategic imperatives steered its evolution, how certain breakthroughs facilitated it and how it transitioned from a state-led initiative to being noted on the New York Stock Exchange (NYSE). The section is divided into three periods, roughly corresponding to three distinctive phases in the semiconductor development in Taiwan ROC.

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4.2.1.1 The Rise of Domestic Capacity (1974-87)

The origins of the semiconductor industry in Taiwan ROC preceded the founding of TSMC by at least a decade. Already in 1974, the government designated the semiconductor sector as key to developing the economy by initiating the Integrated Circuit Project (ICP). In order to exchange semiconductor technologies with the US company Radio Corporation of America (RCA), the then minister of foreign affairs, Yun-Suan Sun[11] (孫運璿), established the Electronics Industrial Research Centre, later known as the Electronics Research and Service Organization (ERSO), of the Industrial Technology Research Institute (ITRI). This contract was for a period of ten years (M.-F. Chang et al. 2021). This entire endeavour was funded through the Electronics Industry Development Project (EIDP) and received the equivalent of around USD 12.2 million. Even though the first 3-inch silicon wafer was produced in 1977, the initiative remained mainly to be pushed by the government, as private investment was limited to the packaging of ICs for foreign companies such as Philips and Texas Instruments.

During this time also the KMT's industrial policy experienced a change in course. From 1949 onwards it maintained a policy of land reform and SOE promotion. The motive behind the reform was mainly regime survival through both removing the economic and political base of the local elites and garnering popular support amongst the many Taiwanese peasants (Gold 1986). On the other hand, the choice to keep DPCC low and focus on development through SOE is often attributed to the need of the KMT to employ its large base of Mainlander supporters who joined them on the flight to Taiwan (Minns 2006). The strong state presence in the development of the semiconductor industry in the early 1970s can be seen in this context. However, this changed as the 1970s developed as

[11] He would later serve for six years as Premier to the Republic of China

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the KMT was confronted with events that affected their legitimacy. There was the oil crisis which led to a global recession, in turn giving rise to popular discontent as to how the government had handled the economy (Rigger 1996). Second, and more symbolically, was the loss of the UN seat to the PRC in 1971, which led to the derecognition of many other states of the Republic of China. While SOEs were focused on the domestic market, small to medium enterprises (SMEs) catered mostly to export markets. Throughout the economic crisis, they had maintained their economic capacity and now the KMT turned to them to reclaim their lost legitimacy (Wu 2005). From this moment onwards the Taiwanese semiconductor industry will also change direction and gradually move away from government control towards private investors and free market dynamics.

After the initial success of the EIDP, the second stage of the program was implemented from 1979 to 1983. This program led to the creation of United Microelectronics Corporation (UMC), a joint initiative between the government and private investors to kickstart domestic semiconductor production. Phase II received approximately USD 19.9 million. In the 1980s, the trend of VLSI technologies rose to prominence across the globe, which led to the creation of the VLSI Circuit Technology Development Project from 1983 to 1988. Its main tasks were the development of in-house IC technology, setting up a complete IC supply chain, and being the support centre for the domestic electronics industry (M.-F. Chang et al. 2021). For this, it received a budget of around USD 75 million. It is also during this period that TSMC was founded as a spinoff from ITRI, with a mix of government funding, private capital and Philips Inc. The presence of TSMC and its ability to take on the expensive manufacturing part of the production process opens up space for domestic IC design companies to flourish. While maintaining strong state support

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with SOE in heavy industries, the KMT actively stimulated SMEs to participate in the rising high-tech industry during this period (Wu 2005, 162).

4.2.1.2 Private Incentives Take Over (1989-2000)

The democratisation process which had been building since the late '70s truly takes shape in the '80s and has its effect on the semiconductor industry. While the KMT fell into disarray after the death of President Chiang Ching-kuo[12] (蔣經國) in 1988, an opposition party started to form in the form of the Democratic Progressive Party (DPP). It would take until 1995 for the KMT to acquire less than 50% of the electoral spectrum, and during this time more and more democratic transition took place within the governmental system. Finally, in 1996, Taiwan ROC held its first presidential elections which would put the KMT candidate, Lee Teng-hui (李登輝), into office.

During this period in the semiconductor sector, the Taiwanese government gradually moved away from state-based development and looked to increase tax incentives and attract investment. Initially, this was done through the launch of two 5-year development projects, one in 1990 and one in 1996. The second project managed to attract USD 76 million in public funding, which was considered a big success and led to the government allowing even more free market forces to steer the course of the industry (M.-F. Chang et al. 2021). The signing of the Information Trade Agreement (ITA) at the Singapore Ministerial Conference in December 1996 secured reduced tariffs on semiconductors with many nations, leading to an increase in the globalisation of the industry (Crivellaro 2022). Interestingly, in the year 2002, in which the Taiwanese semiconductor industry for the first time exported more than it imported, the KMT was ousted from office by a candidate from

[12] The only son of the first president of the Republic of China, Chiang Kai-shek (蔣介石)

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the DPP (M.-F. Chang et al. 2021). This marked the end of more than 50 years of consecutive KMT rule.

