



LUND UNIVERSITY

School of Economics and Management

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Will the Tigers Keep Roaring?

Catch-up and Capability Formation in the Asia-Pacific Region

by

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Abstract: The Asian tigers have been a tremendous case of economic success for decades. The economic financial crisis of 1997 put this to a test and they clearly passed it. This dissertation tries to unveil whether the same factors that led to the growth path in the 1960s, the so-called East Asian Miracle, are still responsible for overcoming the crisis. By means of factor analysis and a set of multivariate regressions I find that the same factors are still applicable. Governance is in all the specifications the main factor explaining the recovery, as it was also in the 1960s. However, and the main finding of this thesis, my preferred specification fixed effects shows that the impact of governance is negative nowadays, contrary to its effect during the miracle, as extensively proven by the State Led school of thought. I also find that openness and financial system have a second order importance impact on the recovery. Finally, a strong innovation system is also related to economic growth. The consequences of the deleterious effects of governance during the crisis cannot be neglected and would imply that the tigers have to explore a new path in the near future, by adopting an alternative political system.

Keywords: East Asian Miracle, MF, SL, crisis, capability, catch-up

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Table of Contents

1	Introduction	1
2	Historical background: The East Asian Miracle	7
2.1	Towards the end of the Asian paradigm: the financial crisis of 1997-1998	10
2.2	Stepping up: catch-up process and capability formation	12
2.3	Addressing the heterogeneity of the region: The case of the Asian tigers	15
2.3.1	Openness	15
2.3.2	Education.....	17
2.3.3	Innovation.....	19
2.3.4	Governance and Financial System	21
3	Data and Methodological Approach	24
3.1	Data description, limitations and sources	24
3.2	Methodology	27
3.2.1	Summarising the data: Factor Analysis.....	27
3.2.2	Empirical Model: Evaluating the growth of the Tigers.....	29
4	Empirical Analysis	31
4.1	Factor Analysis: Identifying National Capabilities	31
4.2	National Capabilities and Growth: assessing the relationship	34
5	Conclusion	38
6	References	40
	Appendix A	47

List of Tables

<i>Table 1.1: Performance of the Asia-Pacific region during the financial crises.....</i>	<i>5</i>
<i>Table 2.1: Improvement in the standards of living in the Asia-Pacific region</i>	<i>7</i>
<i>Table 2.2: Measure of openness of first-generation NIEs.....</i>	<i>16</i>
<i>Table 2.3: Educational attainment of first-generation NIEs.....</i>	<i>18</i>
<i>Table 2.4: Measure of innovation of first-generation NIEs</i>	<i>20</i>
<i>Table 3.1: Measuring capabilities.....</i>	<i>25</i>
<i>Table 4.1: Results of factor analysis</i>	<i>33</i>
<i>Table 4.2: Regression results</i>	<i>35</i>
<i>Table A.1: Definition and Source of Variables</i>	<i>47</i>
<i>Table A.1 (Continued).....</i>	<i>48</i>

List of Figures

<i>Figure 1.1: Annual GDP growth rates, 1961-1970</i>	2
<i>Figure 1.2: Annual GDP growth rates, 1996-2016</i>	5
<i>Figure 2.1: Map of the Asia-Pacific region and the miracle economies</i>	8
<i>Figure 4.1: Scree plot</i>	32

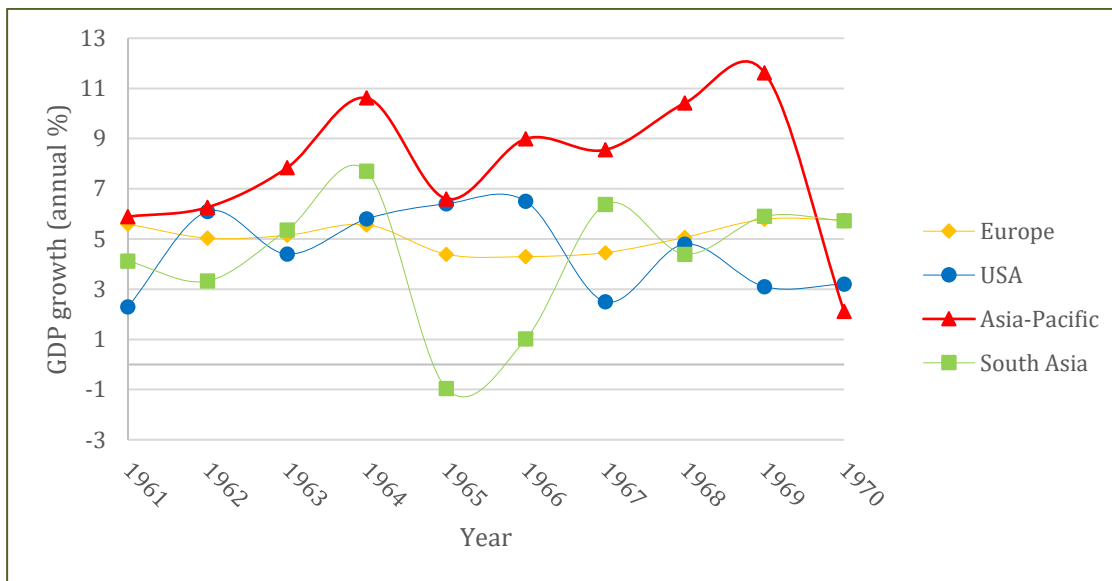
1 Introduction

In the aftermath of World War Two, the global economy was characterised by its immense volatility. Death, hunger, soaring inflation, unemployment and social instability were only some of the outcomes of this horrific conflict (Kesternich, Siflinger, Smith and Winter 2014). This environment promoted the rising tension during the so-called Cold War. The idea of either the break out of a new conflict between the two blocks or the radicalisation of some states was conceivable. In order to prevent the latter, the United States set the global economic system to increase the economic interdependence of the nations and to promote their own development (Jomo 2003). In this respect, the agreements of Bretton Woods were a key aspect to guarantee international stability (Dooley, Folkerts-Landau and Garber 2003).

As a result of this favourable international context, both developed and developing countries thrived in the professed Golden Era of development (Adelman 2003). There is ample consensus that Japan together with the first-generation newly industrialized economies (NIEs) initiated their industrialization process under this specific conjuncture. At this time, the violation of the laissez-faire approach or neo-liberal economic principles was happily tolerated (Jomo 2003:176). Under the auspices of the American government, Northeast Asia's growth rates soared in a process that lasted for several decades, the so-called *East Asian miracle*. Figure 1.1 depicts the astounding growth rates of the Asia-Pacific region in comparison with the leading developed blocks, namely Europe and USA, and its region counterpart, South Asia, over the period 1961-1970¹.

¹ It would have been intriguing plotting the period from the 1950s onwards, but it was not possible due to the lack of data.

Figure 1.1: Annual GDP growth rates, 1961-1970



Source: World Development Indicators (2017)

The East Asian miracle refers to the process of rapid industrialization that took place in the Asia-Pacific region starting in the 1950s which yielded stupendous sustained growth rates during more than two decades for many of these economies. As a consequence of this event, many agrarian and normally underdeveloped nations evolved into industrial and modernized economies. Its relevance was of such magnitude that the miracle is considered as the growth milestone of the 20th century. The drivers of the process are considered the four ‘tigers’ or NIEs, i.e. Hong Kong, Singapore, South Korea and Taiwan; along with the Association of Southeast Asian Nations (ASEAN) economies, that is to say, Malaysia, Thailand and Indonesia²; all of them under the guide of Japan.

As a result of this so-called miracle, many researchers have been involved in finding out the multiple reasons for this outstanding sustained economic growth process. Extensive research has been carried out and many questions have been posed. Including whether the model can be replied elsewhere, or if there is an East Asian model of development. Despite the ample research on the topic, the facts are clearly exposed but the underlying mechanisms are not fully understood. In consequence, two different schools of thought command the debate on the miracle. On the one hand, the market friendly (MF) approach and, on the other, the state-led

² Philippines did not develop as much as the other ASEAN economies despite its incredible prospects (Bautista and Lamberte 1996). Thus, it is not always included in the group of drivers of the miracle.

(SL) approach. The former displays the point of view of the neoclassical tradition (Kreuger 1984, Kuznets 1988) and is represented by the World Bank, whereas the latter is appointed to the revisionist school (Amsden 1989, Wade 1990) and relies on iconoclastic recommendations. Nevertheless, both schools try to give an answer to how the mixture of growth, equity, and structural transformation took place in the region.

This debate has been alive for more than 50 years, but the lack of conclusive answers has raised doubts about the existence of an East Asian model of development. One crucial factor that has ignited this hesitation is the heterogeneity among the countries that lived this process, and especially among the tigers (Krueger 1995, Lall 1996, Deshpandé, Farley and Bowman 2004). Each of these countries adopted different industrial policies and fostered different commercial strategies. Nonetheless, in general terms, there are some factors that can undoubtedly be pointed as the foundations of the miracle. The role played by openness, education, governance, finance, and innovation is not neglected by any of the approaches (World Bank 1983 and 1993, Rodrik 1994), but these factors are regarded from a different point of view depending on the school considered.

Despite not knowing thoroughly the underlying mechanisms of the miracle, it was becoming more widely accepted that the Asia-Pacific region meant the beginning of a new development paradigm. Along these lines, the Asian Development Bank (1997) published a report praising the attainments of the miracle. However, against all odds, one month later a severe financial crisis shook the region. This event supposed a watershed for the debates on development. Moreover, as happened with the miracle, there was not full understanding of the reasons for this crisis. Some put the blame on the iconoclastic model applied in the region, whereas other pointed towards the globalisation forces (Wade 1998) or the intervention of the International Monetary Fund (IMF) (Sachs 1998).

