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Estimation of the effect of Trade Openness on the Steady State growth rate of selected Asian countries.

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Abstract

While there is almost no doubt on the positive effect that trade openness has on growth, this certainly does not mean that all countries are affected in the same manner or that such effect is permanent. This thesis attempts to apply the extended exogenous Solow model of growth to country-specific data by using an Error Correction framework. The aim is to verify and measure the long and short-run contribution of trade openness for Indonesia, Taiwan, Vietnam, and Sri Lanka for policy suggestion. The model will also attempt to control the effect of trade by using the share of government spending as a proxy for responsible policies. The findings suggest a positive effect for Vietnam and Taiwan and a negative for Indonesia and Sri Lanka in the long-run, indicating that country specific characteristics play a role on how trade liberalization affects growth.

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Chapter 1

Introduction

A common policy advice for developing countries is to introduce trade liberalization policies, as they are believed to be fundamental in order to promote growth. International trade represents a valuable tool in many aspects. First, it promotes competition as many companies may die out if not productive enough, leaving space and resources to more dynamic organizations. Second, the access to a bigger market allows for economies of scale, making cheaper products for consumers and, third, domestic firms are exposed to new technologies, ideas, management skills and industry standards promoting innovation and productivity.

While most of the empirical studies affirm that there is no doubt concerning the effect per se, often economists discuss whether it influences in a similar manner all countries and to which extent said effect last. Are they permanent or influence only the short-medium growth?

The aim of this work is to study if, in a selected group of south east Asian countries, trade openness is able to permanently influence the steady state growth rate. This thesis will use an extension of the Solow model with technological progress adopted by Rao and Singh (2010). This means finding if, indeed, for countries like Indonesia, Vietnam, Taiwan and Sri Lanka, there is an effect on the long-run growth of output.

Two important advantages of such approach are, first, the ability to separate the long and short-run effects. This is possible thanks to the adoption of an Error Correction Model that will be discussed in the next chapters. Furthermore, as Rao and Singh (2010) pointed out, this methodology attempts to fix some specification issues linked with time series frameworks that rely directly on the growth rate as a dependent variable. In fact, when studying the steady state growth rate, such a method can be perceived as misleading as it is not able to properly estimate the unobservable steady state (Rao and Singh, 2010).

According to Dollar and Kraay (2004), Edwards (1992), and Winters (2004) a country would need decades if not more to reach it. The issue is with directly imposing the steady state condition to relatively short data, namely the growth rate series, when it is implausible that the country of study is even

remotely close to its equilibrium. This is the reason why it is necessary to first use the data to estimate the non-steady state model and only after, to apply the condition of equilibrium (Rao and Singh, 2010).

The model is helpful in providing country-specific policy suggestions, since time series will be used and this gives the opportunity to verify how the effect might differ among countries as well. The specification, as mentioned above, will take the form of an Error Correction Model. The long-run relationship will be represented by an augmented Solow production function (Solow, 1956), as the dependent variable is the level of output and not the rate of growth. On the other hand, the dynamic effects or short-run effects will be introduced as differentiated lagged terms.

As explained in the next chapters, in addition to others variables, such as the real GDP per capita and the real capital stock per capita, the variable of interest will be the trade openness index as a proxy for trade liberalization. The latter is computed as the sum of exports and imports over the GDP. Moreover, a proxy for the government responsible policies, the government spending, is going to be used as a control variable for the effect of trade openness on growth. The government spending is computed as the share of government consumption over the GDP.

This thesis is divided as it follows. The extension of the Solow model of growth is presented in chapter two. The third chapter is dedicated to the empirical literature. Chapter four and chapter five will present the methodology and the results of the estimations. Finally, chapter six will contain the conclusions.

Chapter 2

The extension of the Solow model of growth

Rao (2010c) in a paper titled *Time Series Econometrics of Growth Models: A Guide for Applied Economists*, discusses the merits and faults of the exogenous models of growth, namely Solow (1956), and endogenous models, such as Romer (1986) for example. In the same paper, he provides a convenient extension of the Solow's model of growth, especially useful for country-specific policy suggestions.

The model is built, as previously mentioned, on the Solow model with technological progress in which a country's growth rate of output converges, in the long-run, to its steady state growth rate (Acemoglu, 2010). Such a state can be defined as *"...a situation in which the various quantities grow at a constant (perhaps zero) rates."* (Barro and Sala-i Martin, 2004, p.33). This rate is supposed to correspond to the exogenous growth rate of the total factor productivity, known as TFP.