4.2.1.3 Semiconductor Boom (2002-20)

The globalisation of semiconductor supply chains together with Taiwan's specialisation in the fabrication stage led to the gradual erosion of American and European semiconductor manufacturing capacity. To illustrate, from 1990 to 2020, the US global market share in this industry dropped from 40% to 12% (Crivellaro 2022). It is important to note that these developments were not coincidental and were based on earlier Taiwanese decisions to focus on experimental research in the fields of nano-science through organisations such as the National Nano Device Lab (NDL), and academic-private cooperation through the Chip Implementation Center (CIC). These two organisations merged in 2019 to form the Taiwan Semiconductors Research Institute (TSRI) to cultivate world-class talent, increase the speed of development of new technologies and answer to rising global competition through a shared research environment for related studies in Taiwan (TSRI n.d.).

Since the change in office in 2002, the Taiwanese government has moved away from industry-oriented investment and rather focussed on the attraction and education of talent through programs such as the National Si-soft (silicon software) Project (NSSP), and the later National Program for Intelligent Electronics (NPIE). The idea behind the NSSP is the Taiwan-based creation and development of IP cores and EDA integrations for both domestic and international players to further integrate Taiwan ROC into the global supply chain. This meant that third-party chip designers could use these IP cores and integrations in their chip designs, but would need to manufacture them in Taiwan, as no other manufacturer was compatible with the new software (C.-Y. Chang and Trappey 2003).

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This period is generally considered to be the time in which the semiconductor industry truly expanded in Taiwan ROC. From USD 17.07 billion in 2002, the total export value of Taiwanese ICs rose to USD 100.32 billion in 2019. While the IC exports accounted for roughly 5.5% of the total GDP in 2002, by 2019 they provided no less than 17.06% of total annual GDP (M.-F. Chang et al. 2021). In 2019, 92% of <10 nm technology logic chips were produced in Taiwan ROC, and the remaining eight per cent in the Republic of South Korea (‘2021 - State of the US Semiconductor Industry’ 2021). However, the recent war in Ukraine and fears of a spillover effect in the Pacific have highlighted the delicate geopolitical situation between Taiwan and the mainland. This has led policymakers to look for alternatives in semiconductor suppliers and stimulate their domestic industries (Crivellaro 2022).

4.2.2 Conclusion

This sub-chapter provides an overview of the historical development of the Taiwanese semiconductor industry, examining its economic, scientific, and political aspects. It is divided into three distinct periods, each corresponding to a phase in the semiconductor industry's evolution within Taiwan ROC. The first period, from 1974 to 1987, witnessed the rise of domestic capacity with state-led initiatives and limited private investment. During this time, the Taiwanese government established the ICP and EIDP to stimulate semiconductor development. However, as Taiwan faced economic challenges and political legitimacy concerns, the KMT government gradually shifted towards promoting SMEs' participation in the high-tech industry. The second phase, from 1989 to 2000, marked a shift towards private incentives as Taiwan's democratization process took shape. The government moved away from state-based development and increased tax incentives to attract private investment. The ITA in 1996 facilitated the globalisation of the

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semiconductor industry. The KMT's rule ended in 2002 with the election of a candidate from the DPP. The third period, from 2002 to 2020, witnessed a semiconductor boom in Taiwan ROC. The government focused on talent attraction and education, fostering academic-private cooperation to enhance technological development. The establishment of the TSRI aimed to cultivate world-class talent and respond to global competition. During this time, the semiconductor industry significantly expanded in Taiwan ROC, contributing significantly to the country's GDP. However, geopolitical tensions in the region led policymakers to explore alternatives in semiconductor suppliers and stimulate domestic industries.

For Taiwan ROC, the export of Integrated Circuits is the biggest contributor to its GDP, and for the world, Taiwan is the most important producer of semiconductors. Based on the above research, a case for its economic power can be made. It provides close to one-fifth of the Taiwanese GDP and is easily its most recognisable export product. The strategic importance of semiconductors is perhaps even more convincing. The US, PRC and the EU all consider semiconductors to be crucial to their strategic interests and have allocated sizable budgets for the development of their domestic production capacities. Taken together, we can conclude that there is a large geo-economic potential for Taiwan ROC in its semiconductor industry. The next step takes a closer look at another component of geo-economic power, namely how much power the state can exercise over the industry.

4.3 Step 2 – From Interests to Constraints and Geo-economic Power

While the extent of the economic power in the semiconductor industry is now clear, another question remains: What capacity does the Taiwanese state have to turn this

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potential into actual geo-economic power? This question can be answered through the prism of state-industry relations and leads to a simpler expression: Does trade follow the flag[13], or does the flag follow the trade[14]? In other words, does Taiwan ROC have the power to steer its semiconductor industry into an international strategy? And if this capacity is limited, is it perhaps being steered by the semiconductor industry in a direction that is suitable for their expansion?

