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# THE EXTRAORDINARY GROWTH OF THE FOUR ASIAN TIGERS

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Academic Year 2014/2015

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## **Introduction**

This dissertation explores the determinants of economic growth. More specifically, it believes economic growth to be the result of the interrelation of several variables. In the second half of the 20<sup>th</sup> century, many developing countries have started to progress in their economic performance. The countries that grew the most and became the examples of an extraordinary growth process are the Four Asian Tigers, or Dragons, namely Hong Kong, Singapore, South Korea and Taiwan.

The aim of the paper is to investigate the drivers of economic growth, which some economists have identified to be factors accumulation, while others believe the countries' characteristics, as institutions and economic policies, to be the factors that mostly favour or impede countries' development. Indeed, the Four Tigers' governments have strongly supported and emphasized the investments toward physical and human capital in order to promote growth. However, the role of the government in the economic life of the countries has been fundamental, particularly with respect to the degree of openness in each of the Asian country.

The first chapter explores economic growth from a theoretical perspective. It derives the underlying assumptions by considering a major tool used in economic growth analysis, that is the production function. It then proceeds by addressing one by one the determinants of economic development, from the more "technical ones" as physical capital, labor and productivity to factors such as geography, government and institutions.

The second chapter evolves around the development of the Four Asian Tigers. In particular, it firstly highlights the historical distinction between the countries, and it subsequently proceeds with the analysis of those factors that have favoured such an extraordinary performance. Moreover, it explores the role of the Government as a promoter for education, it considers the debate concerning the effect of Confucianism on the economic lives of the Four Asian Tigers, and, finally, it addresses the degree of Openness in the various countries by taking into account the export-oriented strategies and the inflows of Foreign Direct Investments.

The third and final chapter provides an empirical analysis of the drivers of economic growth. It consists of a non-linear regression model with country and time fixed effects. It allows to control for unobserved variables and therefore avoid omitted variable bias estimations.

# 1. The Economic Growth

## 1.1 Definition

Economic growth is a macroeconomic phenomenon that explains the remarkable differences in income and standards of living across countries. It is fundamental in order to address issues concerning differences in the speed of growth and the level of poverty across countries. The unit of measurement for determining economic growth is the national GDP, “*which is a measure of the value of all of the goods and services produced in a country in a year*”.<sup>1</sup> The GDP can be estimated both from the production side and the income side. The former concerns the calculation as the sum of the value of the final goods and services produced in the economy or as the sum of the value added of all firms, “*which is defined as the value of its production minus the value of the intermediate goods used in production*”.<sup>2</sup> The latter instead considers GDP as the sum of incomes in the economy. To avoid the effects of the overall increase in prices, namely inflation, and to effectively measure its growth, the national GDP is calculated in real terms,

$$Y = \frac{NY}{P} \quad (1.1)$$

that consists of dividing nominal output by the price level of the pre-established base year.

In addition, it is possible to compare the different living standards across countries and their relative currencies with the use of purchasing power parity exchange rates.

Finally, the use of output per capita,  $\frac{Y}{N}$ , which involves the division of real output by the size of the population in a country, gives more reliable results when measuring economic progress and comparing different incomes. The importance of output per capita relies on the fact that it allows to derive differences in living standards, the soul of human happiness.

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<sup>1</sup> David N. Weil, “Economic Growth”, Pearson, Third Edition

<sup>2</sup> Blanchard Olivier, Amighini Alessia, Giavazzi Francesco, “Macroeconomics, a European perspective”, Prentice Hill

The rate of growth is fundamental for adequately investigate how fast output per capita is rising. Moreover, it is the variable that determines divergence across countries. The discrete calculation of growth rates enables to determine by how much output per capita increases every year, therefore

$$g = \frac{(Y_t) - (Y_{t-1})}{Y_{t-1}} \quad (1.2)$$

A continuous calculation consists of estimating the average growth rate by taking the difference of the natural logarithm of output in the latest year minus the logarithm of output in the first year, divided by the number of years,

$$g = \frac{\ln(Y_T) - \ln(Y_0)}{T} \quad (1.3)$$

The higher the growth rate of a country the faster it will converge to a state characterized by a greater level of income.

## *1.2 Physical Capital and Labor*

Physical capital plays a major role in the determination of disparities between countries, since higher levels of capital enable workers to be more productive. The availability of physical capital is responsible for increasing productivity and thus output in the economy.

One of the most used tools in economic growth is the aggregate production function,  $Y = F(K, L)$ , where  $F$  represents the productivity of the two implied inputs, capital ( $K$ ) and labor ( $L$ ). The three possible ways through which increase output are increasing capital, increasing labor or changing the function  $F$ .

The production function depends upon two assumptions:

1. The production function has constant return to scale.
2. The marginal productivities of Capital and Labor are both positive and diminishing.

The production function considered in this paper that entails the above assumptions is the Cobb-Douglas

$$Y = AK^\alpha L^{1-\alpha} \quad (1.4)$$

where  $A$  indicates the productivity of the inputs that are neither  $K$  nor  $L$ , and the parameter  $\alpha$ , which is assumed to have a value between 0 and 1, defines the combination of capital and labor involved in the production of output,  $Y$ .

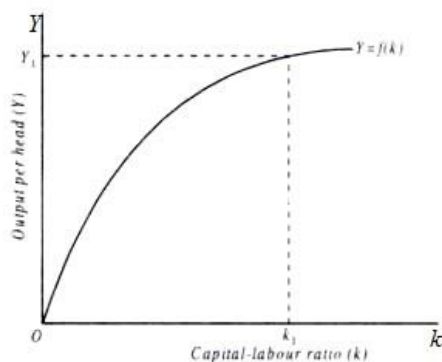
By taking the first derivative with respect to capital and labor, the resulting marginal productivities are positive:

$$MPK = \frac{dY}{dK} = \alpha Ak^{\alpha-1} \quad \text{and} \quad MPL = \frac{dY}{dL} = (1 - \alpha)Ak^\alpha \quad (1.5)$$

In Equation (1.5),  $k$  stands for the capital labor ratio  $\frac{K}{L}$ .

The second derivative of each of the marginal productivities is negative, which conveys the idea of decreasing returns to capital and to labor.

Figure 1. *The effect of the capital labor ratio on output*



Source: Supriya Guru, "Neoclassical Theory of Economic Growth"

Indeed, what can be inferred from the graph is that as the capital labor ratio increases, the marginal returns of output become smaller and smaller.

After having examined the main implications of the production function, it is important to analyze which are the drivers of economic growth. The first reasoning concerns the dynamics of capital accumulation, firstly addressed by Robert Solow in 1956. Through the development of subsequent theories, the role of capital accumulation as the *engine of growth* was abandoned and the concept of productivity and its components emerged in economic growth analysis.

### *1.3 Savings, Capital Accumulation and Output*

The Solow model considers capital deepening, the increase in capital relative to labor, as the primary engine of economic growth. The model refers to a closed economy characterized by the relation of savings equal to investments, and a constant returns to scale production function. Moreover, it assumes that there are two kinds of depreciations for the capital labor ratio, physical and by growing population. The rate of depreciation in the economy is  $\delta$ . In addition, savings, which range from 0 to 1, are proportional to income,

$$S = sY = sF(K, L) \quad (1.6)$$

which implies that investments are also proportional to income. Finally, the model assumes that population grows at a rate  $n$ .

The Solow model predicts that in the long-run, countries will converge to a steady state where savings or investments equal deprecation. In the case of the Cobb-Douglas production function, the steady state is reached when  $sAk^\alpha = nk$ .

On the one hand, the model explains a sort of convergence between countries; indeed, capital deepening depends on savings; therefore the higher the level of savings, the higher the steady state of output per capita in the country. Moreover, what the model claims is that the closer a country is to the steady state the slower is its growth, where closeness depends on the initial level of capital in a country.

On the other hand, the model fails in the determination of the long-run sustained output per worker. Indeed, when the country reaches its steady state, capital per worker and output per worker no longer grow. Because of decreasing marginal productivity of capital, each year a larger fraction of output should be saved and channeled to capital deepening in order to sustain and permit economic growth. However, there is a threshold where the fraction of savings needed for the production will be higher than 1. The reason is that capital per worker is constant in the long run, thus output per worker must be constant too. The model fails to establish how an economy can sustain a positive rate of growth forever. Hence, a closed economy with the peculiarity of savings equal to investment, is to be considered a barrier to growth.



The assumption of savings equal to investments holds the main issues of the model. Indeed, it concerns the idea of reverse causality. If savings, which are strictly related to the level of income per capita, are treated as an endogenous variable, the effectiveness of the Solow model is limited. The straightforward reasoning is that countries that are rich will save more, while countries that are poor cannot afford to save and will therefore face more difficulties in developing.