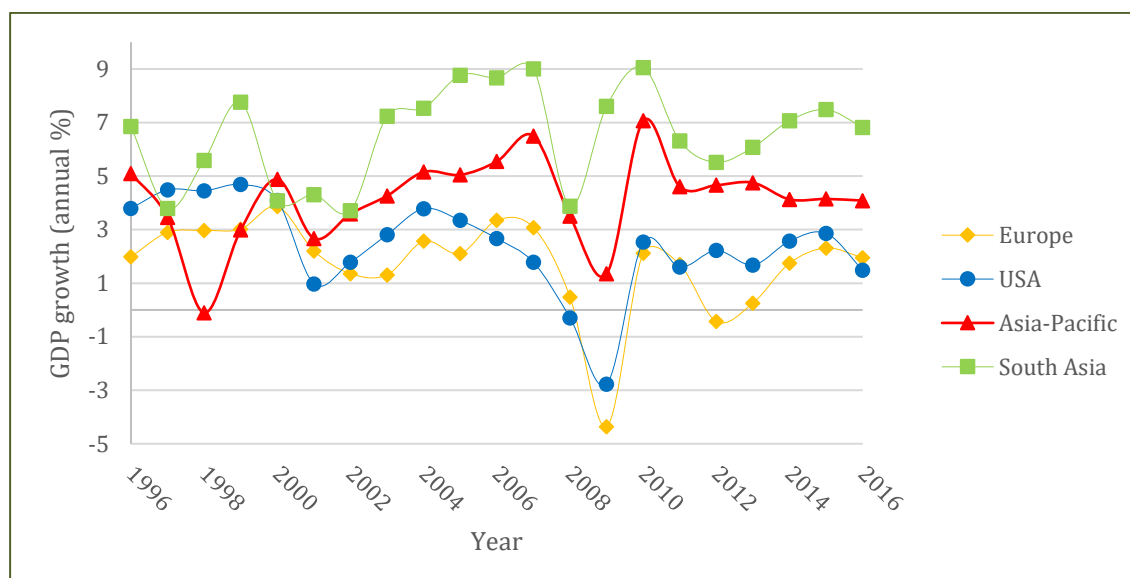
Notwithstanding the lack of consensus about the underlying mechanisms of the miracle and the financial crisis, the successful performance of the Asia-Pacific region cannot be ignored. The incredible economic achievements along with the ability to recover from a harsh crisis and walk again the road of success, are fantastic features. For that reason, spotting the main factors behind the catch-up process may yield valuable insight. In this respect, there are two leading threads in the literature tackling this question.

On the one hand, Gerschenkron (1962) stated the resulting advantage that developing countries may find in their delay, concept that he devised as the *advantage of backwardness*. The possibility of borrowing technologies from countries which are in the technological frontier implies the chance of starting a virtuous circle where technology and growth would feed each other until the technology frontier is reached.

On the other hand, it may be the case that Gerschenkron's framework errs on the side of simplicity. The idea that a country will catch-up with developed counterparts only relying on the adoption of their technology seems naive. Aware of this issue, Abramovitz (1986) acknowledged the necessity of accounting for alternative factors without which a complete catch-up process would be a daydream. To address this problem, he coined the concept of *social capability* which refers to the complementary factors covering: social, financial, educational, industrial, and technical competences, required to carry out a complete catch-up process. Furthermore, by analysing a wide set of developing and developed countries, Fagerberg and Srholec (2008) have found abundant evidence on the relation between capability building and economic development. In particular, the interaction of governance and innovation seems to be of particular relevance.

Regardless of the harshness of the 1997 Asian financial crisis that hit this region, these economies managed to recover and thrive once again (Webber 2001). Furthermore, these countries showed another time its adaptability and strength after the world economic crisis of the 2000s (see Figure 1.2 and Table 1.1). Notwithstanding the huge setbacks endured, the Asia-Pacific region growth rates are still remarkable and considerably higher than those from European and American blocks. Therefore, even though there are not conclusive answers for any of the events that took place in the region for many decades, I hypothesize that there are some underlying factors which are directly linked to the extraordinary performance of these nations both in the miracle and in the aftermath of the financial crisis. In particular, I will review the same factors claimed by the MF and SL schools back in the 1960s (openness, education, governance, finance and innovation) in the modern international context.

Figure 1.2: Annual GDP growth rates, 1996-2016



Source: World Development Indicators (2017)

Table 1.1: Performance of the Asia-Pacific region during the financial crises

Panel A: Asian financial crisis of 1997						
Year	Annual growth (%)		Share of GDP (%)			
	GDP per capita	Inflation	FDI inflows	R&D expenditure	Gross Fixed Capital Formation	Imports of goods & services
1996	3.88	3.89	1.03	2.2	31.27	22.11
1997	2.30	3.47	1.26	2.3	30.45	22.22
1998	-1.17	3.34	1.40	2.3	29.84	21.89
1999	1.98	2.12	1.58	2.3	29.06	21.73
2000	3.91	2.51	2.11	2.3	29.12	24.62
Panel B: World crisis of 2000s						
Year	Annual growth (%)		Share of GDP (%)			
	GDP per capita	Inflation	FDI inflows	R&D expenditure	Gross Fixed Capital Formation	Imports of goods & services
2006	4.78	4.05	2.61	2.4	30.60	31.42
2007	5.76	3.21	3.24	2.4	30.07	31.01
2008	2.78	7.83	2.72	2.4	30.60	32.35
2009	0.66	2.44	1.97	2.3	31.79	26.40
2010	6.35	3.16	2.93	2.4	31.55	29.11

Source: World Development Indicators (2017)

In the present work, I will assess the period that covers from the aftermath of the Asian crisis until nowadays, namely 2000-2016. This time span is propitious to test the hypothesis previously stated. The data used will be extracted from mainstream sources such as the World Bank and UNESCO in an annual basis. Given its relevance in the miracle process, the countries

under study will be the four tigers. I will rely on the methodology applied by Fagerberg and Shrolec (2008), i.e. factor analysis. This technique allows summarising a big set of data into a small set of uncorrelated composite variables. Irrespective of the heterogeneity of these countries, with factor analysis I will be able to capture the main dimensions claimed in the literature of the miracle (openness, education, governance, finance and innovation) in the context of national capability building and see if these factors still explain the growth of the region. Because factor analysis only provides correlations, I will additionally perform an econometric analysis based on different regression methods to show a better account between growth (measured as GDP per capita) and these indicators. These results will not be causal, but some important insights about the uniqueness of the region may be extracted. Moreover, this research may help to rethink if the Western model of development can be extrapolated to every developing nation given their different initial conditions and context. It can also help to understand whether despite the different international context of nowadays, the same factors that worked back in the 1960s are still important.

I find ambiguous results. Even though all the factors stated are of relevance and governance remains of crucial importance in both periods, governance shows reverse signs in the impact on growth depending on the specification used. Since my preferred model, fixed effects, reflect a negative sign, this has implications for the future of the region with respect to the policies that should be implemented. Moreover, adopting more inclusive principles may be of interest given their current stage of development.

The remainder of the paper goes as follows. Section 2 depicts in detail the historical background, the Asian financial crisis, the main theories explaining the catch-up process and the existent heterogeneity among the countries of the region. Section 3 describes the data, shows the capabilities included in the analysis and how they are measured and presents the methodology. Section 4 renders the results. Finally, section 5 concludes.

2 Historical background: The East Asian Miracle

The so-called East Asian Miracle was a growth milestone that took place in East and Southeast Asia in the 1950s and gained momentum in the 1960s. This process generated exceptional growth rates for several decades and was considered the engine of catch-up for the countries of the Asia-Pacific region (Stiglitz 1996, Quibria 2002). As a consequence, poverty has reduced to an historic low and the standards of living of the population have reached its documented maximum (Andersson and Axelsson 2016). Table 2.1 renders some examples of the amelioration in the standards of living over time.

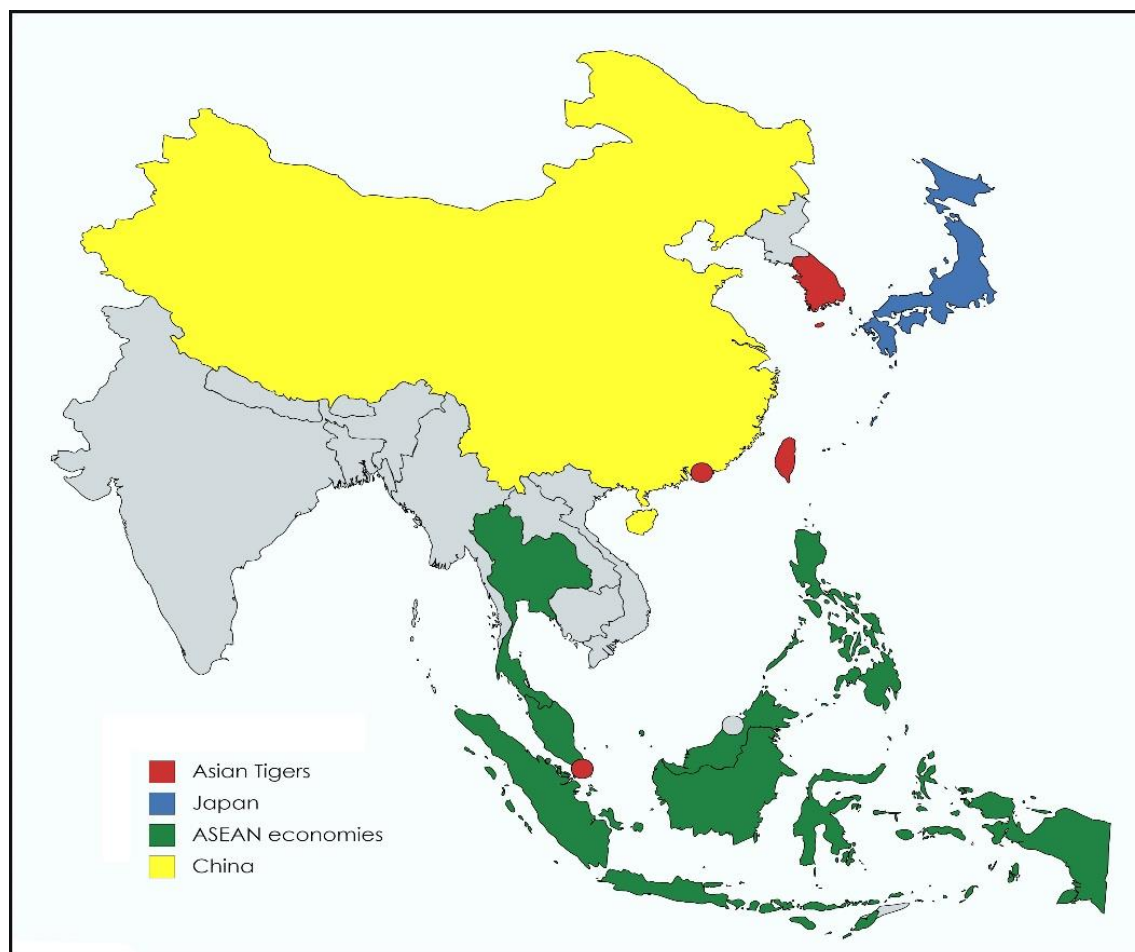
Table 2.1: Improvement in the standards of living in the Asia-Pacific region

Year	GDP pc (constant 2010 US\$)	Life expectancy at birth (years)	Mortality rate (adult males per 1000)	No Schooling (% aged 15 and over)
1960	1,279	48	432	38
1970	2,200	60	266	25
1980	2,929	66	192	17
1990	4,182	69	167	13

Source: World Development Indicators (2017) and Barro-Lee (2016)

Some economies of the region were the drivers of the process, in particular, the Asian tigers or first-generation newly industrialized economies (NIEs), i.e. Hong Kong, Singapore, South Korea and Taiwan; together with the ASEAN economies represented by Malaysia, Thailand and Indonesia. Given its genuine path of development along with its international impact, China has earned a special mention (Baek 2005). Finally, also important to note the leading role played by Japan in the process of development of these High-Performing Asian Economies (HPAEs) according to the definition of the World Bank (1993). Figure 2.1 portrays the map of the region and the miracle economies.