4.3.1 The Industry-State Dynamic

The main indicators in our model to analyse state-industry relations are DPCC, FDI and SOE. The higher the DPCC, the more concentrated business incentives will be, and the more power they will have in opposing the government. On the other hand, if FDI is high, then the government is less reliant on domestic capital for the funding of state programs and state investment initiatives. This means it maintains its autonomy in policymaking despite potential domestic pushback. Finally, the presence of SOE created a class of business elites whose interests are more aligned with the government. At the same time, the workers in these SOEs differ from those in the private sector, undermining the capacity of organised labour groups to mobilise against the state[15]. Thus, the state to maximise its power over the industry should attempt to keep DPCC low, FDI high and SOE high. At the same time, it should make sure that this does not impede the economic development of the industry. Let's analyse the historical development of these three metrics in the Taiwanese semiconductor industry, before coming to the current situation.

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[13] An expression popularised during the heyday of the British Empire, stating the close relationship between commerce and colonial expansion, the latter preceding the former

[14] A German expression indicating the strategy of Bismarck Germany during the late 19th Century, in which commercial ties are established first, after which territories are militarily occupied

[15] For an in-depth analysis of this process, please refer to the subchapter "Economic Interests" in Chapter 4

doi:10.6342/NTU202304268

There are roughly two periods when it comes to Taiwanese industrial policy in the semiconductor industry. First is the period from 1974 until 2002, in which the state is very present in the development and maintains a lot of centralised authority. This is also the extent of the development that is fully under KMT rule and is still influenced by its political economy choices. There is a Chinese idiom that is sometimes used to describe the mentality of Taiwanese entrepreneurs: *"Rather be the head of the chicken than the tail of the cow"*, which means to be one's boss, regardless of the size or scale of the business. Indeed at this time the Taiwanese economy overall, but the technology sector, in particular, had a decentralised, small firm-dominated industrial structure (Wang 1995).

And then, in 1986, a spinoff project from the overarching ITRI was launched. It was then that the now famous TSMC was founded with 48% government funding, 27% by Phillips Inc. and 25% by private investors (Bozok 2023). The total amount was USD 220 million, a very large sum for Taiwan ROC at that time, hence the need for support from private investors. Being the largest shareholder meant the government would have a significant say in the course of the company, while private investment sped up the development process. With Phillips, the government would have 75% of the shares, and could thus block any initiatives originating from domestic spheres it deemed threatening. At this stage, despite being a public-private partnership, TSMC had all the looks of a government project (Miller 2022, 167). We can conclude that from the '70s until the late '90s, there was a period in which the state was very present in the development of the industry. It set up research programs, and cooperation projects with foreign firms, and overall provided most of the capital in the industry.

The second period is characterised by a gradual decentralisation of authority due to the democratisation process, which created room for private investment and clustering of

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domestic private capital. The Centralisation of capital had two reasons. On the one hand, the nature of the semiconductor industry makes it so that winners win big, and losers lose big. Over the past two decades, the top five companies in the industry: Apple, Intel, Qualcomm, Samsung and TSMC together make more profit than the rest of the market combined. Thus, there was a clear commercial need for TSMC to grow as big and fast as possible (Burkacky and De Jong 2021). At the same time, the freshly elected DPP managed to take over the presidential position from the KMT. While the presidential position gave them access to a whole new range of institutional power, they found themselves in a rather hostile environment, as the KMT had had 55 years to build up its presence in SOE and institutions. The DPP was, as a grassroots party, at a huge financial disadvantage compared to the KMT. To improve ties with business elites and to secure funding, the DPP opened up the presidential palace to remodel business-state relations. Thus, by 2009, after two financial reforms, the level of DPCC had completely changed and the three most prominent Taiwanese family businesses controlled around 64% of Taiwan's GDP (He 2021, 187). To summarise, the rise in capital concentration in the industry was necessary to remain competitive internationally and led to the rise of giants such as TSMC. However, it also came with a reduced capacity in state control over the industry, as its interests are highly concentrated and it is the most crucial part of the Taiwanese economy. The extent of this loss of control is analysed in the following paragraph.

4.3.2 Constraints on Government Policy

Though Phillips Inc. sold its stake in TSMC over the years and got rid of its last shares in 2009, foreign investment has been growing in the company. In 2019, the Taiwanese government in the form of the National Development Fund only owned 6% of the shares of TSMC (Franek 2023). This still makes it the largest shareholder by far, but it is a very long

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way from the power it had over the company in the ’80s and ’90s. With 94% of the capital in the hands of private investors, the main goal is no longer the strategic benefit of the Taiwanese government, but rather the pursuit of revenue. It seems that instead of the government controlling TSMC, the company is now capable of setting its own policy, which adds to political tension in Taiwan. A day before the opening ceremony of the new plant in Arizona, there was a debate in the Taiwanese Legislative Yuan between Minister of Foreign Affairs Joseph Wu (吳釗燮) and Chiu Chen-yuan (邱臣遠) from the opposition Taiwan People’s Party (TPP). Chiu grilled Wu over allegations that TSMC experienced political pressure to transfer technology and personnel to the US in a secret deal. Wu assured this was not the case and confirmed the commitment of the government to maintain the presence of TSMC in Taiwan (Liu 2022; ‘會議隨選’ 2023).