The failures of the Solow model are overcome by considering the open economy, where investments do no longer depend entirely on savings as they can be financed by borrowing from abroad. Indeed output in the open economy is calculated as

$$Y = C + G + I + EX - IM \quad (1.7)$$

from which it follows that investments

$$I = (Y - C - G) + (IM - EX) \quad (1.8)$$

where,  $(Y-C-G)$  are private and public savings, and  $(IM-EX)$  is the trade deficit. Hence it is possible to state that  $I = S + TD$ .

The fundamental inference of the open economy is that a country is able to grow much faster if it accounts for savings and trade deficit together. The equilibrium condition for an open economy is  $MPK = r + d$ , where  $r$  is the global interest rate, adopted because of the assumption that a country is small enough as not to have its own interest rate, and  $d$  is the technological parameter. Consequently, if we assume that each country has the same  $(r+d)$ , the factor responsible for differences across countries is the productivity,  $A$ .

In the case of a Cobb-Douglas production function estimated in per worker terms,  $y = Ak^\alpha$ , the steady state level of output is

$$y_{ss} = A \times \left(\frac{\alpha A}{r+d}\right)^{\frac{\alpha}{1-\alpha}} \quad (1.9)$$

Here it is noticeable how the productivity  $A$  has a double effect on output: a direct one, but also an indirect one through capital.

## 1.4 Productivity

The concept refers to how productive is the combination of the various factors of production in the different countries. More specifically, countries may differ because of the distinct initial endowment, the factors of production as physical and human capital, geographic condition and institution, but they definitively differ also in terms of productivity. However, productivity is hard to measure since it is the part that explains output after the different factors of production are taken into account. An imprecise measure of any of the inputs could result in an overestimation or an underestimation of the value of productivity.

The techniques used in the estimation of productivity are two, **growth accounting** and **development accounting**. The former examines the growth of productivity over time while the latter research for the determinants of different levels of income per capita cross countries.

The growth accounting equation enables to calculate the growth rate of the productivity,  $g_{TFP}$ , as a residual. The analysis starts with a Cobb-Douglas production function

$$Y = A_t K_t^\alpha L_t^{1-\alpha} \quad (1.10)$$

By taking the logs and by calculating the change from one period to the other the result is

$$\begin{aligned} \ln Y_t - \ln Y_{t-1} = & \ln A_t + \alpha \ln K_t + (1 - \alpha) \ln L_t \\ & - \ln A_{t-1} - \alpha \ln K_{t-1} - (1 - \alpha) \ln L_{t-1} \end{aligned} \quad (1.11)$$

since  $\ln Y_t - \ln Y_{t-1} = \frac{\Delta Y}{Y}$ , it is possible to rewrite the equation in the growth accounting terms where

$$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} + \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L} . \quad (1.12)$$

The factors of production are paid their marginal product, therefore the shares of income that goes to capital and labor respectively are  $\alpha$  and  $(1 - \alpha)$ , which are equivalent to  $s_K$  and  $s_L$ . Thus, the growth accounting equation becomes,

$$g_{TFP} = g_Y - s_K g_K - s_L g_L \quad (1.13)$$

The equation states that the growth rate of output cannot be entirely explained by capital, as Solow had predicted. Hence, the Solow model would have been correct if the growth of the total factor productivity  $A$  was zero. Nonetheless, real data show that the growth rate of TFP is never equal to zero.

The technique of development accounting, on the other hand, focuses on how much productivity is related to human capital, and more specifically to education.

I will now turn to a more in depth investigation of productivity's main determinants, namely *Human Capital* and *Technology*.

#### 1.4.1. Human Capital

Human Capital is part of productivity since it refers to the workers' skills, acquired through education, involved in the production process. Differences in the quality of workers are therefore relevant for differences in output and consequently income across countries. The concept of human capital was developed with reference to physical capital; indeed, just as physical capital, human capital needs investments. Hence, it involves a payment to finance education in the present but it gives returns in the future. Thus, the distinction between rich and poor countries arises because the latter are composed, on average, by people who do not have funds to finance their studies. The result is that, due to the lack of education, poor countries are less productive with the effect of lowering the level of output.

The use of development accounting with the estimation of the average years of schooling in the various countries has made it possible to establish how much of productivity is accounted for by human capital.

The study begins with a Cobb-Douglas production function, augmented with human capital,

$$Y = AK^\alpha hL^{1-\alpha} \quad (1.14)$$

where  $h$  denotes the amount of labor input per worker and, consequently,  $hL$  is the measure of total labor income in the country.

At the end of the 1990s the economists Klenow and Rodriguez-Clare (1997), Hall and Jones (1999) and Caselli (2005) tried to explain the impact of human capital on productivity by applying the growth accounting's method and by estimating the average years of schooling. More specifically, their research showed that each year of schooling between 0 and 4 increased wages by 13%, between 4 and 8 increased wages by 10%, and each year between 8 and 12 increased wages by 7%. Thus, by considering the average years of schooling and the level of human capital, they were able to establish the level of output per worker in a country through the use of the Cobb-Douglas aggregate production function.

A further study suggested by Caselli, explains that human capital is responsible for almost 40% of the differences across countries. Caselli estimated the variable virtual output per worker as the result of what explained by physical and human capital,

$$y_{KH} = k^{\alpha} h^{1-\alpha} . \quad (1.15)$$

Moreover, he defined the rate of success as measuring the fraction of the variation of the logarithms of virtual output per worker relative to that of actual output, if countries differed only by physical and human capital.

To conclude, what stems from Caselli's analysis is that education relatively explains differences in output across countries, but the remaining 60% is explained by other factors, such as technology and institutions.

#### 1.4.2. Technology

Technology is another important feature that, combined with other factors, tries to explain the remaining 60% of the cross countries differences in productivity. The presence of technological improvement means that inputs can be combined more efficiently with the result of an increased level of output. *“Because technology changes the way in which factors of production are combined to produce output, changes in technology can affect the process of economic growth”*.<sup>3</sup>

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<sup>3</sup> Ivi, Blanchard Olivier, Amighini Alessia, Giavazzi Francesco, “Macroeconomics, a European perspective”, Prentice Hill

Technology allows to overcome the issue of limited income per capita caused by diminishing returns. Indeed, if the parameter  $A$  continues to grow, it is possible for the variable income per capita to grow as well. Technology is problematic. It is possible to explain that technologies can differ over time because they are invented gradually but, at any point in time, the technologies available are the same for all countries and if a technology increases the productivity in a country it should increase the productivity in all countries. Thus, it is hard to demonstrate why some countries are provided with more technologies and others are not.

The solutions reached by Krugman, Parente and Prescott all lead to the same conclusion: the adoption of technologies is costly. One of the main assumption is that the cost of imitating a technology is higher as the gap between poor and rich countries decreases. The rationale behind is that the imitability of technology may differ, and poor countries are those which will more likely adopt easy to imitate technologies.

Technology has the peculiar characteristics of being non rival but at the same time excludable. On the one hand, it permits the adoption of technology for poor countries without leaving worst off the country in which the technology has been developed. On the other, the technology can be adopted only by those countries which are rich enough to undertake big investments because of its cost.

The investments in the R&D sector is most of the time associated with private firms, even though the government may intervene in order to favor the adoption of the developed technologies, that protect the inventors with the introduction of patent rights. Hence, it seems sensible to analyze the role of technology as dependent on the decisions of private firms on whether or not to invest in the R&D sector.

The first concern regards the idea of profits. A firm will invest in the R&D sector if the technological investment will lead to higher profits in the future. Initially, since technologies are rapidly adopted, the firm will undertake the investment only if it gains a substantial advantage compared to its rivals; this clearly depends on the presence of patents. Moreover, the firm will make higher profits by supplying its inventions in bigger markets. Thus, the possibility of international trade gives firms incentives to invest in the R&D sector. Finally, the decision of investing is strictly linked with the

risks associated with the outcomes. Time and research spent on R&D might not bring to the hoped results. Hence, the opportunity of sharing the risks with other firms will further boost the incentives of take on the investment.

The second concern remarks the idea of creative destruction. The technological industry is characterized by a continuous innovation process. That is, once a technology has been developed, it provides the foundation for the development of other technologies. Hence, the newest technology incorporates the features of the oldest one, which in turns becomes obsolete.

It is extremely important to provide the right incentives to firms that are willing to invest and develop new technologies. The government may give tax credits to stimulate private firms' investments in the R&D sector. In many of the OECD countries, the governments enact policies that reduce tax liabilities for the firms that invest in the technological sector. These policies are particularly oriented towards small and medium enterprises or large company scheme, that fit with the established requirements. Incentives in the form of tax credits have resulted to be a Pareto efficient solution for the investments in the R&D sector. Indeed, by the use of tax credits, the decision of how much to invest and where to invest depends entirely on firms.

### *1.5. Government*

The importance of government is to be found in its performance towards the process of economic growth. Government is involved in the delivery of the factors of production in the country as well as in the provision of those goods on which the subsequent improvement of a country is based. First, it intervenes in the economy through investments which favor the accumulation of physical capital. Second, it provides public education to solve for the inefficiency of the capital markets. Finally, as previously stated, it grants patents to the inventors.