The resulting statement is that, in order to increase permanently the growth rate, a country need to rise its technological progress. Unfortunately, the TFP is presented, in an exogenous model, as a *black box* since its determinants are unknown (Acemoglu, 2010). Still, by introducing further explanatory variables, it is possible to reduce the might of the TFP as it can be considered a measure of ignorance when it comes to the explanation of growth (Rao, 2010c).

Rao (2010c) proposes a way to introduce variables that may be able to influence the TFP growth rate, more precisely *manna from heaven* determinants[1] such as the trade openness or the strength of property rights. These kind of variables, on the contrary of the others, are difficult to be placed as simple intercept shift variables in the Solow production function (Rao, 2010c).

Nevertheless, as explained below, since the interest is to quantify their effect on the growth rate and not on the level of output, the additional factors need to be inserted as trended. It is important to point out

[1]Types of variables that Rao (2010) defines as potential determinants of TFP that do not require ulterior resources to produce effects. They do not have a direct effect on the quantity or productivity of labor and capital.

that, for this reason and the relatively small sample size, it is rather difficult to add an excessive amount of trended explanatory variables. In fact, it may lead to a higher multicollinearity (Rao, 2010c).

The extension is obtained as follows. Starting from a Cobb-Douglas function of production with constant returns and Hicks neutral technical progress[2] such as

$$Y = AK^{\alpha}L^{(1-\alpha)} \qquad 0 < \alpha < 1 \tag{2.1}$$

Where:

- Y is the level of output;
- A is the level of technology;
- K and L are the factors of production, respectively the stock of capital and the labor;
- α is the constant share of capital.

The production function has a set of assumption such as, the constant returns to scale to both inputs, decreasing returns to each input and positive smooth elasticity of substitution between inputs (Barro and Sala-i Martin, 2004). In addition, it is assumed that the level of technology and labor grow exogenously.

$$A_t = A_0 e^{gT} \tag{2.2}$$

$$L_t = L_0 e^{nT} \tag{2.3}$$

Which means that the level of technology at time t is the result of its initial level and its exogenous rate of growth g. The same is for labor where n is the population growth. Both rates are assumed to be constant.

The per capita version of the production function 2.1 is the following

$$y_t = A_0 e^{gT} k_t^{\alpha} \qquad 0 < \alpha < 1 \tag{2.4}$$

In this function:

- y is the per capita output at time t;
- A_0 is the initial technological level;
- g is the growth rate of TFP;

[2]It means that technology is considered a simple multiplicative constant in the production function. See Acemoglu (2010) *Introduction to modern economic growth.*

- k is the capital stock per capita at time t.

Generally, the steady state is reached when capital accumulation stops, hence the additional savings invested are equal to the part of the stock of capital that depreciates. This is the result of the diminishing returns to capital (Barro and Sala-i Martin, 2004). At this point, capital and output per worker grow at the exogenous rate of g. Following Solow (1956) it is possible to find the level of output in steady state.

$$y^* = \left(\frac{s}{d+n+g}\right)^{\frac{a}{1-a}} A \tag{2.5}$$

Where:

- s, d, n are respectively the constant rate of saving, the constant rate of depreciation and the labor force growth rates;
- A is the stock of knowledge in steady state.

The steady state growth rate g can be found from the production function 2.4 by applying the natural log and then differentiating (Rao, 2010c).

$$lny_t = lnA_0 + gt + \alpha lnk_t \tag{2.6}$$

$$\Delta lny_t = g + \alpha \Delta lnk_t \tag{2.7}$$

$$\Delta lny^* = \Delta lnA = g = SSGR \quad \text{if} \quad \alpha \Delta lnk_t = 0 \tag{2.8}$$

Assuming that the level of technology depends, not only, on time but additionally on a variable X.

$$A_t = f(T, X_t) \tag{2.9}$$

It is possible to capture its effect on the growth of productivity by adding it inside formula 2.4 like this.