4.3.3 Conclusion

After this, what can we conclude about the state's capacity to turn economic power into geo-economic power? First of all, there is a counterintuitive observation, namely that TSMC before its boom in the 2000s was de facto controlled by the state, which in turn made it easier to use in geoeconomic policies such as the establishment of information sharing despite Taiwan’s non-recognition, or the exchange of talented researchers. It was the need for rapid growth that led the state to loosen its control over the company and allow more foreign investment. This allowed TSMC to develop rapidly and outperform all its competitors. The paradox then is that the state had full control over the company when it was not yet of great strategic benefit, and to achieve strategic importance the state had to give up control.

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4.4 Step 3 - From Power to Tools to Outcomes

The final step is perhaps the most visible: How does the state wield its semiconductor tool in International Relations? Remember the first part of Blackwill and Harris' definition of geopolitics: "*The use of economic instruments to promote and defend national interests…".* By now the extent and limitations of the economic instruments are quite clear. The problem lies rather in the delineation of "*national interests"*. The political theatre in Taiwan ROC is divided mainly into two camps: the greens and the blues. The Greens are those favourable to a distinct Taiwanese identity and push for an independent Taiwan in some shape or form[16]. They are mainly represented by the DPP, the largest opposition party in the country. The blues derive their colour from the original flag of the Chinese Republic[17] and maintain the notion of a unified China under a single nation. This group is embodied by the KMT, the original party that founded the Republic of China and fled to Taiwan after the Chinese Civil War in 1949. The main difference between these two parties lies in their attitude towards China, which leads to two very different geoeconomic strategies and the use of tools. Their different interpretations of national interests are explored in the following subchapter. Afterwards a few notable examples of the use of semiconductors as geoeconomic tools are analysed before finally moving to the 6th and final chapter of the thesis: the discussion and conclusion.

4.4.1 Taiwanese Political Goals

To understand the complicated status of the political goals of Taiwan ROC, it is first necessary to understand the historical division between the KMT and the DPP. Taiwanese scholar He (2021, 176) summarises their position as follows: *"Competition between the*

[16] As not all greens necessarily push for a de jure independence, but are definitely for reduced reliance on China

[17] A white sun on a blue field, which is still a component of the Taiwanese flag

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KMT and DPP pushed the ruling elites *to adopt two competing state strategic visions. The formulation of these two highly-politicised policy visions, in line with their respective partisan identities, indicates the continued erosion of the state strategic vision in formulating a national economic programme for industrial upgrading. However, neither strategy was viable to enhance Taiwan's economic competitiveness within the global economy."* In short, each party has a radically different view on the future of Taiwan, and thus formulates a very different economic strategic policy, while neither fully answers to the needs of the economy.

4.4.1.1 KMT Political Goals

The main political guideline for the KMT can be found in what is known as the 1992 Consensus. It is a resolution based on multiple rounds of negotiations running from March until November 1992 between proxy organisations from both sides of the Taiwan Strait. These are the Strait Exchange Foundation (SEF) for the KMT, and the Association for Relations Across the Taiwan Strait (ARATS) for the PRC. The final product was the Resolution on the meaning of One China, in which the two parties agree to a 'One China' principle, but differ on the actual meaning of the term. For Beijing, this means both territories are a part of the PRC, and Taiwan takes the form of a special administrative region after unification. For Taipei however, 'One China' refers to the Republic of China founded in 1911, which holds sovereignty over all of China, but de facto sovereignty only over Taiwan and the island groups of Penghu, Kinmen and Matsu. In the end, both parties agree to disagree on the exact meaning of the term but do agree on the adoption of it (Xu 2001).

Over time, the focus in this implicit agreement shifted from 'Two Interpretations' to 'One China'. This trend was then refuted during the 20th Party Congress in 2017, where the

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KMT stressed its commitment to the ROC constitutional framework by maintaining the status quo of *"no unification, no independence, and no use of force"* ('KMT Pulls Pro-Unification Plank from Platform' 2017). During the Party Congress in October 2021, the KMT positioned itself as a defender of the ROC constitution in contrast to both calls for unification from the PRC and independence from the DPP. In a presentation, the 1992 consensus is referenced as a "historical description of past cross-strait interaction" (Taipei Times 2021). Over time it seems the KMT is aiming to maintain the status quo and work towards a workable, peaceful and transparent form of cross-strait relations.

4.4.1.2 DPP Political Goals

For the DPP, there are several official documents of importance. As the political climate across the Taiwan Strait changed between 1999 and 2023, so did their goals and statements change when it came to Taiwanese independence. In their original Party Platform, the first point in the fundamental principles calls for the establishment of the Republic of Taiwan as a sovereign, independent, and autonomous nation ('DPP Party Constitution Part 2 - Party Platform' 1991). This was reiterated upon their election in the Resolution on Taiwan's Future, this time stressing that while Taiwan is still called the Republic of China according to the constitution, it does not belong to the PRC, and neither does the PRC belong to Taiwan. Change in the status quo of independence has to be decided by the people through a referendum ('Resolution on Taiwan's Future' 1999).