The most important effect of government intervention concerns the promotion of efficiency: if effectively established, it is able to provide the country with the right features for economic growth. The differences across countries depend also on the government establishment.

*“Economists have been quick to point to the adverse effects of bad governments on development, but have said little about the sources of bad government itself, which they see as properly the matter of other discipline. Yet bad government- or for that matter, any kind of government, good, bad or indifferent- is not unrelated to economics”*.<sup>4</sup>

As the author claims, the relation between the type of government and the economic development of the country is crucial. It took centuries for developed countries to establish a good government able to promote economic growth. Thus, developing countries are still far from reaching the settlement of a good government. Indeed, being late is often associated with having a bad government.

The proper role of the government concerns the acts and policies undertaken to render a country as qualified as possible for its successive improvement. Nonetheless, the debate about the degree of state intervention is a striking feature in economic growth theory. Most economists argue that the government role is fundamental for restoring the issues arising from market inefficiencies in the setting of education, public health and welfare subsidies. Others, sustain that state intervention has not brought to the desired effects: rather, it often lacked the incentives to act in the appropriate way. Moreover, they consider market failures to have less serious consequences than those caused by government failures.

*“[...]Because government efforts to address market failures comprise a major portion of what the government does on the economic front, the poor performance of these diverse government interventions constitutes a substantial drag on economic growth”*.<sup>5</sup>

The author advocates that governments have so abundantly operated with inefficient policies that have worsened the economic performance of the countries. Nevertheless, they were aware of the possibility of adopting different and more efficient policies approaches. To conclude, what emerges from the debate, is that government surely has a role in economic growth.

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<sup>4</sup> S. Landes David, “Why are we so rich and they so poor?”, The American Economic Review, May 1990

<sup>5</sup> Review by: Viscusi W. Kip, Winston Clifford, “Government Failure versus Market Failure: Microeconomics Policy Research and Government Performance”, Journal of Economic Literature, Dec., 2007

## 1.6. Geography

The initial endowment of resources as a reason of the difference across countries is the heart of a rather intense debate. A part of the economists, among whom the main representative is Jeffrey D. Sachs, sustain that *geographic conditions* and *natural resources* are the fundamentals of economic growth, while the other part, of whom the main exponent is Daron Acemoglu, sustains that what matter beyond geography are *institutions*.

The importance of geography lies mainly in its strict relation with the level of income per capita. Indeed, by analyzing the world with reference to the latitude, empirics show that the more distant the country is from the equator, the richer it is. Two geographical correlates of economic development are unmistakable. First, the countries in the geographical tropics are nearly all poor. Almost all high-income countries are in the mid- and high latitudes. Second, “*coastal economies are generally higher incomes than the landlocked economies*”.<sup>6</sup>

What the economists claim is that richer countries are characterized by the proximity with the ocean and by the vicinity with global markets, which are mostly situated in and near these regions. The feature of proximity is central in the geographic view, since it has an impact on the country specific policies. Indeed, those countries which are closer to the ocean are those more open to trade. The openness to trade favors the transfer of natural resources and technology. Furthermore, it allows the country to export those goods that it can produce more efficiently. Hence, the openness to trade of a country has effects on its level of income.

Another feature related to the possibility of trading is transport cost. A country that finds itself in a more isolated area, far from the global markets, faces higher transport costs in exporting produced goods.

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<sup>6</sup> Sachs J.D., Gallup J.L., Mellinger A.D., “Geography and Economic Development”, National Bureau of Economic Research, Dec., 1998



A further reasoning of the geographic view concerns the adoption of technologies. After having identified the poorest countries of the world as those belonging to the tropical area, Sachs suggested that these countries failed to develop due to the impossibility of adopting technologies that were developed for temperate zones. Indeed, he supported the idea that technologies developed in the temperate zones, which favored the improvement in areas such as health, agriculture and energy utilization, had contributed to the development of these countries. Thus, tropical countries, which could not implement these technologies failed to develop and lagged behind.

In conclusion, Sachs advocates that geographic conditions and climate have facilitated the development of some countries with respect to others, and that ultimate differences arose because of the political factors, such as institutions, which have further amplified the gap between poor and rich countries.

### *1.7. Institutions and Cultural Factors*

When referring to institutions it is important to categorize the type of institution. In the book “Why Nations Fail: The Origins of Power, Prosperity and Poverty”, Acemoglu and Robinson establish the difference between *inclusive* and *extractive* institutions. The former are those protecting human rights, that allow a broader participation in the market and place check and constraints on ruling classes. Moreover they foster economic development. The latter, are institutions established to protect a limited elite, that prevent market entrance by the imposition of high barriers. In the authors’ view, extractive institutions are an impediment for economic growth.

The authors highlight a strong dependency between the set of institutions established in a country in the past and its subsequent development. They argue that the Europeans imposition of extractive institutions in the colonized areas is to be considered the cause of those countries’ failure to develop and catch up. Indeed, it took and it still takes time for most of them to recover and develop after periods of exploitation.

Furthermore, they found economic institutions to be the result of political choices: the countries that are stuck with bad governments are those facing the higher difficulties in emerging and in solving the issue of underdevelopment. The central point is that

institutions, no matter whether inclusive or extractive, are a deep determinant of economic growth, as they favor or impede the economic improvement of a country.

The most evident example is that of North and South Korea, the first characterized by an authoritarian system which leaves no space for individual freedom and the second, the Republic of Korea, that relies on a capitalists organization of the economy, promoting international trade and giving legal protection to a wide range of producers. Due to its more inclusive institutions, South Korea has sustained an incredible growth since the 1960s (between 5-6% per annum), while the growth rate of North Korea as remained rather constant throughout the years.

Nonetheless, the example of China clearly contradicts Acemoglu and Robinson's thesis. Indeed, the presence of Chinese authoritarian institutions has permitted the creation of large and complex infrastructure and has attracted a substantial amount of foreign direct investments. With regard to this example, the availability of each country's resources determines the extent to which institutions can operate.

After having analyzed the main determinants of economic growth and the characteristics which may favor or prevent a country from growing, I agree with those economists who support the idea of growth as a result of the interdependence of several variables. In addition, I consider geography, government and institutions as the factors responsible for the efficient combination of resources as physical, human capital and technology, which are the hearth of economic development.

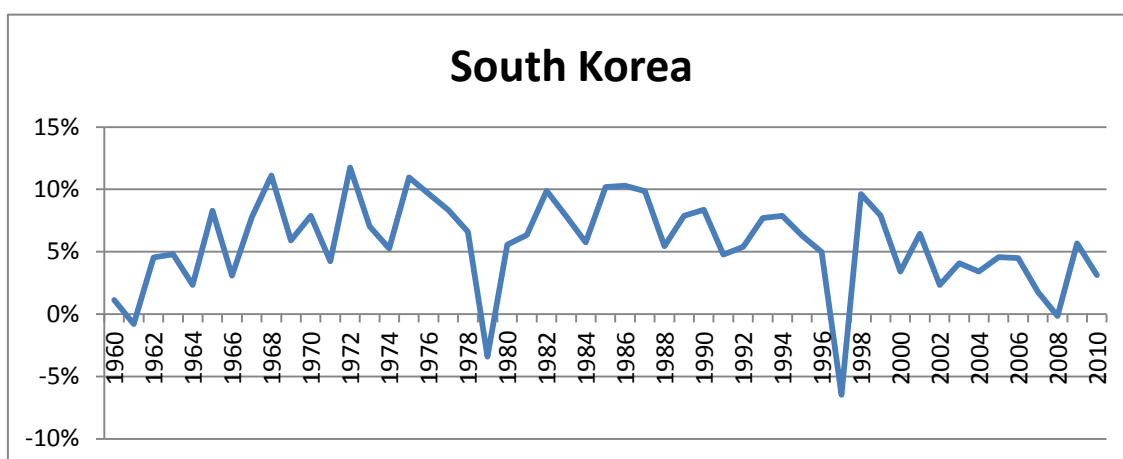
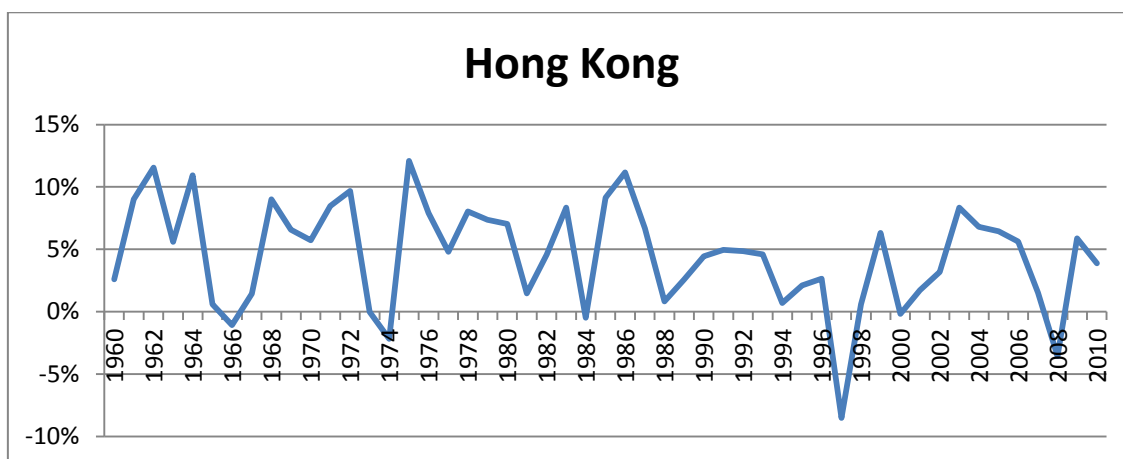
## 2. The development of the Four Asian Tigers