$$y_t = A_0 e^{(g_1 + g_2 X_t)T} k_t^{\alpha} \tag{2.10}$$

Other variables might be introduced as conditionality factors Z. in which case, the production function and the steady state growth rate specification can be written as follows

$$y_t = A_0 e^{(g_1 + g_2 X_t + g_3 X_t \times Z)T} + k_t^{\alpha} \tag{2.11}$$

$$lny_t = lnA_0 + (g_1 + g_2X_t + (g_3X_t \times Z_t))T + \alpha lnk_t \tag{2.12}$$

$$\Delta lny_t = g_1 + (g_2 + g_3Z)X + (g_2\Delta X + g_3(\Delta Z \times X + Z \times \Delta X))T + \alpha \Delta lnk_t \tag{2.13}$$

$$g = g_1 + (g_2 + g_3Z)X = SSGR \tag{2.14}$$

In the latter, g is assumed to be a function of an autonomous rate g_1, which represents the unselected trended variables, and other explicit trended variables linked to X and Z (Rao and Cooray, 2012).

Chapter 3

Empirical literature

Most cross-country studies present evidence of a strong positive relationship between trade liberalization and growth. For example, Dollar (1992) studied which were the sources of growth in developing countries. He compared the effect on growth of outward and inward orientations and explained how Asian countries, by adopting outward oriented policies, were able to generally grow more than African or Latin American countries which tended to do the latter.[3]

In fact, such findings are motivated with the idea that outward oriented policies encourage the use of external capital for development and, moreover, the increase in both exporting and importing activities promote the spread of positive externalities or spillovers that ultimately lead to a positive effect on growth in the long-run. Practically, Dollar (1992) built an index, the real exchange rate distortion, and found a negative relationship between the index and growth.

Dollar and Kraay (2004) analyzed the link between trade, growth and poverty and came at the conclusion that trade and growth are positively related. They found that trade liberalization is responsible for a good part of growth especially in countries that they defined as *New Globalizers* who reported a different pattern compared to other developing countries which tended to grow less as a result of not imposing large cuts to tariffs and increasing trade volumes. In fact, some of the less open developing countries, showed a decline in the catching up process as well (Dollar and Kraay, 2004). At the same time, they acknowledged the difficulty in properly isolating the trade effect given its correlation with other growth inducing factors such as macro stability, low government expenditure and the rule of law.

Frankel and Romer (1999) reported a positive relationship between trade and income. In particular, in their paper, they tried to overcome the difficulty of identifying the true effect that trade has on income, given that the influence can present itself on the opposite direction as well. According to them, many cross-country studies find a moderate positive relationship, but those findings may result from an endogeneity problem of openness. Nations with open economies are more likely to have stable fiscal policies and other

[3]By outward orientation, Dollar (1992) means the combination of two elements; low level of protection and a stable real exchange rate. With the last one begin the most easily comparable one among countries.

elements correlated positively with income.

Starting from the assumption that geography affects bilateral trade, but is not affected by income, they tried to use the geographical characteristics as a proxy for trade. The main idea is that a country may engage more in international trade if close to populous neighbors, despite the level of income or the government policies (Frankel and Romer, 1999). The analysis was carried out controlling for within country trade though size as there is a negative correlation between this and proximity. The outcome was for a robust, positive even if moderately significant effect of trade on income. It is important to know, that the study presents some shortcomings as many other aspects apart from geographical proximity might allow the effect of trade to income.

Yanikkaya (2003) found results that are less consistent with the previews works. A cross country study with different openness measures was carried out. The author ended up rejecting the idea of a simple and direct relationship between trade and income. The proxies used can be divided into two families, the indexes of trade volumes and the indexes of trade restrictions. While the results of the former are consistent with the previews findings, the latter showed a positive association with income.

The main *bridge* connecting openness to growth is the productivity. Greater openness to other countries may lead to stronger competition, therefore, forcing companies to become more productive. They will be exposed to new technologies and ideas coming from abroad, leading, consequently, to more growth (Winters, 2004).

Edwards (1998) reinforced the idea of openness leading to an increased absorption capacity of the technological progress from other nations, in particular from the developed ones. This means increasing productivity by promoting an efficient allocation of resources since many goods and services may be purchased from abroad. Edwards (1998), furthermore, stressed the role of the cost of imitation. If said cost is found to be lower than the cost of innovation, a poor country might experience faster growth than the developed ones with a propensity to converge. This situation is more likely to happen in open countries, whose firms have the opportunity to capture new ideas (Edwards, 1998).