Figure 2.1: Map of the Asia-Pacific region and the miracle economies



Source: mapchart.net

On the other hand, in spite of being categorised as the growth landmark of the 20th century, there is still no consensus about the underlying mechanisms directing the main factors pointed out by the literature. Even though the countries involved shared some common traits, such as culture or the presence of autocratic regimes, and followed, to a certain extent, similar development strategies, given the heterogeneity of both the countries and the measures implemented (see Section 2.3), two incompatible interpretations have commanded the debate on the Asian miracle. They are usually classified as the market-friendly (MF) approach and the state-led (SL) approach. Despite their noteworthy differences, both highlight the mixture of growth, equity and structural transformation experienced by the region. Both schools also agree on export orientation as the main strategy to understand the miracle (Balassa 1981, Kuznets 1988, Weiss and Hobson 1995).

The disagreement between both schools of thought revolve around three centres of attention (Andersson and Gunnarsson 2003). First, how to explain the outstanding export pattern.

Second, what is the meaning of the reduction in inequality in the distribution of income. Third, the different interpretation assigned to the government policies. The debate generated around these questions can be summarised by three key concepts: export-led growth, growth with equity, and developmental state³.

The MF approach or neoclassical explanation (Kuznets 1988, Krueger 1995) refers to the free market view praised by the World Bank in their controversial 1993 report named ‘The East Asian Miracle: Economic Growth and Public Policy’. This study goes in line with the prescriptions proposed by the Washington Consensus. Concepts such as openness, restricted state intervention, stable macroeconomic principles (what they called *getting the basics right*), early education focus, market mechanisms and a healthy financial system are considered the cornerstone of economic growth. According to the first attempt from the World Bank (World Bank 1983) to explain the miracle, the economies of the region relied on a market strategy with low state intervention. Specifically, in consonance with this approach, openness was the engine behind export-led growth (Balassa 1972, Riedel 1984). In fact, this strategy fostered circumspect governance and equity came up as a result of full employment. In consonance with the studies of the World Bank, the strategy followed by the countries of the region combined infrequent state intervention along with considerable openness and movements of capital. This model of growth was exemplified by Taiwan and South Korea in contrast to the widely spread import-substitution strategy (ISI), common to the developing countries at this time.

It has to be noted that the hypothesis of trade openness was also defended from the academic field (Balassa 1981 and 1988, Little 1981). Despite not counting with copious natural resources, the tigers possessed a comparative advantage in highly-educated, methodical and low-paid workforce (Andersson and Gunnarsson 2003). In fact, broadly speaking, education has been generally recognised by many scholars (e.g. Birdsall et al. 1995, Campos and Root 1996) as the instigator of a virtuous circle where both education and growth fed each other. In this context, the four tigers followed the export-led path marked by the leading Asian economy, Japan.

Conversely, the SL approach, represented by the so-called revisionist school who refused the predominating free market statement (Amsden 1989, Wade 1990), focuses on altering the

³ I will rely on the definition of developmental state proposed by Andersson and Gunnarsson (2003): “a developmental state is a vehicle of industrialisation that uses control over the financial system to direct national savings into productive investments.”

normal functioning of the market through scrupulous state intervention along with direction of the market, i.e. through industrial policy management. Opposite to the Western model of development, the SL model rejects Western principles such as the faith on free markets and in democratic institutions and governance. According to this school of thought, the comparative advantages were created artificially by means of state intervention also known as ‘getting prices wrong’ (Amsden 1989). Industrial policy aimed at promoting the export sector through favourable conditions such as tax exemptions or rebates on import duties. In the beginning, exports were mainly focused on basic consumption goods. However, progressively production changed into more advanced and technological capital goods. Backed up by the favourable context, sophisticated technologies were embraced while national capabilities were built⁴. Moreover, the influence of an efficient and transparent bureaucracy was key in the process. The interaction of all these factors helped linking the ‘East Asian model’ with the developmental state concept.

2.1 Towards the end of the Asian paradigm: the financial crisis of 1997-1998

Notwithstanding the lack of consensus about the underlying mechanisms behind the miracle, it was thoroughly accepted the existence of an Asian development paradigm. However, the financial crisis that shook the region during 1997 and 1998 raised doubts about its existence and the unlimited growth rates pattern of the region (World Bank 1993:366, Andersson and Gunnarsson 2003:1). Right before the start of the crisis, the Asian Development Bank released a study exalting the accomplishments of these countries (Asian Development Bank 1997). This enormous and unexpected economic setback would therefore change the direction of the debates on this development model (Adelman 2003).

The same lack of insight revolving around the miracle also applied to the explanations of the crisis. On the one hand, Alan Greenspan, prior chairman of the US Federal Reserve, pointed towards the collapse of an iconoclastic development model, whereas, on the other hand, others

⁴ The concept of national capability building refers to the different types of capabilities, e.g. social or technological, which are created during the process of development. According to Abramovitz (1986), these elements are a necessary condition to experience a successful structural transformation.

put the blame on the globalisation forces (Wade 1998) or the intercession of the International Monetary Fund (IMF) (Sachs 1998). However, as Jomo (2003) stated, eminent analysts agree that the East Asian crisis does not resemble any previous currency crisis. It could be identified as new type of currency crisis.

After the government devaluation of the Thai baht, the panic expanded to the rest of the currency markets of the region. The effects of this event were, among others, soaring external debt, bankruptcies and the proliferation of capital outflows. As a result, unemployment rose, investments plunged and real incomes decreased (Andersson and Gunnarsson 2003). The unexpected financial crisis generated turmoil and an active debate took place. From the perspective of some economists, the distortions created by industrial policy were one of the main causes of the crisis (Anchordoguy 2001). Other concepts such as 'crony capitalism' and 'bad governance' were constant part of the debate (Wade and Veneroso 1998, Backman 1999). The separateness from the neoclassical proposals were frequently pointed out as the main factors (Wade 2002) and state-led policies were regarded as the genesis of the problem. The existent relation between state and industrial circles altered the normal market allocation, giving rise to a system based on patronage (Andersson and Gunnarsson 2003:6).

On the other hand, some supported the hypothesis of panic in the financial markets as the only culprit (Furman and Stiglitz 1998, Krugman 1999). Hence, the role played by the IMF was crucial to understand this outcome. In the opinion of this approach, deficiencies in both government regulation and financial system inspection can be regarded as the main factors behind the crisis (Sachs 1998).

It is important to note that the scope of the crisis varied extensively among the countries involved. For example, there were significant differences between the countries of East and Southeast Asia (Radelet and Sachs 1998). Some were deeply affected, while others entered the path of recovery rapidly. This fact restates that there was not a standard and homogeneous development model. The countries from the Asia-Pacific region underwent, at the same point in time, a regional industrialisation process in which their initial conditions have strongly altered the role played by the government. Based on that evidence, it can be concluded that the financial crisis was the result of a long-term development process and can be interpreted as consequence of incidents that took place many years before it actually started (Andersson and Gunnarsson 2003).

Another factor to be highlighted is the high degree of heterogeneity among the miracle economies (Deshpandé, Farley and Bowman 2004). The fact that the crisis hit in very different degrees these economies, brings to the forefront the uneven developmental levels they were transitioning. Despite sharing common traits, their development processes were highly different and to some extent unique (Lall 1996). Opposite to this reality, it is usually claimed that all these nations were rather similar. As it is explained in Section 2.3, not even the first-generations NIEs share a high degree of similitude (in this respect, Taiwan and South Korea are the most comparable economies). Detractors of this view may correctly point out that poverty dropped sharply in the whole region due to the economic miracle, but this outcome was only possible because of structural transformation and economic growth (Quibria 2002). Nonetheless, the disparate international context in which these nations started their development process along with a range of varying strategies employed were crucial (Krueger 1995).

In special, context played a crucial role. Given the extreme tension in the aftermath of the World War Two, the so-called Cold War, the international economic stage was set to avoid a new conflict (Jomo 2003). In this environment, the Americans fostered a model of development based on economic interdependency which also promoted the development of backward nations. Along these lines, the agreements signed in Bretton Woods were crucial for this purpose (Dooley, Folkerts-Landau and Garber 2003). In the Asia-Pacific region, only Japan and the four tigers were able to industrialise at this time. Therefore, big part of the success it is usually conferred to the friendly environment of this time (Adelman 2003, Andersson and Gunnarsson 2003, Jomo 2003). In comparison with this case, the international context in the 1980s was radically different. As a result, the latecomers were guided through different and usually more challenging paths (Adelman 2003:34). For that reason, if there was an East Asian model of development, the one from the 1960s bears little resemblance to the one of the 1980s.

2.2 Stepping up: catch-up process and capability formation

Regardless of the differing initial conditions, development paths and international context, it cannot be neglected that the Asia-Pacific region was defined as miraculous for a compelling reason. The sustained growth rates experienced for decades have no parallel. Therefore, despite the lack of insight about the underlying mechanisms of the miracle and the financial crisis, it is

a matter of interest spotting the main factors behind the catch-up process. Along these lines, the theory developed by Gerschenkron tackles this issue in an insightful way.