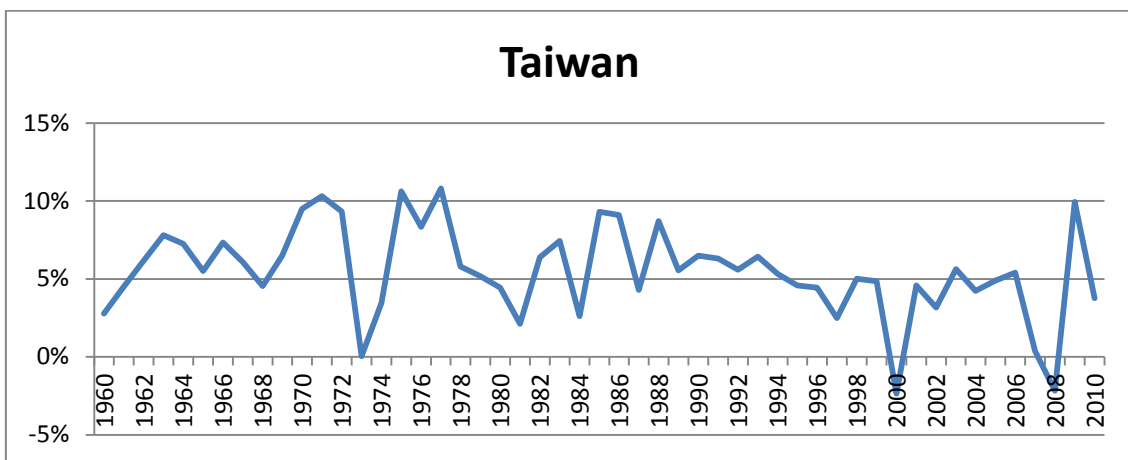
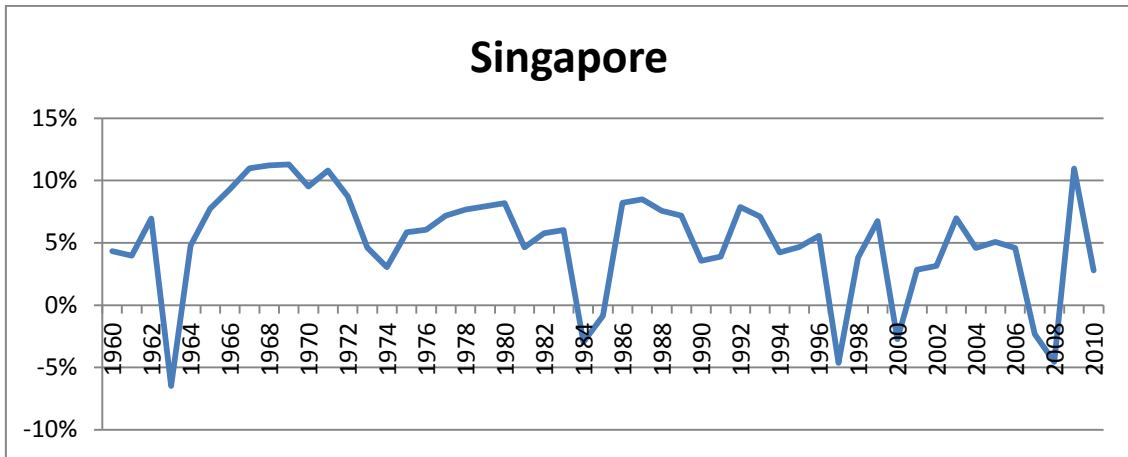
The term “tigers” refers to a group of South-East Asian countries that experienced a period of extraordinary growth from the 1965 to the 1995. Those countries referred to as “tigers” are Hong Kong, Singapore, South Korea and Taiwan. Prior to a more in depth analysis of the factors that have permitted the successful development of the Asian Tigers, I have deemed relevant to highlight their singular historical characteristics. It is conceivable to establish a common historical feature: their development has been influenced by difficult relationships with a neighboring power. These threats has brought to the promotion of extremely strong states from the political point of view, and to the desire of undertaking a rapid technological progress, from the economic point of view. It is possible to divide them into two groups: the *city-states*, namely Hong Kong and Singapore, and the *Japanese-style tigers*, South Korea and Taiwan. The former group that comprehends Singapore, which was a British colony in the past, and Hong Kong, which still is one, has sustained extraordinary rate of growth due to the cities’ role as trade centers. This feature was promoted by the countries’ governments which were in favor of more liberal policies aimed at fostering internationalization and trade. The latter, instead, consists of Japanese colonies which became independent after the Second World War because of the US intervention. Subsequently, they have experienced a period of large land reforms which enabled their fast development. The history of the Tigers highlights that, just before their extraordinary growth, they were all exhausted by the consequences of the war. In addition South Korea and Taiwan were also facing threats derived from the invasion of their neighbor country, China.

Many economists have agreed that the policies enacted by the governments were the main actions which subsequently foster economic growth. The four Asian Tigers sustained an extraordinary growth rate of Real GDP per capita particularly in the decades between 1960-1990. More specifically, the average growth rates in those years were 6%, 6%, 7% and 6% in Hong Kong, Singapore, South Korea and Taiwan respectively. Figure 2, shows the growth rates of Real GDP per capita in each of the Four Asian Tigers. The resulting average growth rates from 1960 to 2011 are 5%, 5%, 6%, and 6%. The estimations highlight the astonishing rates at which these countries

have grown. Indeed, none of the other developing countries have managed to reach such rates. Despite some isolated fall in the growth rates of the four countries in the second half of the 1970s, it can be inferred that they have all experienced an almost continuous and positive growth until around the 1995. Indeed, in the 1996 these countries were hit by the sharp Asian financial crisis, which has evidently lowered their annual growth rates. However, it was considerable how fast the Asian tigers have managed to recover from the crisis, an event which as lead many economists to talk about the *Asian Miracle*. The Financial Crisis of 2007-2008, has had repercussions on the entire world. This is the main reason for the fall in the growth rates of the four countries in that year.

Figure 2. *The Growth Rates of per capita GDP*





Source: Excel, Penn World Table 7.1 Dataset

It is relevant to notice how the tigers' growth rates have decreased in the years. The slowdown in the growth rates reveals the path of convergence. This goes along perfectly with the idea that as countries grow and narrow the gap with the frontier, their rate of growth decreases.

The Tigers are a more than exhaustive example of the concept of *conditional convergence* developed by Barro and Lee (1994) and Sachs and Warner (1995). The theory states that, once accounted for structural and policy variables, those countries characterized by lower initial level of income grow faster towards their steady state levels of income. Indeed, through capital deepening and through the adoption of already developed technologies, the countries which are far behind grow faster with respect to those countries that have already achieved higher levels of income.

The main variables which permitted the fast and sustainable growth of the Four Asian Tigers can be divided into four categories: the *initial conditions*, *natural resources and geography*, *government policies* and *demographic variables*.

The potential for development is strictly related to a country's initial conditions, as specified by the theory of conditional convergence. Back in the 1960s, the East Asian Tigers had the potential for growth due to their low levels of income.

Natural resources and geography affects economic growth through at least four sub-variables: the initial abundance of natural resources, the proximity to the sea, the percentage of people living in the coastal area and the location in the tropics.

As revealed by evidence, those countries with initial abundant natural resources experienced relatively worst performance with respect to countries provided with a lower level of natural resources. There are not clear explanations for this negative relationship, however one suggestion concerns the idea of "Dutch Disease", which consists in the appreciation of the real exchange rate which in turns makes unprofitable the manufacturing industry aimed at exporting. The Four Asian Tigers, which indeed lacked natural resources, by investing in the manufacturing sector, have encountered extremely high returns in the export of the manufactured goods, the first step headed for industrialization. With regards to the geographical structure, the Asian Tigers definitely find themselves in favorable positions: they are all situated in proximity to the sea, thus their transport and shipping costs are relatively small, and the ratio between the population living near the coasts to the land area is one of the highest in the world.