This concept is linked to the neoclassical theory of trade represented first by Smith's absolute advantage (Smith, 1937) and afterwards by Ricardo's comparative advantage (Ricardo, 1817). Generally speaking, an open country will be lead, by engaging in international trade, to specialize itself on the products or industries in which it is more productive or, better put, for which the opportunity cost is lower. This stems from differences of endowments or technology among countries, which allow for a better allocation of resources. Ultimately, a country will export the goods in which it has an advantage compared to its trading partner and import the others.

Grossman and Helpman (1991) identify four channels, that are supposed to link openness to economic performance. One is, indeed, the reorganization of resources due to trade between dissimilar countries. The country with the lower technological progress, might not specialize in research-heavy industries as

those goods are produced more efficiently by other commercial partners. In addition, if a country is endowed with a lot of unskilled labor force, that may also favor traditional sectors characterized by low innovation. These elements may reduce the long-run growth of said country. Despite this, in such cases, trade may lead to a net positive outcome. The reasons can be: the consumption of innovative goods that otherwise would not be available in the domestic market, and the static gains in efficiency coming from their comparative advantages (Grossman and Helpman, 1991).

Other mechanisms capable of affecting the long-run output growth are: the transmission of technical information, hence the access to foreign knowledge, the competition-driven innovation of domestic firms, and the potential increase in market size. The last one can have multiple different consequences. While the expansion may bring higher potential profits for domestic companies, that is also true for foreign firms as well (Grossman and Helpman, 1991).

Among the studies of the link between openness and productivity, there is also a contribution by Alcalá and Ciccone (2004). In their paper, they found a positive, significant, and robust effect of international trade on productivity when controlling for institutional quality and geography. In particular, they adopted an alternative index, the real openness computed as the import plus export over the GDP in purchasing power parity. The real openness has the function of eliminating distortions related to the increase of prices of non-tradable goods caused by specialization and the rise in productivity in the tradable sector (Alcalá and Ciccone, 2004). Additionally, they also found that the main channel is the total factor productivity.

Another theme is related to the permanence or not of such effects. For example, Winters (2004) underlines that a resulting long-lasting raise in growth rates may not be true, as the increase of output might come mostly from transition dynamics. On the other hand, its persistence can be the result of coupling openness policies with other growth enhancing ones. Said policies may revolve around fighting corruption, lower inflation, increase investments, or improve institutions and education. This means that its long lasting effect, if present, may be the result of a combination of other policies, which are intertwined with trade (Winters, 2004).

This is confirmed in many other studies, trade liberalization is seen as not sufficient to produce strong effects on its own but the outcome depends on other kinds of policies. Edwards (1992) while studying the relationship between trade orientation, trade distortion, and growth, came at the conclusion that more open economies with low levels of distortion grow faster. Nevertheless, its long lasting effect is dependent from other aspects. To carry out his analysis, Edwards (1992) used cross-country data with an endogenous model that allowed for technological absorption. While coming at the previously reported conclusion, he argued that the main reasons why trade openness effect on income is unresolved is because of a weak theoretical underpinning link that leads to problems when passing from static to dynamic and, lastly, because of empirical limits in measuring trade orientation (Edwards, 1992).

In the empirical literature, there are also contributions such as the one of Rodriguez and Rodrik (2000)

who cast doubts on the methodology and the measurement of trade in some studies. While not denying completely the positive effect, they do doubt the strength of it and the relative higher importance of trade liberalization to growth compared to other growth enhancing policies especially in developing countries.

Their focus was in studies analyzing policy-induced openness. Meaning, empirical works using variables related to tariffs and barriers. For instance, excessive openness in countries with low technological progress can lead to a more efficient allocation of their resources but in industries that are considered with low added value and not very innovative which might result in a lower long-run growth (Rodriguez and Rodrik, 2000).

Rodrik et al. (2006) while studying the implication of the export portfolios on growth found that the products a country specialize in are relevant when it comes to economic performance. By default, what is produced is the result of a combination of endowments such as physical capital, human capital, labor, state of institutions and natural resources that they define as *fundamentals*. Such fundamentals lead to the specialization in specific industries, which have different effects on growth. They found that countries, specializing in goods exported by developed countries, are prone to grow faster (Rodrik et al., 2006).

Among time series studies concerning the selected countries of this research project, most of them analysed the effect of trade openness together with other variables and concluded that trade openness increases growth.