In his seminal paper of 1962, 'Economic backwardness in historical perspective', Alexander Gerschenkron laid the foundations for the upcoming literature in one of the most studied topics of development theory: the catch-up process. The starting point of his theory falls on the assumption that backwardness implies an inherent advantage. The idea is that less developed nations may have more rapid productivity growth than its developed counterparts because of the possibility of borrowing or importing their technology (Findlay 1978). Therefore, following this reasoning, openness to FDI and trade would be bound to institutional change. In this sense, this framework matches the view proposed by the MF approach in the East Asian miracle context.

This notion of catch-up applied to the Asia-Pacific framework was first devised by Akamatsu (1961) under the name of 'flying geese' pattern. Specifically, this approach states that every country has to transition specific phases in the development process. The stages are determined by the comparative and competitive advantages that a nation possesses along with its endowment structure. For that reason, according to this theory, it is to be expected that latecomers copy the pattern of behaviour of countries which are ahead to capitalize on its advantages. In this case, the leading goose role was played by Japan. However, the reality showed that this theory did not completely adjust to the behaviour displayed by the drivers of the miracle. FDI played a minor role among these countries, whereas R&D, industrial policy and skills were the cornerstone of the process. For example, it was not until 1985 that the intra-regional FDI of Japan and Taiwan became important in Indonesia, Thailand, and Malaysia (Gunnarson 2016).

Another issue to be discussed referring to the *advantage of backwardness*, is the scope of the catch-up process that can be achieved. The importance of technology itself cannot be questioned, but it would be naive claiming that the entirety of the catch-up process can be accomplished relying only on technological spillovers. It may be the case that late developers acquire the required technology to transition the process of catch-up, but the absence of complementary factors hinders climbing the technology ladder. Along these lines, Abramovitz (1986:390) claimed that technologically backward countries only have the capacity to create fast-paced growth if *social capabilities* are adequately evolved to permit prosperous exploitation of the available technology. However, a definition of social capability has to be

first provided. Abramovitz (1994:25) defined the term as ‘countries’⁵ levels of education, technical competence, industrial, financial and commercial institutions required to finance and operate large-scale businesses, as well as the social and political characteristics influencing the incentives, the rewards and the risks of economic activity. The author argued that factors such as: dissemination of knowledge, the incidence of structural change, the accumulation of capital and the increase of demand, directly shape the rate of the ability for catch-up.

There is abundant evidence (Amsden 1989, Wade 1990, Kim 1997) pointing towards capability building as the main tool used by the Asian tigers in the process of catch-up. Nevertheless, it is important to note that the literature point towards the importance of a set of different capabilities. For example, the Korean scholar Linsu Kim, specialist in the Korean electronic firm case, claimed the relevance of knowledge in the process of catch-up. He noted that to generate welfare, the social actors⁶ have to possess the abilities to access, absorb and use it. To characterise this phenomenon, Kim coined the concept of *technological capability*. The term can be defined as the capacity of using effectively technological knowledge in order to use, adapt and improve current technologies ... to conceive new technologies so as to create novel products and processes (Kim 1997:4).

Finally, addressing the concerns raised by Abramovitz with respect to social, institutional, economic and politic aspects, the concept of *national innovation systems* (NIS) emerged. First introduced by Freeman (1987) in the study of Japan, the NIS refers to the required flows of technology and information among firms, people and institutions needed to accomplish the innovation process. It can be interpreted as a wider, more systemic approach to the interaction between technological and social capabilities. The concept seems appealing for researchers who want to better understand the interaction between technology and economic development (e.g. Lundvall 1992, Edquist 2004). However, measuring this capability is challenging and also the main issue.

In this regard, the research carried out by Fagerberg and Srholec (2008) backs up the theories stated by Gerschenkron and Abramovitz. The authors rely on a wide sample of countries along

⁵ In the beginning the concept of social capability only referred to firms, but its use is widely accepted for countries given the capitalist context and the resemblances between both.

⁶ Given the capitalist context, social actors allude to firms.

with a variety of indicators depicting the principal types of capabilities, namely, technological and social. Their findings go in two directions. First, capability building and catch-up go hand in hand. To fully exploit the advantage of backwardness, the countries have to build the necessary capabilities. Second, innovation and governance turn out to be of special importance to fuel the process of economic development.

2.3 Addressing the heterogeneity of the region: The case of the Asian tigers

In the words of Kuznets (1988) there was an East Asian model of development based on five pillars: large investment ratios, small public sectors, competitive labour markets, export widening and government intervention in the economy. However, after more than 50 years of debate without conclusive answers, it is widely accepted that there is not an Asian developmental model per se (Amsden 1994, Jomo 2003). Broadly speaking, there is a set of countries belonging to the same region, which shared a common international context during their process of industrialisation and which adopted a standard set of measures, i.e. export-oriented growth, focus on human capital and reliance on industrial policy, among others.

If the case is studied closely, it can be acknowledged that the countries of the Asia-Pacific region carried out different policies and focused on different factors to spur structural transformation (Krueger 1995, Deshpandé, Farley and Bowman 2004). Thus, understanding the heterogeneity of this region is fundamental to obtain valuable insight about the Asian miracle. The principal economies involved in the process were the first-generation NIEs or tigers; together with the ASEAN economies and Japan. In this section, I will study the case of the tigers given its outstanding performance and its parallel development path (Lall 1996, Kim 1998). In particular, I will assess these economies in terms of the dimensions mentioned by the MF and SL approaches, i.e. openness, education, governance, finance and innovation.

2.3.1 Openness

Table 2.2 depicts three measures of openness, namely, exports and imports of goods and services and trade, all of them measured as a percentage of GDP. According to the MF approach, openness was the engine behind the miracle for all the Asia-Pacific economies

(World Bank 1993). Moreover, it is widely accepted that export-led growth was responsible of the outstanding growth rates yielded by the first-generation NIEs (Balassa 1981, Kuznets 1988).

Table 2.2: Measure of openness of first-generation NIEs

Country	1953	1960	1970	1980	1990
Hong Kong					
Exports of goods and services (% GDP)	109	83	93	88	117
Imports of goods and services (% GDP)	154	99	85	101	130
Trade (% GDP)	-	173	178	178	226
Singapore					
Exports of goods and services (% GDP)	-	162	126	202	177
Imports of goods and services (% GDP)	-	153	122	204	172
Trade (% GDP)	-	339	271	411	344
South Korea					
Exports of goods and services (% GDP)	2	3	11	28	25
Imports of goods and services (% GDP)	10	16	32	41	32
Trade (% GDP)	11	14	32	65	51
Taiwan					
Exports of goods and services (% GDP)	8	15	41	47	45
Imports of goods and services (% GDP)	12	17	35	48	35
Trade (% GDP)	22	29	60	104	87

Source: World Development Indicators (2017), Federal Reserve Bank of St. Louis (FRED) and Krueger (1995)

Hong Kong is a remarkable example of outward oriented policy, it possessed a large number of entrepreneurs along with experienced textile and metalworking engineers and technicians coming from mainland China (Lall 1996). For that reason, Hong Kong relied to a large extent on both exports and imports already in the 1950s. It has to be stressed that the manufacturing structure in Hong Kong was never altered given the lack of industrial policy (Lall 1996). It was always devoted to the light manufacturing industry, whereas the other tigers sought deepening strategies. This fact hindered Hong Kong's technological deepening in the long-run (Tsui-Auch 1998). As a consequence, it endured enormous deindustrialisation processes as the costs of land and wage increased. Subsequently, it relocated its manufactures to other nations, principally to China. Table 2.2 corroborates the crucial role of openness in the development process of Hong Kong.

Contrary to the previous case, Singapore represents the result of an interventionist policy along with free trade. Along these lines, the government used industrial policy to promote its economy, specially through FDI inflows (Chia 2005). Singapore is a less populated country than Hong Kong and has higher gross domestic product per capita, but never suffered from such

a process of deindustrialisation. Moreover, its industrial structure was much deeper regarding the complexity of the goods produced and exported (Lall 1996). Initially, Singapore relied on import substitution for a short period. Afterwards, it swapped to export oriented industrialization. Table 3 portrays the relevance of openness in the case of Singapore. The share of its GDP devoted to export-led industrialization exceeds by a large margin the figures of Hong Kong.

On the other hand, compared to Hong Kong and Singapore, South Korea and Taiwan adopted a modest export-oriented policy. These two economies behaved similarly in many points. For example, they decided to strongly intervene the economy on trade and the allocation of domestic resources. In addition, they showed preference in the promotion of native enterprises along with the improvement of local technological capabilities (Cheng 1990). With respect to FDI, it was set aside, adopting a supporting role for them (Rodrik 1995). Their exports were mainly driven by local enterprises, and some state interventions fostered great development of technological capabilities (Booth 1999). Conversely, free trade was not available for the domestic market and the development of capabilities for infant industries was promoted by means of quantitative measures and tariffs (Lall 1996). The adverse effects of excessive protection were compensated with strong incentives to exports. Table 2.2 displays the similitudes in the strategies followed by these countries. Nonetheless, in the recent history, Taiwan has always been more export oriented than South Korea.

2.3.2 Education

Education has always been praised as one of the most characteristic features of the Asian economies (World Bank 1993, Campos and Root 1996, Morris 1996). There is a common belief that all the tigers owned the advantage of education, but authors such as Booth (2003:148) demystified this proposition. In this respect, Table 2.3 points out that this widely held assumption is not totally true.