Finally, Singapore and Hong Kong have not suffered for their tropic position because of their unique characteristic of *city-states*. Indeed, as the term suggests, their GDP was mostly affected by the manufacturing industry rather than the agricultural sector: this feature has enabled them to avoid the issue of converting an agricultural-based economy into an industry-based one.

The economic policy that above all affects economic growth is openness to trade. The Four Tigers were among the most open countries in the world, in the period from 1965 to 1990. The principal policies undertaken to allow international trade were the reduction of the tariffs for both import and export goods, and the decrease in the restrictions to trade and in the barriers for international inflows of capital.

Two policy indicators effectively show the behavior of the East Asian Tigers' governments. Government savings define the soundness of the macroeconomic policies and the indirect effect on the inflation and exchange rate. The estimation of government savings for the tigers consists of an average of 5.6% of GDP in the years 1965-1990<sup>7</sup>, higher than any other region in the world. This measurement highlights the solid balance of their governments in the three decades period. Furthermore, their institutions resulted to be extremely efficient according to the index developed by Knack and Keefer (1995), which assigns to the Tigers' institutions a value of 7.8, on a range from 1 to 10.

The demographic variables are related to the comparison of the growth rate of the working age population with the growth rate of the total population, and to life expectancy at birth. Firstly, it has been proved that an increase in the working age population is positively related to economic growth. In addition, an increase in the workforce's growth rate higher than the increase in the population growth rate leads to the growth of income per capita, while the opposite holds true. Referring to the period 1965-1990, evidence shows that the East Asian Tigers were characterized by a growth rate of workforce of one percentage point higher than the growth rate of the population, which implied an increase in the growth rate of GDP per capita.

The other estimate, Life Expectancy at Birth, is linked with the productivity of the workers. Indeed, the higher the life expectancy at birth, the healthier and more productive the workers, the more output they are able to produce. Life Expectancy at Birth for the Asian Tigers was 63 years back in 1965, and its average was far above that of the other developing countries in the years that followed.

### *2.1. The Role of Education*

Human Capital, as previously described, is one of the factors used to measure the productivity of a country. Indeed, human capital, measured in terms of average years

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<sup>7</sup> According to: Radelet S., Sachs J.D., Lee J.W., (July 1997), *Economic Growth in Asia*, Harvard Institute for International Development

of schooling, can be accounted for as a source of economic growth. Given the initial endowment of natural resources, a more educated, skilled labor force is able to produce more output with respect to less-skilled workers. According to Barro and Lee's estimations, it has been found that the average years of schooling for the Asian Tigers in 1965 was 1.5 years, far above the average of the other developing countries.

Education, as accumulation of human capital, has played a critical role in those countries and it is thus rather responsible for their incredible growth. As the IMF (1991) suggests, “[...], economies-such as Japan and South Korea- which committed themselves to education and training made great strides in both human development and economic growth”. Therefore, education is considered as the mean through which economic growth is achieved.

One of the common aspects regards the almost equal enrollment rates in primary school in 1965; South Korea, Hong Kong and Singapore were all above 100%, while Taiwan was just below it with a rate of 97.15%. However the differences consisted of the way in which education was provided in the several countries. In South Korea and Taiwan it was the state to provide the basic level of education, while primary education in Hong Kong was implemented initially only by private schools, with government intervening only later in the years. At that time, through the supply of education, discrepancies in the male and female literacy rates started to decrease.

The expansion of secondary and tertiary education occurred mainly in the 1970s and 1980s. At the beginning of their development process, the rates of secondary education in the Asian countries were relatively small. Indeed, secondary education was conceived as particularly selective and elitarian. The enrollment rates were 35%, 45% and 29% in South Korea, Singapore and Hong Kong respectively. As they started to sustain economic growth, the demand for public education increased and the government began to invest and supply public secondary education.

Government intervention, which had major effects in the most liberal countries, Taiwan and South Korea, contributed to the increase in the enrollment rates in secondary education, which around 1986 reached 95% in South Korea, 92% in Taiwan, 71% in Singapore and 69% in Hong Kong. The latter was the one with the lowest increase due to its government slower response to the increase in public demand for secondary



education: it was mainly the consequence of the several political crises which have more than once exposed the government to threats.

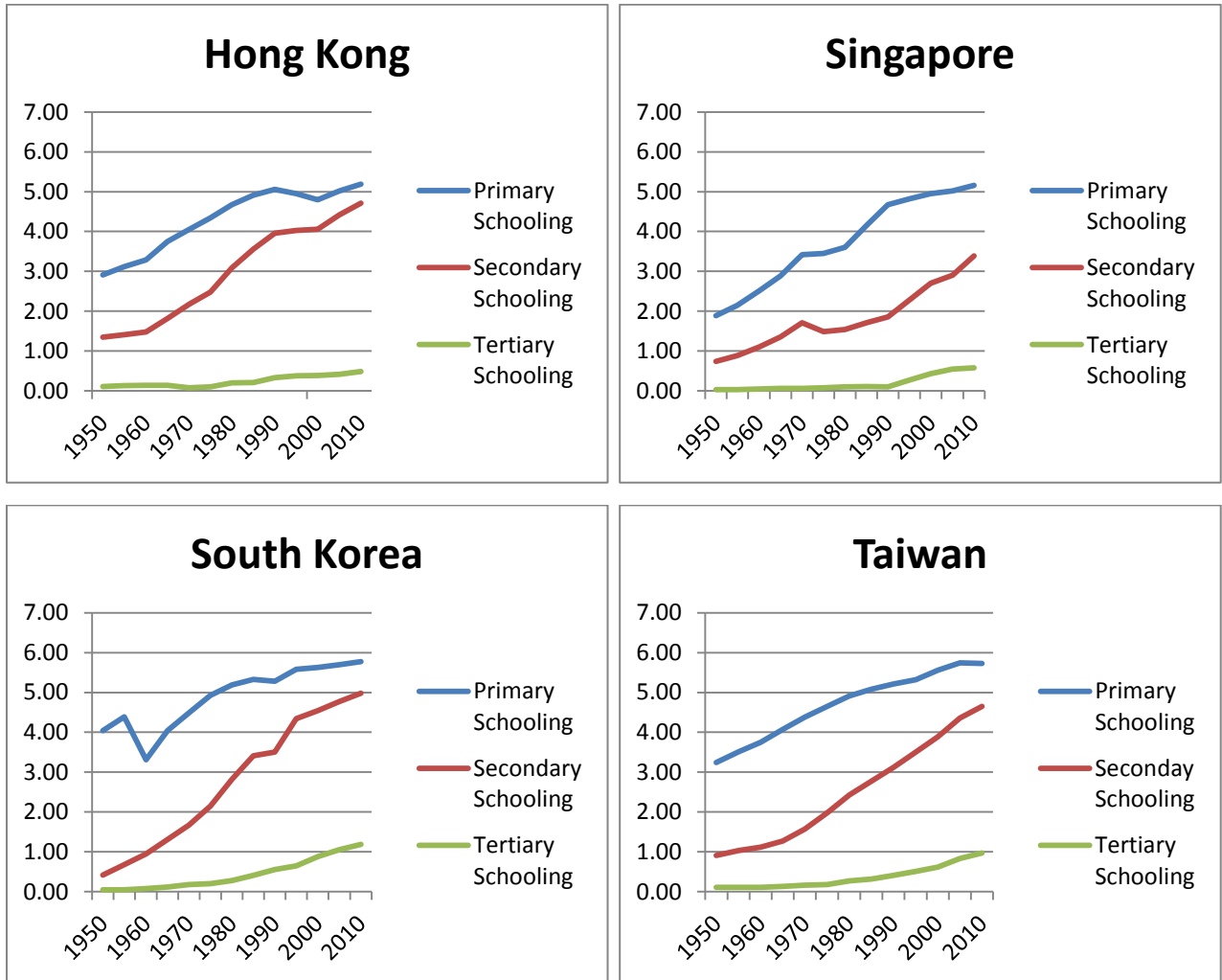
The distribution of tertiary education was strictly related with the role of the government and its preference to direct students towards more technical and vocational studies in the period right after the beginning of industrialization. Indeed during the 1970s, the governments of Hong Kong and Singapore were sustaining more market oriented policies which followed the decision of investing in the supply of a more general level of education. For instance, the Hong Kong's government in 1975 declared that 40% of the young should have attended technical or vocational schools. However, this policy was never implemented since the government delivered major importance to the market forces and to parental decisions. Similarly, the government of Singapore has strongly sustained the attendance of technical school by activating parents 'and employers' attitudes. On the opposite side lied Taiwan and South Korea, where by the 1970s more students were enrolled in technical schools following the governments' desire to meet the needs of the future industry. The strong support of the technical and vocational schools reduced the space for the enrollment in tertiary education which was perceived as an even more elitarian road, allowing just few to complete the entire process of studies. Indeed, the enrollment rates in tertiary education were low and more specifically only 6%, 10% and 5% in South Korea, Singapore and Hong Kong respectively.