However, during President Tsai Ing-wen's (蔡英文) inauguration speech in 2016, the rhetoric on Taiwanese independence was toned down significantly. She there confirmed her commitment to operate by the ROC constitution, and states to engage in cross-strait relations in the way they had been done for the past decades while taking into account the democratic desires of the Taiwanese people (Taipei Times 2016). During a New Year's

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speech a few years later these statements had evolved into Four Musts: the PRC must *"recognize the existence of the Republic of China (ROC), respect the commitment of Taiwan's 23 million citizens to freedom and democracy, peacefully handle cross-Strait differences on a basis of equality, and engage in negotiations with the Taiwan government or government-authorised representatives.*" (Aspinwall 2019). This policy is a clear step away from the former antagonistic approach and is more in line with maintaining the status quo. While hard statements on independence are avoided, the DPP maintains that Taiwan ROC is de facto independent, and thus there is no need to declare it officially (*BBC News* 2020).

Both parties, while starting from radically different perceptions of the future of Taiwan in the 1990s, seem to be moving towards each other in recent years. During this time also the Taiwanese perception of their own identity has changed and is generally becoming less and less contested. An overall consensus is growing over a workable, transparent and beneficial relationship with the mainland while maintaining a healthy reluctance against foreign interference and democratic backsliding. This consensus in turn allows for a more in-depth debate on other aspects of governance (S. S. Lin 2016). With a more uniform set of political goals between the two major parties, also the geoeconomic policy should become more stable. In the following subchapters, cases are made for the use of semiconductors as geoeconomic tools, both by as well as on Taiwan ROC.

4.4.2 The Global Chips Crisis

Before 2020, very few people had heard of semiconductors, integrated circuits or transistors. But then, something problematic happened in the supply chains of the automotive industry. After a government-induced slumber during the COVID-19

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pandemic, the global economies started to reopen. With them came the sudden demand for products that many people had pushed forward during the lockdowns, specifically cars. When waiting periods for new cars grew and grew all because of the scarcity of something smaller than a coin, many of us were introduced to the industry. With a bang, the Semiconductor Crisis was there.

The prevailing explanation for the semiconductor crisis attributes the shortage of semiconductor parts to significant disruptions in supply chains caused by the closing and reopening of economies, the rapid shift to digital during the pandemic, and the China-US trade war (Lincicome and Obregon 2022). While these factors indeed contributed to the shortage, Christopher Miller, the author of "Chip War: The Fight for the World's Most Critical Technology," challenges this one-sided view of the crisis. He argues that instead of a decrease in supply, semiconductor production actually increased by 10% year-to-year from 2019 to 2020, and further increased from 2020 to 2021 (WoodrowWilsonCenter 2022). This viewpoint is supported by Stacy Rasgon, Managing Director and Senior Analyst at Bernstein Research. In an interview with CNBC, Rasgon contends that the shortage in the automotive industry is primarily caused by automotive companies cancelling their chip orders in late 2019 due to the pandemic. As a result, semiconductor-producing companies faced challenges in catching up with the sudden increase in demand (CNBC 2021).

The impact of the chip shortage extended beyond the automotive industry, affecting various other sectors as well. Resilience, when applied to supply chains, refers to their ability to adapt to structural changes by adjusting supply chain strategies, products, and technologies (Hippold 2021). As competition intensified, supply chains pursued greater efficiency, but this pursuit often came at the expense of resilience. For instance, Toyota's

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implementation of lean principles in the 1970s revolutionised the industry by making it more efficient (Poggi n.d.). In recent years, the dominant strategy in the industry has been to maintain less stock and implement practices like Just in Time (JIT) to keep prices low and competition in check. However, this approach also made supply chains vulnerable to sudden shocks in supply or demand. When the global economy experienced disruptions from closing and reopening, supply chains with the least amount of stock, i.e., the most efficient ones, were particularly susceptible to supply problems. As a result, the logistics industry shifted its strategy, with a significant majority of supply chain professionals planning to invest in resilience (Hippold 2021). This shift towards resilience in the industry contrasts with governments' move towards securitization. Given the critical role of chips in various technologies, from household appliances to automobiles, the shortages of chips had far-reaching implications across numerous industries. As a response to these challenges, the industry urged their respective governments to adopt more active investment policies in the semiconductor industry to ensure a steady supply of chips despite unpredictable global changes (Ravi 2021). Since then, global actors have become more cautious about the concept of unlimited free trade and have started to localise certain industries. This move is driven not only by the desire to establish a reliable supply chain but also to retain control over critical value chains. Outsourcing to third countries, while potentially cheaper, poses challenges in maintaining this control. The semiconductor crisis served as a significant warning to governments about the need to consider securitization, given its wide range of applications and the substantial investment needed for its production.