Table 2.3: Educational attainment of first-generation NIEs

Country	1950	1960	1970	1980
Hong Kong				
No schooling	38.7	31.7	24.1	16.2
Primary	14.0	17.8	24.0	22.5
Secondary	9.4	10.1	18.8	24.4
Tertiary	2.8	2.6	1.4	3.3
Singapore				
No schooling	61.2	49.4	34.3	29.8
Primary	7.7	10.0	12.5	18.5
Secondary	4.5	7.2	11.6	9.8
Tertiary	0.7	1.1	1.3	2.4
South Korea				
No schooling	27.9	42.6	24.3	13.1
Primary	53.5	32.5	37.6	27.1
Secondary	4.3	8.7	13.4	26.1
Tertiary	0.7	1.4	3.2	4.8
Taiwan				
No schooling	46.5	33.7	23.6	15.7
Primary	27.3	34.1	37.7	30.8
Secondary	7.9	9.8	13.0	22.3
Tertiary	1.5	1.7	2.5	3.6

Note: Primary, Secondary and Tertiary attainment refer to completed education for individuals aged 15 and over. No schooling also refers to individuals aged 15 and over

Source: Barro-Lee (2016)

Findings point towards Japan, South Korea and Taiwan as the only economies to enjoy this convenience back to the 1960s (Kuznets 1988). For instance, it is generally acknowledged that because of the low development at this time, South Korea and Taiwan educated ahead of demand (Booth 1999). Table 2.3 confirms the high educational achievements for that time for these economies. In the 1950s, South Korea already had great levels of primary education completion and a relatively low share of people without schooling. However, after the Korean Civil War the educational attainment suffered a deterioration. With respect to Taiwan, its initial levels were far from South Korea, but in the next decades it experienced a rapid catch-up. Finally, in the 1980s both countries held almost identical levels.

On the other hand, Singapore is also commonly considered representative of the model of highly populated country with low resources which relied on investment on education to achieve its rapid growth. Nevertheless, far from reality, in the 1980s the education was taught in English and Mandarin because of the influence of the British system and 85 percent of the children did not speak either of the languages at home, yielding poor results (Goh 1979). Table

2.3 shows this fact along with the improvement experienced in the following decades. Nowadays Singapore is a leading nation in terms of tertiary education (Tee Ng and Tan 2010).

The fact that Hong Kong has been a British colony until 1997, when its sovereignty returned to mainland China, altered profoundly its educational prospects (Morris and Sweeting 1991). Furthermore, as happened to its Asian counterparts, the transmission of values such as hard-work, discipline, confidence and self-reliance, sacrifice, resilience and perseverance is a result of its Confucian tradition which shaped enormously its academic performance. It is also argued that given the high reliance on market signals, Hong Kong fostered a model based on greater academic curricula (Foster 1992, Morris 1996). Consequently, Table 2.3 addresses the fast improvement of education over the four decades studied. The educational attainments in 1980 are almost identical to one of the leading countries, South Korea.

2.3.3 Innovation

Innovation is regarded as one of the core elements for a successful catch-up (Wong 1999). It drives future success, is the engine for businesses to thrive in the long-run and promotes the growth of the organizations. There are many advantages associated to an increasing base of *research and development* (R&D) capabilities. For example, innovation improves technology diffusion channels, diminishes the cost of technology transfer and allows to capture a larger amount of the spillover benefits of foreign firms (Lall 1996). Furthermore, by means of creating a technology culture, it grants greater flexibility and diversification of industrial activity. On the other hand, it cannot be overlooked that once a country starts to develop and scale the technology ladder, the requirements to keep thriving become more demanding. Hence, depending on the phase of development the countries are transitioning, the level of this capability varies. Another issue for backward countries is the difficulty of developing their own technology. Creating the necessary capabilities to improve, adapt and modify technology is very costly and it cannot be ignored that technology can also be imported. Hence, the strategies followed by the NIEs differ to a great extent.

Table 2.4 portrays two indicators related to this task, that is to say, *gross expenditure on research and development* (GERD) and USPTO patents which denotes the number of patents filed in the *United States Patent and Trademark Office* (USPTO).

Table 2.4: Measure of innovation of first-generation NIEs

Country	1963	1970	1980	1990	2000
Hong Kong					
USPTO patents	6	8	27	52	176
GERD (% GDP)	-	-	-	0.1	0.46
Singapore					
USPTO patents	0	0	3	12	218
GERD (% GDP)	-	-	-	1.00	1.82
South Korea					
USPTO patents	0	3	8	225	3,314
GERD (% GDP)	-	-	-	2.10	2.18
Taiwan					
USPTO patents	0	0	66	737	4,671
GERD (% GDP)	-	-	-	1.73	1.94

Source: U.S. Patent and Trademark Office (USPTO) and UNESCO

South Korea is an exceptional case of economic success. In the 1960s, South Korea was a poor and backward country, whose gross domestic product was below some African countries (Rodrik 1995:56). Nowadays, it can be catalogued as one of the top industrial and technological nations. Relying on the case of high technology firms such as Samsung, Kim (1997) described the steps followed by these enterprises. At first, the Korean's electronic firms purpose was replicating imported technology. The following step was upgrading their technology to be able to introduce incremental improvements in their products. Finally, in a later stage, they were able to compete with top innovation-based firms. Therefore, Kim identified different stages in the upgrading process, namely, production, investment and innovation capabilities. Table 2.4 depicts that in the decade from 1990 to 2000, South Korea consolidated as a top innovative nation.

Taiwan is also the case of a highly innovative nation and resembles in some respects to South Korea, but there are also important differences due to their divergent industrial structure and political economies (Yeh-Yun Lin and Yi-Ching Chen 2007). For example, South Korea fostered *large conglomerates* (chaebols) whereas the Taiwanese industry relied on *small and medium-sized enterprises* (SMEs). Given its high dependence on trade already in the 1950s, Taiwan started developing R&D capabilities so as to diversify its exports. Along these lines, some programs tackling science, technology, biotechnology or food technology, among others, were also implemented in the late 1970s and early 1980s (Lall 1996). As in the case of South Korea, Taiwan's R&D orientation was set early due to its export-led growth strategy along with state measures to diminish technology imports.

In the case of Hong Kong, it never adopted policies supporting technological enhancement. Hong Kong only backed SMEs up through technical support (Lall 1996). Table 2.4 displays the low relevance of both USPTO patents and GERD in its economy.

Finally, Singapore is also the case of an economy that did not focus extensively on innovation. Singapore's innovation strategy did not target local firms, but *multinational corporations* (MNCs) through R&D improvement. As Table 2.4 depicts, the number of patents in Singapore are akin to the figures in Hong Kong. However, there are considerable differences in GERD with this country, where the share of Singapore is rather similar to South Korea and Taiwan. This fact points towards Singapore's lack of individual promotion in favour of MNCs.

2.3.4 Governance and Financial System

A sound financial system will to a great extent depend on the quality of the decisions taken by the leaders of a nation. Hence, I consider that these two dimensions go hand in hand and they will be commented together. Given the difficulty to measure these two factors there is no much availability of historical data. Even though nowadays this is not a problem anymore because there are many proxies, the lack of data from the miracle period (at least I did not manage to find it) hinders presenting evidence. For that reason, the main events can only be discussed. Also, important to note that the definition of good governance is an issue itself because there are no agreements about what a trustworthy government is⁷. Thereby, in order to grasp these concepts, I will interpret them in relation to the industrial policy carried out by the NIEs. This approach is useful to know the degree of intervention of the government and the type of industries supported.

Hong-Kong is a hardly replicable model due to its strategical geographic location and its unexpected political stability. Hong-Kong possessed unique initial conditions, i.e. the existence of global trading links, strong financial and trade infrastructure and the presence of the 'Hong's' (extensive British companies). Thus, it can be affirmed that this set of unique initial conditions was the main driver of its strategy and cannot be catalogued in any of the two mainstream

⁷ Along these lines, Acemoglu and Robinson (2013) make a distinction between *inclusive* and *exclusive* institutions to distinguish them, but there is an endless debate about which parameters should be assessed when making this distinction.

schools of thought (Lall 1996). As it was argued before, the lack of selective promotion led Hong Kong to a profound deindustrialisation process. In this respect, its financial system was not only altered by the influence of selective industrial promotion, but by the fact that Hong Kong's sovereignty returned to mainland China in the year of the Asian financial crisis. However, it is considered a top 10 *International Financial Centre* (IFC) since 1900 (Meyer 2009). Since this period, Hong Kong's trade has remained robust, meaning that its financial sector has been a key aspect of its success (Goodstadt 2009).

Singapore is the example of a country which relied heavily on industrial policy. Also, Singapore always fostered the existence of MNCs. As it was stated before, in the beginning Singapore adopted import substitution for a short period, but then it embraced export-oriented industrialisation which was mainly promoted by the investment made by the MNCs. Later on, after a period of light industrial activity, there was an improvement of the industrial structure from the side of the government. The government also implemented a set of crucial measures: it led MNCs to greater value-added activities, promoted the creation of the specific skills required, and established public enterprises to develop activities favouring the country's interests.

South Korea focused thoroughly in the development of advanced and heavy industry. The strategy followed by South Korea to acquire technology was based on capital-goods imports, agreements on technology-transfer and technology licensing (Westphal 1990). It applied reverse engineering and own-product development to augment its capabilities (Lall 1996). A key concept in South Korea's technological strategy was the creation of enormous private conglomerates known as *chaebol* (Chang 1988). These conglomerates were thoroughly selected from prosperous exporters and were helped through subsidies and privileges. Given the prospects of inefficiency on capital, skills, infrastructure and technology markets, these conglomerates were created (Campbell II and Keys 2002). The advantages associated to the chaebols were mainly: the ability to absorb expensive and advanced technology without being dependent on FDI, the capacity of developing fast through their own R&D and the creation of their own distribution networks and brands (Chang 1988). This strategy worked because of the discipline displayed by the government in terms of export performance and dynamic domestic competition. Moreover, it also has to be stressed the role of the government building an extraordinary technology infrastructure besides the creation of global and technical capabilities among its population.

Finally, the industrial policy carried out by Taiwan focused on: protection of imports, directed credit, selective FDI, intensive export promotion and development of domestic skills and technology (Rodrik 1995). In spite of resembling the South Korean case in many aspects, there are some crucial differences. Taiwan neither focused extensively on heavy industry, nor did it promote private conglomerates. On the contrary, Taiwan's industry is mainly compounded of *small and medium-sized enterprises* (SMEs) (Yeh-Yun Lin and Yi-Ching Chen 2007). Therefore, by considering in terms of technology the weak points of SMEs, the government took part improving their technology with a set of incentives and institutional measures (Lall 1996).

After a thorough analysis of the main factors claimed by the mainstream schools of thought, it can doubtlessly be affirmed that the Asian tigers implemented very different development strategies even though they industrialised at the same point in time. On the other hand, it may be argued that the most important factor favouring their industrialisation process was the propitious international context after World War Two. However, how can the fast recovery from both the financial crisis of 1997 and the world crisis of 2000s be explained?