Nonetheless, as the countries developed and as the majority of people began to be involved in secondary studies, the demand for tertiary education increased with the government having to provide tertiary schooling on a larger scale. Thus, by 1986 the enrollment rates reached 25% in South Korea and 33% in Taiwan, the two countries where the state played a central role. For the less interventionist state of Hong Kong, the enrollment rate in tertiary education managed to grow only up to 13% by 1986. In the 1990s the tertiary rates experienced a further boost which permitted them to reach 44% in South Korea and 25% in Hong Kong.

Beside the substantial differences concerning the way of providing and funding education, through the estimation of the average years of primary, secondary and

tertiary schooling it is possible to state that governments' intervention has been responsible for the large increase in these rates during the years.

Figure 3. *The Average Years of schooling in the Asian Tigers*



Source :Excel, Barro and Lee Dataset

As shown by the graphs, the two Japanese-style tigers, South Korea and Taiwan, have higher average years of schooling attendance. The most striking difference concerns the average years of schooling for tertiary education. Indeed, it seems that the governments' promotion towards more technical and vocational studies in Hong Kong and Singapore have lowered the attainment of tertiary education school.

## 2.2 *The Role of Confucianism*

The interrelation of culture and development has been vastly taken into account, in particular with respect to the development of the Asian Tigers, as scholars were trying to discover whether these countries were following a unique path of growth, driven by their peculiar characteristics.

Many economists have considered Confucianism as a barrier for economic growth, particularly in the early stages of development. The reason concerns the traditional system promoted by the religion itself that puts emphasis on hierarchy, on individuals and on respect for the authorities. Moreover, *“the natural world and man's social world [are] seen as a unity and believed to be governed by the same moral principle...” and thus the natural order is used to “justify existing social norms and institutions”*.<sup>8</sup>

In accordance with this statement, many economists suggested that the principles of Confucianism could have prevented or at least slowed down the development of the Tigers because of the strong linkages with the historical traditions and institutions it endorses. Confucianism is indeed connected to a “feudalism” society, clearly in opposition to a “capitalist” society. Thus, they considered the religion as a factor impeding the process of modernization, necessary to sustain the contemporary competition and internationalization of the world’s markets.

In contrast, the opposite front sustains that Confucianism, with the principles it incorporates, has favoured economic development in the South-East Asian regions. *“Indeed, “[...], the Confucian values and tradition lead to a model of maximal government, with its myriad responsibilities, duties and obligations. The State is not just supervisory and regulatory in function but to a very large extent developmental, educational and mobilizational in emphasis. The bureaucracy is not just administrative and government functionaries but acts as guidance of national interests and is often perceived as leaders, intellectuals and teachers”*.<sup>9</sup>

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<sup>8</sup> Hane 1969: 357

<sup>9</sup> Wei-Ming T.,(May 2008), *The Rise of Industrial East Asia: The Role of Confucian Values*, The Copenhagen Journal of Asian Studies

The conception of individualism, the importance of education and the perception of the government as a superior entity are just some of the values which have fostered the creation of strong states able to sustain the international Western competition and favoured the countries' development. To conclude, economists supporting this view argued that the Confucian values which may have limited the initial development of the four Asian tigers, are the same values which have permitted and supported their extraordinary growth in the last decades.

### *2.3. Exports and Total Factor Productivity*

An emerging feature that accounts for most of the Four Asian Tigers' development is the role of the manufacturing industry and the consequent exports. This is the case where the governments' intervention in the promotion of export goods is again relevant for the countries' success. The openness of North America and European markets, made it possible for the Asian Tigers to implement and sustain the export-oriented strategy.

At the beginning of the 1960s, such a strategy was not considered as one promoting economic growth by many policymakers, who instead supported a more import-based strategy for economic growth. However, the import-based strategy was never accomplished in Hong Kong and Singapore, while it was removed in South Korea and Taiwan after the first difficulties showed up. From there on, the governments' role in financing and promoting openness to trade has brought substantial changes which contributed to the development of the Four Asian Tigers. Moreover, the countries were able to sustain the export strategy due to a combination of policies aimed at incentivizing free trade and macroeconomic stability and the establishment of innovative institutions which included export processing zones and incentive packages for foreign direct investments.

In the paper, *The Tyranny of Numbers: Confronting the statistical realities of the East Asian Growth Experience*, Alwyn Young argues that despite the extraordinary growth in terms of output and manufacturing exports, the total factor productivity has not grown as much in these countries. In particular Young found out that the total factor productivity in Hong Kong grew with an average of 2.3% in the years from the 1966 to

the 1991. Furthermore, what he found to be essential was the growth of labour input, which he defined as the rate of the employed in the economy.

The case of Singapore highlights the different path that the growth rate of output and the growth rate of total factor productivity have undertaken. Indeed, while GDP per capita grew by an average of 8.5% through the years 1966-1990, the total factor productivity has been found to decrease at a rate of -0.3% in those same years.<sup>10</sup>

For what concerns South Korea, the manufacturing sector is what has proved to be the major determinants in the rise of the total factor productivity in the country. However, because of the large increase of capital deepening that occurred in the country, the total factor productivity, calculated as the residual, has grown only by 1.6% in the three decades going from the 1960s to the 1990s.

Taiwan's total factor productivity has grown by 2.4% per annum in the reference period. The main determinant of the productivity's growth appeared to be services, which have grown by 3.4% on average per annum. Nonetheless, the great importance gained by the services could be due to the different approach used by the Taiwanese government in the determination of the output of the public sector. "*It incorporates a quality adjustment, allowing for the growing productivity of the public sector employees*".<sup>11</sup> Once adjusted to the standard method, Young estimated the growth rate of TFP to be 1.9% per annum rather than the 2.4% previously established. Similarly, the contribution of services to the rise of total factor productivity slightly decreases to 2.5% per annum.

To conclude, Young suggested that the high rates of economic growth experienced by the four Asian Tigers were caused mainly by the accumulation of human and physical capital, namely machines and buildings. What he argued was that technological progress played little or no role in the economic growth of the tigers, which was mostly conducted by capital deepening. Indeed, the example reported by Young is Singapore.

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<sup>10</sup> Young admits that data are likely to be overestimated due to the use of the Singapore's Index of Industrial Production, which is most of the time undeflated, in referring to the annual Census of Industrial Production, the principal source of information for Singaporean manufacturing.

<sup>11</sup> Young A., (March 1994), *The tyranny of numbers: confronting the statistical realities of the east Asian Growth Experience*, Working Paper No. 4680, National Bureau of Economic Research

As shown above, the Singaporean's growth rate was almost entirely backed by the accumulation of human and physical capital, and with extremely high investment rates, the TFP turned out to be even negative.

Young's results were heavily criticized, in particular those referring to Singapore. Indeed, Chang-Tai Hsieh showed that the Singaporean growth in productivity was not negative, as Young predicted, but estimated at 2.2% per year. In Hsieh's view, the results obtained by Young were misleading because of the overestimation of the capital stock based on the Singapore's government national account statistics. However Young's studies seems to be reasonably valid.

The explanation behind the large and rapid capital deepening depends on the governments' policies which favored and stimulated rapid investments. Without the policies, capital would have not grown as much and economic growth would have not reached the extraordinary levels it actually achieved.

#### *2.4. The Role of Foreign Direct Investments*

The East Asian Tigers were the countries with the highest level of Foreign Direct Investments inflows during the 1970s.

Indeed, the Tigers attracted more than 3% of FDI, far above the world average, that was around 2.28%. The main explanation for the high quantity of FDI inflows lied in the success of the export-oriented strategy implemented by the governments in those countries. *"The very fact that a region produces for global markets makes it most naturally attractive for foreign direct investment as it best exemplifies absorptive capacity"*.<sup>12</sup>

A study performed by Daniele in 2009 highlighted the negative relationship between Foreign Direct Investments inflows and crime rates at local levels. The higher the crime rate, the lower the inflows of foreign direct investments. The stability and the well-functioning of governments have certainly a role in the determination of FDI's inflows. The governments in the four Asian Tigers have demonstrated to be rather stable in the

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<sup>12</sup> Marktanner M., Neaime S., (Jan 2009), *The Role of Foreign Direct Investment for Economic Development in the Mena Region*, American Univeristy of Beirut

years and have enacted policies aimed at maintaining a long run stability which has favoured the countries' economic growth.

### 3. Empirical Evidence

#### 3.1. Data Description

The empirical study presented in this paper analyzes the variables which have mostly influence economic growth in the four Asian Tigers, namely Hong Kong, Singapore, South Korea and Taiwan. Unfortunately Taiwan could not be included in the regression due to the unavailability of data for most of the time periods and most of the variables. Thus, for the integrity of the research, Taiwan has been substituted with China. The rationale for the inclusion of China in the regression concerns its relevant influence on the neighbors countries. This dissertation presents a Panel of Data in Hong Kong, Singapore, South Korea and China over a thirty-year period, 1982-2010. It was built on the basis of four different datasets, Penn World Table 8.1, World Bank Database, the Barro and Lee Dataset (2010) and data from United Nations Conference on Trade and Development. The final dataset refers to Hong Kong, South Korea, Singapore and China for the years 1982-2010; the reduction of the initial dataset, which referred to the period 1960-2010, is due to the insufficiency of Chinese data before the year 1982.