The shortage may not have been a deliberate move, but was Taiwan ROC able to capitalise politically on it in any meaningful way? The US Department of Commerce requested data on chip inventories and sales from US and international semiconductor businesses,

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including TSMC and Samsung Electronics Co. of South Korea, on September 23, 2022, suggesting the contrary is true. Alex Fai (費鴻泰) of the opposition KMT party harshly criticized this, saying that TSMC risked losing its competitive edge and its capacity to serve as the "sacred mountain guarding the nation" if it divulged confidential information about its orders, inventory, and manufacturing process (L. Lin 2021). An editorial in the Taipei Times offered cautious advice, *"the government must remain alert to the effects these efforts* could have on the nation's sacred mountain." While also stating "it is the government's responsibility to help TSMC and local chip firms handle, or avert, potential political influence." (Taipei Times 2021)

4.4.3 The US-China Semiconductor Rivalry

And yet, some aspects of geoeconomics are beyond the state's control. For example when you are caught in the crossfire between two of the most important nations in your proximity, one your biggest support, the other your biggest threat. As the US and the PRC got more and more entangled in a trade conflict, semiconductors did not remain unaffected. On October 7, 2022, the US Department of Commerce's Bureau of Industry and Security (BIS) announced a series of "targeted updates to its export controls as part of BIS's ongoing efforts to protect U.S. national security and foreign policy interests", with the goal "to restrict the PRC's ability to obtain advanced computing chips, develop and maintain supercomputers, and manufacture advanced semiconductors" (U. S. Mission to China 2022). This move was initially applauded by American commentators such as Michael Schuman from the Atlantic who called it a sign that "The U.S. continues to hold tremendous economic and technological advantages over China…" (2022). The ban came not too long after President Biden had signed into law the CHIPS Act of 2022, which aims to invest USD 280 billion in domestic US semiconductor capacity (Badlam et al. 2022).

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However, there was some pushback from within the industry, as the export controls will most likely harm American tech companies too (Reuters 2022b).

On the Taiwanese side, the response from the government was limited to the official statement that Taiwanese firms would comply with the new regulation, and a visit by Economy Minister Wang Mei-hua (王美花) to the US to respond to the concerns of sides about the recent supply chain resilience and geopolitical issues (Reuters 2022a). TSMC responded with the announcement it would build a production facility in Arizona, capable of 4 nm technology and to be operational by 2024. While this does raise questions and concerns about a US company like Intel eventually replacing TSMC, this scenario seems to still be far off. Even if Intel would receive significant state funding for exactly this purpose, it would still take at least 10 years to catch up with TSMC, let alone surpass them (Gibson 2022). Chris Miller holds a same view, calling those worries "overblown" and noting that TSMC has chosen to continue producing its cutting-edge products in Taiwan and that “TSMC’s technology is top-notch and the Chips Act funding is unlikely to remove TSMC from its position at the top of the chip industry” (Hale 2023).

In turn, the PRC has installed an export restriction to take effect as of August 2023 on Gallium and Germanium (Liang and Sherman 2023). Gallium is often used as a compound in microwave circuits and violet LED applications, or as a semiconductor in Blu-Ray applications. On the other hand, germanium has been highly effective in space technologies such as solar cells because it is more resistant to cosmic radiation than silicon (Harper 2023). These components, while needed in far smaller quantities than Silicon, are also much scarcer on the global market. Both are present on the EU and US lists of critical elements and in both cases, China is the leading producer and exporter of the materials

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(‘2022 List of Critical Minerals’ n.d.; ‘Critical Raw Materials’ n.d.). As the measure is yet to take effect, it is not possible to determine the effect it will have on the Taiwanese semiconductor industry.

Finally, it seems there is a way in which TSMC is leveraging the new geopolitical reality between the US and China. Its technology and production capacity are coveted by many, and it has recently announced the construction of production plants outside of Taiwan. While many players within the industry maintain that continued fab expansion by TSMC in Taiwan is necessary to maintain its supply chain advantage, more and more non-Taiwanese fabs have been announced (Chen and Shen 2023).

For Taiwan, this could be an opportunity as well as a threat, because while fabs in third countries integrate them more and more in the global system, it also reduces the domestic control over TSMC. Furthermore, third nations like the US might be less eager to defend Taiwan in the face of China if they had the choice to locally create cutting-edge semiconductors. This does not appear to be the situation right now, though. The Taiwan Policy Act of 2022, which provides Taiwan with USD 4.5 billion in security assistance over four years and encourages its participation in international organizations, was supported by the US Senate Foreign Relations Committee one month prior to BIS's announcement of tightening export controls (Zengerle and Martina 2022). The fact that this action was taken shortly after TSMC declared its intention to construct and run an advanced semiconductor fab in the United States shouldn't come as a surprise. (‘TSMC Announces Intention to Build and Operate an Advanced Semiconductor Fab in the United States’ 2020).