The combination of high sustained growth rates together with their different initial conditions and development schemes, motivate this research. In particular, I hypothesize about the existence of some underlying factors which are directly linked to the extraordinary achievements of the tigers. For example, it may be the case that the kind of autocratic but efficient governance present in these nations is bound to economic growth or that their above average education for the time was especially positive.

To assess this hypothesis, I will base my empirical analysis on the methodology applied by Fagerberg and Shrolec (2008), that is to say, factor analysis. Given the heterogeneity of the tigers, factor analysis permits summarising the main dimensions aforementioned. Because this method only provides correlations, I will also implement an econometric analysis based on OLS and fixed effects to account for the relation between growth (measured as GDP per capita) and the factors retained. The results will not be causal, but intriguing insights about the uniqueness of these economies may be extracted.

3 Data and Methodological Approach

3.1 Data description, limitations and sources

In order to carry out the factor analysis, data on the dimensions previously argued are needed. The main sources from which data were extracted are: World Bank (2017), UNESCO (2016), Barro and Lee (2016), Kaufmann et al. (2014), Institute for Management Development (IMD) and FRED (2017). Given that World Development Indicators (2017), a database belonging to the World Bank, was the most used source and it does not include data on Taiwan, national sources for this country were used extensively (National Statistics, ROC (Taiwan), Ministry of Economic Affairs, ROC and Central Bank of the Republic of China (Taiwan)). Note that the Appendix encompasses the definitions of each variable, the period of time covered, the units of measure for each of them and the source from which they were extracted.

The time span covered starts in the aftermath of the Asian financial crisis until nowadays, namely, from 2000 to 2016 in an annual basis. I constructed a panel covering all the dimensions argued for the four tigers through the inclusion of 20 variables (see below). All the data included are quantitative and can be considered highly reliable because they mostly come from direct evidence. It has to be stressed that some of the variables related to the dimensions of governance and financial system are based on estimates (e.g. rule of law or financial freedom), but they come from trustworthy sources such as the World Bank. I also consider that my data is representative because the variables do not give rise to unclear interpretations. For example, survey data are more prone to be biased (Deaton 1985). The majority of my variables are macroeconomic indicators which adjust accurately to the reality. Finally, my data can be considered valid because they are relevant for my case study and also are backed up by previous research (Fagerberg and Shrolec 2005, 2008 and 2017).

Some flaws have to be discussed as well. First, as I will explain below, there are some aspects, such as trust or tolerance, which cannot be measured and would be interesting to include in the analysis. Second, some of the variables are not totally precise for the purpose of measuring the specific dimensions. Some of the proxies and indicators will therefore be unable to capture all

the nuances expressed in the definition of social capability stated by Abramovitz (1986). Table 3.1 renders the dimensions previously discussed, the indicators used to measure them and the type of capability in which these dimensions can be catalogued (according to the theory previously explained).

Table 3.1: Measuring capabilities

Dimension	Measure	Capability
Innovation	GERD, Patent Applications from Residents, USPTO Patent Application	Technological
Openness	Trade, Exports of Goods and Services, FDI Inflows	Technological
Financial System	Regulatory Quality, Investment Freedom, Business Freedom, Financial Freedom, Capitalization of listed companies	Technological and Social
Education	Average Years of Schooling, Average Years of Tertiary Schooling, Tertiary Education Attainment	Technological and Social
Governance	Rule of Law, Law and Order, Bureaucracy Effectiveness, Press Freedom Index, Civil Liberties, Corruption Perception Index	Social

Source: See Appendix

The concept of technological capability refers to the capacity to create and use knowledge commercially. An important facet of this capability lies in innovation, concept that Kim (1997) coined as *innovation capability*. There are different sources of data capturing diverse aspects of this feature. For instance, a representative indicator is *gross expenditure on R&D* (GERD) because it takes into account some of the resources used for creating new products. On the other hand, both *patent applications from residents* and *USPTO patent application* are good proxies for the outcomes of the investments made by the government as well as for the incentives that the population have to develop new technologies. In absence of well defined property rights, people will not have any incentive to use their resources to invent (Helpman 1992). However, it also has to be considered that patent counts are not a totally accurate measure because not all the inventions will be patented. These three measures can be considered relevant proxies for the purpose of approaching innovation, but they only depict a partial measure of the dimension of innovation. For instance, it would have been interesting the inclusion of alternative variables such as firms' ability to innovate, but I did not find data on the matter. *Production capability* is another important element of technological capability (Kim 1997). It refers to quality standards and to the conditions needed to supply high-quality products, and it is devised as an important element to catch-up. Unfortunately, the access to the data was not free.

Openness is also considered within technological capability scope because the commercial interactions among nations foster technology transfers and innovation. In this case, I have chosen some indicators based on previous research by Fagerberg and Srholec (2008), in particular, trade, exports of goods and services and FDI inflows, which capture this dimension accurately. As it has been argued before, these indicators were directly pointed by the MF approach and are closely linked to the widely accepted concept of export-led growth.

Already in 1962 Alexander Gerschenkron highlighted that a sound financial system is necessary for catching-up. Given that in the previous section I argued that financial system and governance go hand in hand, I have proxied this facet through the inclusion of four indicators related to the required freedoms to thrive, namely, regulatory quality, investment freedom, business freedom and financial freedom. It is to be noted that all of them are to a certain extent subjective measures and therefore subject to measurement error. As Fagerberg and Srholec (2008) did, I have also included the variable *market capitalization of listed companies* which is an interesting indicator accounting for the value of the domestic companies. Moreover, variables such as amount of credit would have captured different sides of this dimension, but I did not find data. Financial system will be considered a mixture of social and technological capability because both Abramovitz (1986) and Kim (1997) included financial factors in their respective definitions of capability.

Directly related to the field of innovation is the education dimension, which covers a mixture between technological and social capabilities since without skilled population technology cannot be used efficiently. As I discussed before, notwithstanding the myth generated around the excellent educational standards of the four tigers. It can be affirmed that their educational attainment was above the world's average and nowadays they are some of the best educated economies in the world. Hence, basic educational parameters such as literacy are not included in the analysis. The variables included portray the high quality of the educational system of a country. I opted for the inclusion of: average years of schooling, average years of tertiary schooling and tertiary educational attainment. I consider that in this case these indicators are able to capture precisely the level of skills of these economies.

Finally, the last element taken into account is quality of governance. There is a consensus between the different schools of thought that the type of governance displayed by the tigers was opposite in many ways to the Western democratic principles (World Bank 1993, Rodrik 1995). As an example, their market was not ruled by neoclassical principles such as the reliance on

free markets and the absence of intervention in the economy. Another key factor depicting the ideological divergence between Western and Asian idiosyncrasies is the management of industrial policy. As a result, Asian regimes are not known for the preponderance of freedom. An additional important feature of the region is the absence of crime due to the strict policies implemented. To approach all these characteristics, I considered relevant the inclusion of variables encompassing *law enforcement* (rule of law, and law and order), *civil liberties* (press freedom index, civil liberties, and corruption perception index), and *transparency* (bureaucracy effectiveness). Given its marked social dimension, quality of governance belongs to social capability.

3.2 Methodology

I will replicate the methodology applied by Fagerberg and Srholec (2008), i.e. factor analysis along with a set of regressions involving the factors retained with the previous technique. With the former I will be able to find correlations and spot the main factors which represent these nations, whereas with the latter, even though the results will not be causal, some important insights about the uniqueness of these economies may be extracted. First, I will explain in detail factor analysis and, afterwards, I will present the different regressions that I will perform.

3.2.1 Summarising the data: Factor Analysis

Given the ample number of dimensions studied, the final set of variables is very wide and hence full of information to exploit. Nevertheless, to carry out an economic analysis all the variables would not be necessary given that they represent slightly variations of the same aspect, and therefore tend to be highly correlated (with the subsequent problem of multicollinearity). For that reason, the main challenge to implement the empirical analysis is organizing the information in such a way that a clear-cut economic interpretation can be provided.

To solve this issue, we will rely on the methodology first applied to the field of development by Adleman and Morris (1965), which relies on a multivariate analysis known as *factor analysis*. This method exploits the idea that factors connected to the same dimension tend to be highly correlated. Based on this insight, the complexity of the data can be reduced to create a

set of uncorrelated composite variables, which will express a concrete dimension of the variance of the data.

If the variables show ample correlation (fact that can be assessed with the *Kaiser's rule* or the *scree plot* technique), factor analysis will result on a reduced number of factors that capture a large degree of the variance. The first step consists of creating a matrix of correlations of the variables. With this information, a vector which explains a great proportion of the variance of the matrix can be extracted. This stage is repeated until the vector cannot capture a higher amount of variance than the one expressed by a variable itself. As a result of the iterations, the output is a set of latent indicators which are linear combinations of the original variables.

The biggest issue of this methodology is interpreting the factors retained. To carry out that task, the main strategy is studying the correlations linked to the initial group of variables, i.e. the *factor loadings*. Factor loadings display the amount of the total variance of an initial variable which is explained by this new composite factor, being the first factor the one explaining the highest amount of the variance (followed by the second, then the third, and so on). The problem is that because of the high proportion of variance explained, the first factor is correlated with a high number of the variables included in the initial set, fact that makes it difficult to interpret. To account for this issue, one possible solution is rotating the output obtained. The purpose of this technique is maximizing the difference of the loading of the initial variables across the set of factors extracted. With the rotation, it is to be expected that only a few variables will be loading high, with the subsequent simplification of the interpretation. After this step, the *factor scores coefficients* (the weights adopted to compute the composite indicators) are also provided.

Note that an issue has to be tackled before implementing factor analysis. The highly diverging scales of some of the variables included may pose a problem. For that reason, a standardization of the original indicators has to be done. On the other hand, Fagerberg and Shrolec (2005) also discuss that the variables have to be similarly distributed among the countries, i.e. without big variations due to the inclusion of rich and poor countries. Given that my sample consists of similar countries in terms of economic performance, I do not have this problem. Finally, the presence of outliers has to be addressed. In principle after reviewing my dataset this is not a problem, but to rule out any possible doubt a specific regression technique will be used (see below).