I have tried to include in the regression the majority of the variables that Lee, Radelet and Sachs have included in their empirical model.

The dependent variable of this econometric model, the ***Growth Rate*** of Real GDP per capita at constant 2005 national prices, was obtained from the Penn World Table 8.1. It is measured in percentage terms and it is obtained as

$$\ln(\text{RealGDP}_t) - \ln(\text{RealGDP}_{t-1}).$$

The *GrowthRate* has a mean of 0.05497, where the minimum value is -0.090 and the maximum 0.12752. The Penn World Table Dataset comprehends National Income Accounts converted in international prices and Purchasing Power Parity for 189 countries since the year 1950. Moreover, Penn World Table 8.1, is a recently updated version of the 8.0 database. It provides macroeconomic variables for 167 countries from the year 1950 to the year 2011, estimated at 2005 constant prices.



The variables Imports (*IM*) and Exports (*EX*) have been collected from the World Bank dataset to address the concept of Openness. On the one hand, *IM* reflects the value of imports converted to U.S dollars and expressed as a percentage of the average for the base period 2000.<sup>13</sup> On the other, *EX* stands for the export volume indexes: they are the ratio of the export value indexed to the corresponding unit value indexes.

Moreover, in order to have more precise estimates I have also included the variable *FDI*. It was derived from the United Nations Conference and it represents FDI inflows and outflows, expressed in millions of dollars, for singular countries and regions.

As for *IM* and *EX*, I collected data for the variable *Savings* from the World Bank database. The values were reported in percentage of GDP and more specifically were derived from GDP less final consumption expenditure. In this sample *Savings* are expressed in terms of 1\$. I divided the World Bank data by 100 and I subsequently multiplied the valued obtained for the correspondent value of real GDP. The World Bank Dataset, permits to gather economic, environmental and social data. Hence, it provides more than nine-hundred indicators, defining values from the 1960 for approximately two hundred and ten economies.

The variable *Educ* accounts for Human Capital. The Barro and Lee dataset provides values on the years of schooling for 146 countries from the 1950 to the 2010, estimated every five years. The values are assumed to be constant within the five years for the purpose of the reliability of the variable, and the implied quality of the entire dataset. I have built the variable *Educ* by considering the effect of education on hourly wages in accordance to the following formula:

$$\begin{aligned} \ln(h) &= 0.13s, & \text{for } 0 < s < 4 \\ \ln(h) &= 0.13 \times 4 + 0.1(s - 4), & \text{for } 4 < s < 8 \\ \ln(h) &= 0.13 \times 4 + 0.1 \times 4 + 0.07(s - 8), & \text{for } 8 < s < 12 \end{aligned}$$

In this way, the variable *Educ* is good at describing the amount of human capital of a country in a given year, since it incorporates the direct impact of years of schooling on

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<sup>13</sup> The World Bank, World Development Indicators (2012). Import value index (2000 = 100) (TM.VAL.MRCH.XD.WD)

wages. Hence, it should better predict the effect of education on the growth rate of a country.

Finally, I decided to include the variables *Mortality Rate* and *Population Growth*, derived again from the World Bank dataset, to account for demographic changes. The former, which defines the infant mortality rate for 1,000 live births, is an important indicator for the health status and living standards in a country. Furthermore, it is among the most used indicators for the socioeconomic development across countries. The latter, *Pop.Growth*, refers to the annual population growth rate expressed in percentage terms. Based on the assumption that the rate of growth of population is constant between two points in time, the pop. growth rate for year  $t$  is the exponential rate of growth of midyear population from the year  $t - 1$  to  $t$ .

### 3.2. Literature

The paper to which I referred in developing the regression is that of Lee J.W., Radelet S. and Sachs J.D, *Economic Growth in Asia*. The paper uses an augmented version of the Neoclassical Growth model, defined by Barro (1991), Barro and Lee (1994) and Sachs and Warner (1995a – 1995b). The authors have considered a consistent amount of explanatory variables, twelve, which they have mainly divided into four categories: *initial conditions*, *natural resources and geography*, *policy variables* and *demographic variables*. The dataset consists of records for 78 countries, in the period 1965-1990.

Unfortunately, I was not able to gather the same set of variables for the estimation of my results due to data availability. Indeed, a considerable part of the data essential for the development of my regression is unpublished.

Table 1. refers to Lee, Radelet and Sachs' estimation. It relates the control variables to the Growth of Real GDP per capita, 1965-1990. The results show a path of convergence. Indeed, the variable Initial Output per Worker is visibly negatively related to the dependent variable. Furthermore, the regression shows interesting results for what concerns geography: the initial endowment of natural resources is negatively related to the GDP, which means that, in these terms, the “poorest” countries are those who grow

faster and more easily. The magnitude of the significance of the variables *Government Saving Rate* and *Openness* defines them as among the most important drivers of economic growth. Furthermore, being landlocked or situated in the tropics is negatively related to the growth rate of GDP, as theory predicts. To conclude, the policy variables included in the regression convey the idea that well-regulated countries with high level of institutions tend to sustain higher growth rates of Real GDP per capita.

Table 1.

<b>Variables</b>	<b>Coefficients (t-statistics)</b>		
Initial Output per Worker (log)	-1.978 (-9.42)	-1.975 (-8.78)	-2.137 (-8.34)
Schooling (log)	0.208 (1.53)	0.200 (1.43)	0.205 (1.43)
Natural Res. Abundance	-2.430 (-2.36)	2.439 (-2.31)	-2.217 (-2.04)
Landlocked	-0.605 (-2.28)	-0.613 (-2.27)	-0.548 (-2.01)
Tropics	-1.263 (-4.29)	-1.337 (-4.42)	-1.118 (-3.03)
Coast/Land Area	0.262 (2.37)	0.249 (2.18)	0.269 (2.30)
Gov. Savings Rate	0.123 (4.94)	0.122 (4.81)	0.123 (4.83)
Openness	1.965 (6.20)	1.871 (5.61)	1.669 (4.58)
Quality of Institutions	0.248 (3.47)	0.238 (3.28)	0.285 (3.22)
Life Expectancy	0.336 (2.81)	0.329 (2.72)	0.313 (2.55)

Life Expectancy Squared	-0.002 (-2.23)	-0.002 (-2.14)	-0.002 (-2.01)
Growth of Working Age Pop	1.129 (2.86)	1.082 (2.61)	0.977 (2.20)
Growth of Total Pop	-0.774 (-1.83)	-0.731 (-1.64)	-0.596 (-1.22)
East/ Southeast Asia		0.197 (0.51)	-0.209 (-0.42)
South Asia		-0.359 (-0.95)	-0.824 (-1.58)
Latin America			-0.348 (-0.82)
Sub-Saharan Africa			-0.840 (-1.59)
<b>R-Squared</b>	<b>0.87</b>	<b>0.87</b>	<b>0.87</b>

### 3.3. Econometric Model

This paper wants to determine which are the variables that have a major impact on the rate of economic growth in a country. More specifically, it wants to investigate which were the sources of the extraordinary economic growth of the Four Asian Tigers, in the period 1982-2010.

The basic model of this empirical investigation is

$$g_{it} = \beta_0 + \beta_1 Educ_{it} + \beta_2 mort_{it} + \beta_3 Pop_{it} + \beta_4 IM_{it} + \beta_5 EX_{it} + \beta_6 FDI_{it} + \beta_7 Sav_{it} + u_{it}, \quad (3.1)$$

where,  $i$  indexes countries and  $t$  years,  $\beta_0$  is the intercept,  $g_{it}$  is the growth rate,  $Educ_{it}$  is the natural logarithm of human capital,  $mor_{it}$ , mortality rate, is the number of deaths

for a thousand live births,  $Pop_{it}$  is the growth rate of population,  $IM_{it}$  is the level of imports,  $EX_{it}$  is the level of exports,  $FDI_{it}$  is the natural logarithm of foreign direct investments and  $Sav_{it}$  is the natural logarithm of the amount of savings.

It is a non-linear model and more specifically it includes a linear-logarithm relation between the Growth Rate and the variables **Education**, **Foreign Direct Investments** and **Savings**. In this way, it is possible to estimate the effect on  $Y_i$  for percentage changes of  $X_i$ .

However, the rate of economic growth also depends upon other factors, as geographical conditions, natural resources endowments and cultural factors as Confucianism, which vary across countries but are constant over time. With the basic model (3.1) it is not possible to control for these variables leading to omitted variables bias estimations. Hence, a Panel Data is needed. It is a model that allows to capture the changes by country fixed effects ( $f_i$ ), as long as these factors are constant or change slowly over time. In the period considered for the regression, oil crisis may have affected economic policies promoted in the Four Asian Tigers. It is possible to control them by including time fixed effects ( $t_t$ ), if these factors can be considered constant across countries.