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4.4.4 Conclusion

Despite the compelling image of semiconductors as geoeconomic tools, Taiwan ROC seems to be limited in its use on the international stage. It is politically and cognitively divided, making long-term strategic planning erratic at best. However, the Taiwanese identity is becoming less and less contested, allowing room for a more stable foreign policy across party lines. Despite being the largest shareholder in TSMC, its capacity to steer the company is rather limited. The state can get concessions through beneficial actions such as subsidies and tax cuts, but the primary goal of the company remains revenue. What might be considered a geoeconomic act was the announcement of a first and later a second plant in Arizona, which was followed by a major increase in military support from the US. It is clear that the semiconductor industry has granted Taiwan centrality on the world stage, but it has also made it one of the global focal points of geopolitical competition, whether that is a blessing or a curse is yet to be determined.

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Final Conclusion & Future Outlook

Finally, we come back to the research question:

"What geo-economic power does the semiconductor industry generate for Taiwan ROC and how does it use that power?"

This thesis hopes to offer a structured answer to this question, and by doing so contribute to an empirical and structured way of geo-economic analysis. Throughout the research, the dynamics of moving from economic to geoeconomic have been addressed. First and foremost was the study of what geo-economic potential lay within the Taiwanese semiconductor industry. The analysis made clear that the semiconductor production process is an intricate and international endeavour involving numerous stages and countries. With an average of 24 countries participating at each step and approximately 70 borders crossed throughout the value chain, the industry heavily relies on specialized expertise and global collaboration. The process commences with chip design, followed by wafer manufacturing, wafer fabrication, and packaging and testing. Three supplementary steps add to the strategic complexity of the supply chain: sourcing critical minerals, managing IP, and ensuring specific infrastructure for production. The wafer fabrication stage, the actual chip creation process, demands highly controlled environments with minimal atmospheric dust. It utilizes advanced techniques, such as precise light projections to create transistor properties on the chip surface. Taiwan holds a central position in this stage, with four Taiwanese firms ranking among the top 10 largest foundries by revenue.

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Despite the recent trend of nationalization in some aspects, the semiconductor industry's production remains inherently global and interdependent. As companies seek efficiency through specialized global supply chains, they have simultaneously reduced resilience, making them susceptible to sudden supply and demand shocks. The industry has witnessed shifts in strategies from just-in-time practices to resilience-driven approaches following recent disruptions caused by the pandemic, the China-US trade war, and global economic fluctuations. While some explanations point to supply chain disruptions as the main cause of the semiconductor shortage, other experts, like Christopher Miller, contend that production of semiconductors actually increased over the years, suggesting alternative factors influencing the crisis. Nevertheless, the semiconductor shortage impacted various industries, driving the industry to call for more active government investments to ensure a stable supply of chips.

We then turn to answer the first sub-question: **What factors make up the geo-economic potential of the Taiwanese Semiconductor industry?** Based on the research in this thesis, factors making up the geo-economic potential could include the following. There is historical development and government support by the KMT and later the DPP. The industry's development was initially driven by state-led initiatives, and the government played a crucial role in providing funding and creating research organizations to boost semiconductor production. Second, there are Taiwanese talent and research capacities through organisations such as the NDL and the CIC. This in turn gave it the know-how to transition towards the production of advanced technologies, such as Very Large-Scale Integration (VLSI) technologies, and transitioned from two-dimensional to three-dimensional chip production to keep up with technological advancements and maintain competitiveness. TSMC’s monopoly position in the mass production of <5nm technology

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greatly increases Taiwan's geo-economic potential. Externally there are the interconnectedness and widespread use of the industry. The semiconductor industry's value chain involves numerous international partners and moves through many countries. This high level of interdependence with global supply chains contributes to the industry's geo-economic potential. Finally, geopolitical factors, such as Taiwan's delicate relations with mainland China and geopolitical concerns in the region, have increased the geo-economic importance of semiconductors on the world stage.

In chapter 4.3, based on critiques found in the literature research, the model for geo-economic analysis was supplemented with developmental theory to better account for state-industry relations. This subchapter aims to answer the second sub-question: **What capacity does the Taiwanese state have to turn this potential into actual geo-economic power?** The analysis explores the capacity of the Taiwanese state to transform the economic power of its semiconductor industry into geo-economic influence. This is done through the lens of state-industry relations, specifically considering the indicators of DPCC, FDI, and SOE. The interplay of these factors determines the state's ability to steer the semiconductor industry's international strategy. The historical development of the industry reveals two distinct periods: one characterized by strong state presence and central authority (1974-2002) and another marked by a gradual decentralization of authority due to the democratization process and increasing private investment (2002-present). The rise of giant semiconductor companies, like TSMC, was necessary for international competitiveness but came at the cost of reduced state control over the industry. As foreign investment in TSMC increased, the company gained more autonomy in setting policies, contributing to political tensions. Ultimately, the state's capacity to wield geo-economic

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power from its semiconductor industry depends on balancing economic growth with the trade-offs of state control.