3.2.2 Empirical Model: Evaluating the growth of the Tigers

After executing the factor analysis, a set of regressions will be implemented to assess the relation between the factors retained and growth. The factors retained will represent the dimensions previously stated and therefore we will be able to relate them with growth (which will be portrayed by GDP per capita) and see which is more important to understand the recovery of the tigers in the aftermath of the Asian financial crisis. In order to check the consistency of the analysis carried out, three different types of regression will be proposed.

Regression 1: Pooled OLS

$$GDPpc = \beta_1 * D_1 + \beta_2 * D_2 + \dots + \beta_n * D_n + u$$

Note: D_n stands for any of the dimensions identified.

First of all, the simplest specification will consist of a basic OLS regression taking account of the relation between the factors obtained from factor analysis and GDP per capita. To avoid a problem of exact multicollinearity the constant will be removed from the equation. Moreover, there is also the possibility of committing simultaneity bias⁸ and therefore having a problem of endogeneity. For that reason, my simplest specification will only determine the baseline. I will use the subsequent regressions as robustness check to assess the consistency of the results.

Regression 2: Iteratively Re-weighted Least Squares

$$GDPpc = \beta_0 + \beta_1 * D_1 + \beta_2 * D_2 + \dots + \beta_n * D_n + v$$

For the second specification I will use iteratively reweighted least squares. This estimation technique is used as a robustness check and consists of attributing a weight to each observation. It is normally used to control for outliers given that it assigns lower values to them. By means of using this technique we can test the composition of the sample to rule out the existence of outliers. Note that method allows the inclusion of the constant without committing a problem of multicollinearity. However, the reverse causality problem is still an issue to be considered.

⁸ The explanatory variables (dimensions) are jointly determined with the dependent variable (GDP per capita).

Regression 3: Fixed Effects

$$GDPpc_{it} = \alpha + \beta * D_{it} + \xi_{it}$$

Finally, given that I am hypothesizing the existence of some underlying factors which explain the outstanding performance of the tigers and that I count on panel data, I consider intriguing the inclusion of a fixed effects model which I also will consider as my preferred specification. This approach will provide another robustness check to account for the relation between the dimensions aforementioned and growth.

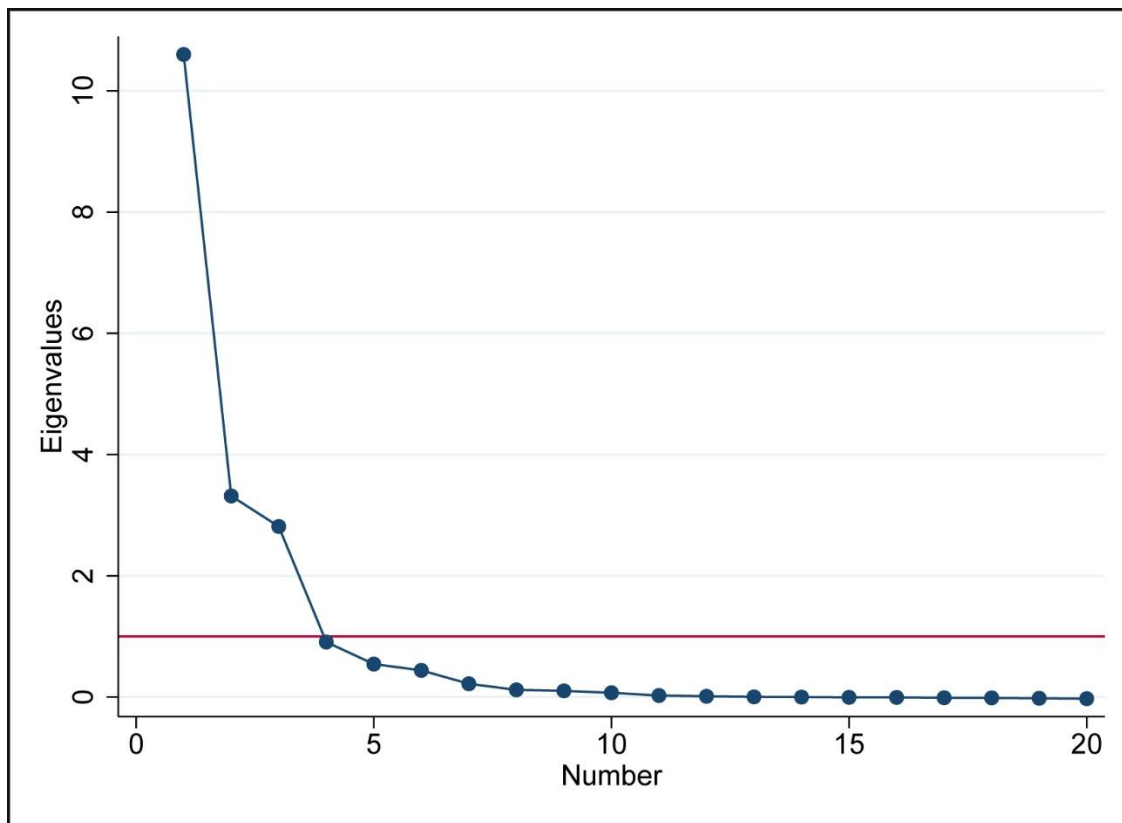
4 Empirical Analysis

4.1 Factor Analysis: Identifying National Capabilities

Relying on the scree plot technique, 3 factors accounting for 88 percent of the total variance of the data have been retained⁹ (see Figure 4). Note that there is one factor for each of the variables included in our dataset. Thus, accounting for almost 90 percent of the total variance with only 3 factors, points towards the high correlation among the indicators and the validity of the technique.

⁹ In order to be retained, the eigenvalue of the factors has to be >1 . The red line draws the threshold of rejection, i.e. only those factors above this threshold will be kept.

Figure 4.1: Scree plot



Source: Own creation

Table 4.1 displays the loadings of the indicators on the factors after rotating them¹⁰. As I argued before, the loadings represent the existent correlation between the variables and the factors. Hence, by means of using this technique, I will only be able to capture the dimensions previously claimed and to see the main common characteristics among the Asian tigers. Note that in this specific case the indicators loading negatively do not have a clear-cut economic interpretation and therefore will not be commented.

¹⁰ “Varimax” rotation assumes that the underlying factors are totally uncorrelated whereas “oblique” rotation does not make this strict assumption. For that reason, I have opted for the latter.

Table 4.1: Results of factor analysis

	Openness & Finance	Governance	Innovation System
GERD (% of GDP)	-0.80	0.30	0.55
Patent Application from residents (Total)	-0.56	-0.24	0.58
USPTO Patent Application (Total)	-0.56	-0.21	0.49
Average Years of Schooling (Total)	0.17	-0.60	0.71
Average Years of Tertiary Schooling	-0.22	0.18	0.90
Tertiary Education Attainment (% gross)	0.12	0.26	0.88
Trade (% of GDP)	0.84	0.25	-0.12
Exports of Goods and Services (% of GDP)	0.79	0.34	-0.09
FDI Inflows (% of GDP)	0.92	-0.11	-0.06
Law and Order	0.24	0.32	0.29
Bureaucracy Effectiveness	0.02	0.99	0.09
Press Freedom Index	0.20	0.89	0.23
Civil Liberties	0.15	0.88	0.07
Corruption Perception Index	0.64	0.51	-0.12
Rule of Law	0.80	0.29	0.12
Regulatory Quality	0.84	0.25	-0.05
Investment Freedom	0.88	0.01	0.04
Business Freedom	0.69	0.25	0.25
Financial Freedom	0.93	-0.43	0.15
Capitalization of listed companies (% GDP)	0.14	-0.75	0.50

Note: 3 factors with eigenvalue >1 are retained, which explain 88.0% of total variance of the dataset; rotation: oblimin oblique. Number of observations 68.

Source: See Appendix

The initial factor (the one accounting for the highest proportion of the variance in the data set and therefore the most representative of these countries) loads highly on indicators related to *openness* (trade, exports of goods and services and FDI inflows) and *financial environment* (regulatory quality, investment freedom, business freedom, financial freedom). Moreover, to a lesser extent, it is also linked to *governance* through corruption perception index and rule of law. Both openness and financial environment were two of the main prescriptions made by the MF approach, and, as it can be assessed with the factor analysis, these two measures are also representative of the four tigers. Given the existent correlations with these two dimensions, this factor will be called ‘*Openness & Finance*’. Note that related to financial system, the only variable purely accounting for the economic value of the firms (capitalization of listed firms) correlates weakly with the first factor. It may be because the indicators included are principally capturing the aspect of freedom. This is an example depicting the difficult task of including all the nuances of a dimension.

The second factor loads especially high on variables related to *governance*, that is to say, bureaucracy effectiveness, press freedom index, civil liberties and corruption perception index. It has already been widely discussed the existent disparity between the Asian and the Western governance principles (Wade 1990, World Bank 1993), but there is no doubt about the efficiency of the Asian regimes (Rodrik 1995, Stiglitz 1996). This factor will be labelled '*Governance*'.

Finally, the last factor correlates highly with the variables representing the dimension of *education* (average years of schooling, average years of tertiary schooling and tertiary education attainment), and to a lesser extent with the indicators related to *innovation* (GERD, patent application from residents and USPTO patent application). Edquist (2004) describes an *innovation system* as a measurement of the capabilities making an impact on the way in which innovations are used, developed, and diffused. This definition can be interpreted as a mixture between education and innovation because both of them are closely intertwined. Consequently, I will identify my last factor as '*Innovation System*'.

Therefore, the Asian tigers are mainly represented by the dimension of '*Openness & Finance*', followed by '*Governance*', and, in last place, by '*Innovation System*'.

4.2 National Capabilities and Growth: assessing the relationship

The analysis implemented in the previous section simply states correlations between the factors retained and the countries evaluated. For that reason, there may be more complex connections which cannot be spotted at a glance. In order to identify them, I will carry out a multivariate econometric analysis using the factors identified before and the level of growth (characterised by the GDP per capita). With this method the main sources of growth will be detected, but causality cannot be established.

Table 4.2 presents the different econometric methods applied. Model (1) represents the baseline model, a pooled OLS regression. Model (2) renders iteratively re-weighted least squares, a robust regression technique to control for possible outliers and to reassert the link established by the first model. Note that both model (1) and (2) will not account for a causal result due to a problem of simultaneity bias. Finally, model (3) depicts fixed effects. This specification will

provide valuable insights about the countries and also will be a robustness check. Furthermore, given that my initial hypothesis lies on the existence of some underlying factors explaining the remarkable performance of the tigers, this model can make a valuable approach through focusing on the inherent characteristics of the economies evaluated.