The country and time fixed effect regression model is:

$$g_{it} = \beta_1 Educ_{it} + \beta_2 mor_{it} + \beta_3 Pop_{it} + \beta_4 IM_{it} + \beta_5 EX_{it} + \beta_6 FDI_{it} + \beta_7 Sav_{it} + f_i + t_t + u_{it} \quad (3.2)$$

where,  $f_i$  is the country fixed effect and  $t_t$  is the time fixed effect.

It is likewise possible to rewrite the model with a common intercept using  $n - 1$  and  $T - 1$  dummy variables

$$g_{it} = \beta_0 + \beta_1 Educ_{it} + \beta_2 mor_{it} + \beta_3 Pop_{it} + \beta_4 IM_{it} + \beta_5 EX_{it} + \beta_6 FDI_{it} + \beta_7 Sav_{it} + \varphi_2 D_{2,i} + \dots + \varphi_n D_{n,i} + \dots + \delta_2 B_{2,t} + \dots + \delta_T B_{T,t} + u_{it} \quad (3.3)$$

Where  $\beta_0, \beta_1, \gamma_2, \dots, \varphi_n$  and  $\delta_2, \dots, \delta_n$  are unknown coefficients.

The combination of country and time fixed effects in the regression permits to eliminate omitted variable bias that arise from unobserved variables that are constant across states and also unobserved variables that are constant over time.

### 3.4. Estimation Results

The empirical model aims at verifying the significance of those variables considered as the main drivers of economic growth. It tries to explore the sources of economic growth with respect to Education, in the form of accumulation of human capital, Demography and Openness. Moreover, the inclusion of variables such as FDI and Savings permits to have insights on the government role and stability. In conclusion the estimation does not ignore the geographical influence over a country's economic growth, but it is considered to be constant in the period under consideration, 1982-2010.

The first regression was run upon the nonlinear model described by Equation 3.1, assessed by OLS estimates and heteroskedasticity standard errors. The concept of heteroskedasticity is related to the distribution of the error term given  $X$ . Thus, if the variance of the conditional distribution of  $u_i$  given  $X_i$  is not constant, the error term is said to be heteroskedastic.

According to Table 2, Regression (1) *Educ* appears to be significant at 1% level, but in contrast with empirical evidence and as expected, the variable is negatively correlated with the *GrowthRate*.

In the same way, the variable *Log(FDI)* results to be significant at 1% and to be negatively correlated with the dependent variable. The result is once more contradicting the literature.

The two variable *Savings* and *Mortality Rate* show significant results at 1% level: the first is positively related to the *GrowthRate*, while the second one is negatively related. Both find themselves in line with previously conducted studies.

Finally, the coefficients of *IM* and *EX* are significant at 5% level. Imports are negatively correlated with the growth rate of real GDP, while exports are positively correlated with it. These results appear to be consistent with formerly assessed results.

The variable *PopulationGrowth* is not significant at neither 1, 5, nor 10% level. Nevertheless, it is negatively related to the growth rate as expected.

The explanation for the misleading results concerning *Education* and *Foreign Direct Investments* is to be found in the lack of control over numerous unobserved variables that change across states and over time. Indeed, the R-squared associated with Regression (1) is extremely low, 0.3569. The value suggests that the estimates are not properly correct and exhaustive.

In order to solve for the omitted variable bias problem that arose with the simple nonlinear regression model and to find more reliable results, I have run the combined country and time fixed regression model.

The estimates obtained in Regression (2), are more accurate than the previous ones, as proved by the R-squared that has now reached a value of 0.737.

The variable *Educ* is now positively related to *GrowthRate*. The coefficient has a z-value of 1.526, which converted to the p-value form equals 0.12701. Thus, Education does not appear to be significant at any significance level. However, this result is consistent with other studies, that were not able to find a strong relation between education and growth. For instance, the education coefficient is not significant in either of the three regression of Table 1., estimated by Lee, Radelet and Sachs. Moreover, the misleading result could also be due to the different effects that quantity of education and quality of education have on economic growth. It is a difference that could not be established in this empirical research.

The results collected from the other variables fit empirical evidence. Indeed, the variable *Exp.GS* is now significant at 5% level and it is also positively related with the *GrowthRate*.

The variable *Savings* is significant at the 10% level and it demonstrates to have a negative relationship with the dependent variable of the regression.

For what concerns Demography, the variables *Mortality Rate* and *Population Growth* are taken into account. The former, is significant at the 1% level and it is negatively related to the dependent variable, *GrowthRate*. Indeed, the higher the growth rate of real GDP, the lower the mortality rate. The latter, shows a negative relationship with the dependent variable and it is once again not significant. In literature, empirical studies have found a weak link between the population growth rate and the growth rate of GDP. What has been assessed is that a significant part of the increasing growth rate of GDP for the Asian Tigers is associated with the fast rising share of the working age population in the years of their extraordinary growth, 1960-1990.

The Imports and Exports variables are both significant at 5% level. They reflect the concept of Openness and as expected *IM* are negatively related with the growth rate of RealGDP, while *EX* are positively related with it. These estimates allow to state that Openness is positively related to *GrowthRate* and it is one of the variables that mostly influences it.

The two following variables have a nonlinear relationship with the dependent variables. The variable *Log(FDI)* is significant at the 5% level, and it is positively related to the dependent variable. Indeed, a 1% increase in the inflows of Foreign Direct Investments is associated with a 0.00013466 increase in the growth rate. Finally, the variable *Log(Savings)* appears to be negatively correlated with the growth rate. The result goes against empirical evidence that, on the contrary, suggest a positive relation between the government saving rate and the rate of growth of Real GDP. Evidence suggests that countries in which governments savings are high and spending are controlled, grow faster. More specifically, Lee, Radelet and Sachs estimates of government savings are highly significant and positively related to the growth rate of real GDP.

Nevertheless, in Regression (2), the *Savings* coefficient is not significant, thus it does not jeopardize the integrity and significance of the regression.

The regression's results suggest that both economic policies and demographics characteristics are key fundamentals for the prosper of economic growth.



Table 2.

<b>Variables</b>	<b>Regression (1)</b>	<b>Regression (2)</b>
Education	-0.1904088*** (0.0494613)	0.4653248 (0.3049538)
Mortality Rate	-0.0023663*** (0.0008122)	-0.0044783*** (0.0017380)
Pop.Growth	-0.0018242 (0.0052084)	-0.0015195 (0.0039483)
Imports	-0.0006704** (0.0002609)	-0.0006071** (0.0002946)
Exports	0.0005533** (0.0002482)	0.0005675** (0.0002702)
Log(FDI)	-0.0121443*** (0.0031840)	0.0134661** (0.0065960)
Log(Savings)	0.0318317*** (0.0066978)	-0.0464608 (0.0324732)
<b>R-Squared</b>	<b>0.3569</b>	<b>0.737</b>

The numbers in parenthesis are the heteroskedastic robust standard errors, \* denotes 10% significance level, \*\* 5% and \*\*\* 1%. When \* does not appear, it means that the coefficient is not statistically significant.

## Conclusion

The main findings of this paper is that *Economic Growth* depends on the interrelation of demographic, economic and geographical variables. Indeed, some of the variables are fundamentals in promoting economic growth, while others are essential for sustaining it. Without their interaction, the efforts could not bring to the desire end-state.

First, geographic variables as initial natural resources endowment, geographic position, climate and percentage of population living nearby the coasts, sets the basis for a favourable or unfavourable growth. The further boost in economic growth comes with physical and human capital accumulation. Indeed, the countries' productivity initially depends on these features. However, their potential is limited as the growth process evolves and technological progress becomes involved in the process. Furthermore, the least technical aspects, as government, institutions and economic policies are important for sustaining the growth.

The East Asian Tigers did not have “extraordinary” features that enables them to grow that much. Surely, the four governments spending on education and investing in physical capital positively affected the production of output. However, they were provided with rather favourable geographic conditions that allowed them to experience an extremely fast development based on trade. Indeed, the vicinity with the sea permitted them to develop their export-oriented strategy more efficiently due to reduced transport costs. Moreover, the particularly high inflows of foreign direct investments predisposed positively their growth rates.

Moreover, the regression results empirically demonstrates what stated above. Imports, Exports and Foreign Direct Investments, which are the variables that reflect the Openness concept, are all significant at the 5% level. The results conveys the idea that the extraordinary growth process undertaken by the Four Asian Tigers was consistent with a process of internationalization, defined as the possibility of trading with the global markets.

To conclude, the Four Asian Tigers have shown a path of convergence towards the most advanced countries, highlighted by their decreasing rates of growth in the latest years. Nonetheless, their catching up process is surely one of the fastest and fascinating one.

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