Finally, since the goal is to find empirical backing for geo-economic behaviour, the findings from sub-question one and two are applied to recent developments in the industry. This part of the analysis, found in chapter 4.4, delves into **how Taiwan ROC utilizes its semiconductor industry as a geo-economic tool in international relations**. It highlights the political divide between the green and blue camps, representing those in favour of Taiwanese identity and independence, and those advocating for a unified China, respectively. Taiwan's political identity remains contested, which hampers its ability to pursue a long-term geo-economic strategy. However, Taiwanese society is moving more and more towards a consensus on a shared identity. The global chips crisis of 2021 left its mark on the semiconductor industry, shedding light on a reluctant Taiwanese government scrambling to keep its competitive edge. Moreover, the US-China semiconductor rivalry and its implications for Taiwan ROC are explored. The Taiwanese government has so far been reluctant in its response to US and Chinese export restrictions, despite the potential influence on its semiconductor industry. The analysis looks into TSMCs expansion plans in the US and the challenges it poses to Taiwan's control over the company. Despite its semiconductor industry's global significance, Taiwan's limitations in using it as a geo-economic tool are highlighted, primarily due to political divisions and TSMC's autonomy in decision-making.

Finally, based on all the above research, the final research question can be answered. **What geo-economic power does the semiconductor industry generate for Taiwan ROC and how does it use that power?** The semiconductor industry generates significant geo-

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economic power for Taiwan ROC. As one of the world's major semiconductor producers and home to leading companies like TSMC, Taiwan plays a critical role in the global supply chain. The industry's technological prowess and capacity to produce cutting-edge chips provide Taiwan with leverage in international relations, drawing attention from major economies like the US and China.

Taiwan uses its semiconductor industry as a geo-economic tool by capitalizing on its strategic importance in the global market. The government provides support to the industry through research programs, cooperation projects with foreign firms, and financial incentives to maintain its competitive edge. Additionally, Taiwan leverages its semiconductor capabilities to build and strengthen diplomatic ties with other countries, securing economic and political partnerships.

Furthermore, the semiconductor industry contributes significantly to Taiwan's economic growth and development, enhancing its overall influence in international affairs. However, Taiwan's ability to fully control the industry's direction is limited, as private investors and global market forces have become major players in the industry. Despite this, Taiwan has sought to maintain its centrality on the world stage by expanding semiconductor production in other countries like the US. Overall, the semiconductor industry empowers Taiwan ROC with economic clout and strategic positioning, allowing it to navigate its way in the ever-changing dynamics of international politics and economic competition.

Finally, it has become clear that the above research is only the tip of the iceberg when it comes to geo-economic analysis. Every state, industry and supply chain has its own dynamics and key actors that influence others and are in turn influenced. Its complexity

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can perhaps be attributed to the interdisciplinary nature of the research. True geo-economic understanding requires a deep knowledge of economics, geopolitics, supply chains and in the case of semiconductors, technology. The contribution of this thesis to the literature lies in the practical application of geoeconomics and the inclusion of state-industry relations in the analysis. Both of these arose in the literature review as blind spots for existing geo-economic research. There is still plenty of space for future studies, for example in the field of comparative analysis, both between nations (ex. comparing Japanese and American geo-economics) or between industries (ex. The geoeconomics of semiconductors vs. fossil fuels). Another avenue for future research would be to expand on the state-industry framework, as the developmental model works for East-Asia, but loses its explanatory power for most other cases. Finally, something would be gained from a study on the effectiveness of geo-economic actions using quantitative methods. Due to its nature, the actual geo-economic policy is often difficult to witness, as it is based on private talks between government officials and businesses in which secrecy is often of the highest importance. For this reason, geo-economics remains a vital subject for policymakers and practitioners, perhaps more so than for IR scholars.

doi:10.6342/NTU202304268

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List of Appendices

Appendix no. 1: Glossary

ARATS - Association for Relations Across the Taiwan Strait

BIS - Bureau of Industry and Security

CIC - Chip Implementation Center

CP - Integrated Circuit Project

DARPA - Defense Advanced Research Projects Agency

DPCC - Domestic Private Capital Concentration

DPP - Democratic Progressive Party

EDA - electronic device automation

EIDP - Electronics Industry Development Project

ERSO - Electronics Research and Service Organization

EUV - extreme ultra-violet

FDI - Foreign Direct Investment

FTA - Free Trade Agreements

IP - Intellectual Property

IR - International Relations

ITA - Information Trade Agreement

ITRI - Industrial Technology Research Institute

JIT - Just in Time

KMT - Kuomintang

NDL - Nano Device Lab

NPIE - National Program for Intelligent Electronics

doi:10.6342/NTU202304268

NSSP - National silicon software Project

NYSE - New York Stock Exchange

RCA - Radio Corporation of America

ROC - Republic of China

SEF - Strait Exchange Foundation

SMEs - small to medium enterprises

SMO - Small to Medium Organisation

SOE - State Owned Enterprises

SWF - sovereign wealth funds

TPP - Taiwan People's Party

TSMC - Taiwan Semiconductor Manufacturing Company

TSRI - Taiwan Semiconductors Research Institute

UMC - United Microelectronics Corporation

US - United States

VLSI - Very Large-Scale Integrated Circuit

doi:10.6342/NTU202304268

doi:10.6342/NTU202304268