Table 4.2: Regression results

Estimation Method	(1) OLS	(2) Iteratively re-weighted least squares	(3) Fixed Effects
Constant	-	0.05 (1.77)	0.01 (0.00)
Openness and Finance	0.56*** (21.36)	0.56*** (15.93)	0.69*** (3.81)
Governance	0.58*** (11.12)	0.67*** (21.16)	-0.80*** (3.79)
Innovation System	0.32*** (9.16)	0.29*** (8.33)	0.31*** (6.24)
F	267.17	411.68	83.68
R ²	0.92	-	0.80
Observations	68	68	68

Note: dependent variable is GDP per capita (constant 2010 US\$). Absolute values of robust t-statistics in brackets; (*, **, ***) stand for significance at the 10%, 5% and 1% levels. Standardized variables were used for the estimations (coefficients reported).

Source: Based on the factors retained with factor analysis.

The first intriguing result is that in every specification *Governance* is the most important factor accounting for growth whereas *Openness & Finance* was the factor explaining more variability of the data in the factor analysis implemented before. However, factor analysis was only capturing the correlations between the variables representing the countries, and these regressions show a different aspect which is the relation between the dimensions claimed by the literature and growth.

In every regression, the three dimensions captured are significative at 1 percent level and the size of the coefficients is very similar. It has to be noted that the baseline specification, the first model, presents a clear problem of endogeneity displayed by its R² of 0.92. However, for the purpose of this thesis we are only interested in assessing the relevance of these factors. Models (1) and (2) show the same dynamic with their results going in the same direction. This fact corroborates the relation of the dimensions claimed by the literature with growth. Moreover, in these two specifications, *Governance* is the most important factor, followed by *Openness & Finance* and *Innovation System*. This result indicates that despite education and innovation were crucial for the catch-up process of the 1960s, nowadays they are not anymore the main factors accounting for the success of these economies. On the contrary, the clear export orientation, their sound financial systems and the type of government displayed are the key aspects to

understand their remarkable performance and the fast recovery in the aftermath of the Asian crisis of 1997.

Nevertheless, specification (3) yields a result challenging all the previously stated. Notwithstanding the fact that the three dimensions rank in the same position (relying on the coefficients), in this case, *Governance* displays a clear negative relation with growth. This evidence indicates that the kind of government present in the tigers could be hindering their growth. However, this result has to be approached cautiously.

On the one hand, the variables defining government (rule of law, law and order, bureaucracy effectiveness, press freedom index, civil liberties and corruption perception index) do not provide a full picture. First of all, these measures are based on subjective opinions. Even though they come from quality sources such as the World Bank, in particular, these measures are based on the opinion of experts but are still subject to measurement problems. Second, the way in which the variables are captured also bias the results. For example, in the factor analysis implemented by Fagerberg and Srholec (2008), they find no link between property rights and innovation system, when clearly these variables should be vastly correlated. The absence of incentives to invest would discourage innovation (Helpman 1992). However, in the same analysis, they find a clear link between ISO 9000 certifications (an indirect measure of property rights specific to technology) and innovation system. This fact discloses the difficult task of capturing all the nuances of the factors retained. Third, with respect to the dimension of governance, there are variables which would have been interesting to include in my analysis such as *impartial courts* or *informal market*, but I did not find data on them. For example, accounting for the informality of the market is rather difficult and subject to important measurement problems. Fourth, I have discussed extensively the pattern of governance in the Asia-Pacific region in a historic perspective, but it should be reminded that the period tackled in this thesis is from 2000 to 2016. The kind of governance displayed by the Asian tigers was to a great extent autocratic in the 1960s, but nowadays they rank much higher on these indicators. Fact that highlights the deep changes that governance in Asia has experimented. Only some results such as press freedom index in Singapore display that they still lack some basic freedoms (according to the data I got). Not trying to downplay the importance of these liberties, the Asian tigers are for instance excellent performers on dimensions such as law and order, bureaucracy effectiveness or rule of law. Fifth, the nations under study have approached to a more democratic path of governance but this new pattern may be related to worse economic

performance. Hence, is this backing up the idea that Asia, exemplified by the case of the tigers, should keep displaying the type of government based on state *dirigisme*? Sixth, finally it also has to be considered that indicators measuring governance are not objective by creation because from its inception they are assuming what “good” governance is. To some extent relying on the propositions stated by Veblen (1898), this would be a *tautological* approach, in which the prefixed mindset alters the outcomes obtained. In this respect, governance understood from a Western point of view would be the goal itself and not the result of a changing cultural paradigm.

On the other hand, it can also be argued that the government displayed by the tigers is not yielding positive results for the recovery from the crisis. It may be the case that once the tigers reached high development standards the pattern of autocratic governance is not useful anymore. The reason could be that a more inclusive type of government is more flexible to introduce new policies to foster the recovery from the crisis. For example, democracy allows people to substitute the government and find new solutions to the economic challenges (Acemoglu and Robinson 2016).

The results establish a clear link between the three dimensions captured and economic growth in the aftermath of the Asian crisis. All the regressions implemented yield the same results and point towards the importance of governance as the main catalyst of growth in the early history of these nations. A strong innovation system along with a sound financial environment and export-led growth seem to be of crucial importance. Nonetheless, the key aspect seems to be governance, but the results point in both directions. Specifications (1) and (2) praise the approach made by these countries whereas model (3) claims against it. This finding contributes to the debate by pointing out that the government shown by the Asia-Pacific region, represented by its industrial policy, was useful when these countries were industrializing, but it may be the case that nowadays it is not that efficient anymore.

5 Conclusion

In the present work I have evaluated the outstanding growth pattern shown by the four Asian tigers. Despite two consecutive crises (the financial crisis from 1997 and the world crisis from 2000s) these countries have managed to recover and enter the path of growth again. How can this be explained? I hypothesized that the same factors associated to the extraordinary development of the region in the 1960s were also crucial to explain the rapid recovery of these economies.

My findings are inconclusive. On the one hand, through the use of a pooled OLS model I find that governance is the most important factor to understand the recovery followed by openness and finance and innovation system, all of them being highly significant. Moreover, by using iteratively re-weighted least squares it is revealed that the findings are the same as with OLS. This lends credibility to the first specification. On the other hand, by using fixed effects, governance is still the most important factor, but in this case the model yields a negative sign. Even if this may be because of some issues with the indicators, I defend that the most possible explanation is that autocratic governments in the region have not adapted properly to the new context. It may be argued that this type of governance is useful when the countries are starting their industrialisation process, but once they have reached a certain standard this type of government is obsolete and incapable to carry out the policies needed to face the crisis. I suggest that the absence of flexibility along with the impossibility of easy political turnover may be the main issues giving rise to this outcome. Instead openness and finance seem to be the most important factors determining the process of overcoming the economic crisis.

Further research may be important to tackle this new and enticing result of governance having a drag-down effect on the economic improvement and examine the background elements leading to this result. This could have an astounding policy implication because a new development model could appear. However, it has to be taken into account that international context matters as shown also by the aftermath of World War Two, the Bretton Woods agreements and the take-off of the tigers. Based on the evidence provided by this thesis, spotting the right interaction of internal factors and international context will be essential to determine

the right mix of policies to be implemented that will allow the tigers to keep roaring in the next decades.

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Appendix A

Table A.1: Definition and Source of Variables

Indicator and definition	Scaling	Source
Gross Expenditure on R&D (GERD): total (public and private) expenditure on R&D performed on the national territory	% of GDP	World Bank (World Development Indicators)
Patent Applications from Residents: worldwide patent applications completed through Patent Cooperation Treaty procedure	Total	World Bank (World Development Indicators)
USPTO Patent Application: Number of patents granted by the U.S. Patent and Trademark Office (USPTO)	Total	U.S. Patent and Trademark Office (USPTO)
Trade: Exports plus imports divided by GDP	% of GDP	Federal Reserve Bank of St. Louis (FRED)
Exports of Goods and Services: value of all goods and other market services provided to the rest of the world	% of GDP	World Bank (World Development Indicators)
FDI Inflows: direct investment equity flows in the reporting economy (sum of equity capital, reinvestment of earnings and other capital)	% of GDP	World Bank (World Development Indicators)
Regulatory Quality: Easiness or difficultness of opening a business	Index	Heritage Foundation (Index of Economic Freedom)
Investment Freedom: assessment of the constraints on the flow of investment capital	Index	Heritage Foundation (Index of Economic Freedom)
Business Freedom: assessment of the efficiency displayed by the government regulating businesses	Index	Heritage Foundation (Index of Economic Freedom)
Financial Freedom: assessment of banking efficiency and measurement of independence from government control	Index	Heritage Foundation (Index of Economic Freedom)
Market Capitalization of Listed Companies: Market value of domestic companies listed on the stock exchange of the countries	% of GDP	IMD World Competitiveness
Average Years of Schooling: average years of schooling for people aged 15 and over.	%	Barro and Lee
Average Years of Tertiary Schooling: average years of tertiary schooling for people aged 15 and over	%	Barro and Lee

Note: all the variables depict the period 2000 – 2016.

Table A.1 (Continued)

Indicator and definition	Scaling	Source
Tertiary Education Attainment: people aged 25 and over whose highest schooling level attained is tertiary	%	Barro and Lee
Rule of Law: perceptions of the scope to which agents trust the rules of society (contract enforcement, property rights, the police and the courts)	Index	World Bank (Worldwide Governance Indicators)
Law and Order: the degree to which the citizens are willing to accept the institutions of their countries, make and implement laws and adjudicate disputes.	Index	PRS Group
Bureaucracy Effectiveness: an assessment of the strength of the institutions and the quality of the bureaucracy	Index	PRS Group
Press Freedom Index: Reporters Without Borders assessment of the freedom of press	Index	Reporters Without Borders
Civil Liberties: the degree of freedoms of expression and belief, associational rights, rule of law, and personal autonomy without state's interference	Index	Freedom House
Corruption Perception Index: people's perception of corruption of their governments	Index	Transparency International

Note: all the variables depict the period 2000 – 2016.