Yusoff and Febrina (2014) and Nursini (2017), for instance, conducted an empirical analysis for Indonesia. The first, studied the effect of trade openness with investments and the real exchange rate while the latter, added only the fiscal policy to the trade openness.

Taiwan, is one of the first and most used example for how trade liberalization helps supporting economic growth. Chuang (2000) and Trejos and Barboza (2015) are some of the studies confirming this link.

Furthermore, Su et al. (2019) and Thach and Huy (2020) carried on an empirical research on Vietnam. While the second focused on the role of trade openness only, finding a short-run effect on growth, the former studied the role of trade and FDI, with both having a positive effect separately which can be enhanced through institutions.

Herath (2010) and De Silva et al. (2012) are two of the many authors that concentrated on Sri Lanka's case. Herath (2010) found a positive relationship between trade liberalization and growth. De Silva et al. (2012) came at the same conclusion while performing an analysis considering openness, investments, and the interest rate. Such factors turned out to be positively related to growth.

Regarding country-specific studies, that try to identify long and short-run contribution of openness, the results differ considerably, indicating that such differences may be the result of specific factors. While such kinds of studies are, for obvious reasons, not able to provide universal evidence on the matter, they surely offer tools for country-specific policy recommendations.

To summarize, the answer to the question, does trade openness influence growth?, is positive but with

a few reservations. As Ulasan (2012) reported, international trade theory is not able to give a proper answer and this means that a potential solution must be reached empirically. However, empirical studies present numerous issues that need to be fixed. How openness is measured, some methodological issues, the mechanism that links trade to growth, and the quality of data (Tahir et al., 2014).

Chapter 4

Methodology

4.1 The Error Correction Model

For the estimation, Rao (2010c) used an Error Correction Model, also known as ECM, based on LSE's general to specific approach.[4] The ECM allows the analysis of both long term and short term effects including the speed of adjustment to the steady state growth rate.

The estimation will focus on the effect of trade openness, referred also as TO from now on, on the steady state growth rate[5] in which the share of government consumption on GDP, GS, will be used as a proxy of responsible government spending to control for the effect of TO. From the previews equations, 2.11 and 2.14 the actual production function and steady state growth rate function are

$$y_t = A_0 e^{(g_1 + g_2 TO_t + g_3 TO_t \times GS_t)T} + k_t^{\alpha} \tag{4.1}$$

$$g = g_1 + (g_2 + g_3 GS)TO = SSGR \tag{4.2}$$

The ECM would look like this.

$$\begin{aligned} \Delta lny_t = &-\lambda[lny_{t-1} - (lnA_0 + (g_1 + g_2 TO_{t-1} + g_3 TO_{t-1} \times GS_{t-1})T) + \alpha lnk_{t-1}] \\ &+ \sum_{i=0}^{n1} \gamma_{1i} \Delta lnk_{t-1} + \sum_{i=0}^{n2} \gamma_{2i} \Delta TO_{t-1} + \sum_{i=0}^{n3} \gamma_{3i} \Delta lny_{t-1} \end{aligned} \tag{4.3}$$

The specification can be visually divided into two main parts. The first being inside the square brackets, and the second is the one composed by the sum of the summations of differentiated lagged variables. The first, also referred as Error Correction Term, represents the cointegrating equation or the long-run relationship between the level of output and the other variables, including the trended enhancing ones. This

[4] Bhaskara Rao (2007) offers an overview of some methods to identify short and long-run relationships, including the London School of Economics' GETS approach.

[5] SSGR in short

part is represented by a one period lagged version of the Solow production function with logs. Essentially, if the estimates turn out as significantly different from zero, it means that said variables influence, in the long-run, the level of output y. However, only the trended variables have a permanent effect on the growth rate of output (Rao and Cooray, 2012). Despite that, a fundamental requirement among all determinants is cointegration that will be discussed in section 4.2.

On the other hand, the summations of differentiated variables represent the short term shocks or dynamics on the growth rate. It is necessary, of course, that the corresponding γs result as different from zero. The core principle is that short term shocks are able to divert the growth rate from its steady state growth path, but Δlny_t is supposed to converge again to the equilibrium at a speed equal to λ. In order to have convergence, λ need to be negative and, in absolute value, lower that unity (Rao, 2010c).

For instance, a value of λ equal to -0.4, when using annual data, would mean that 40% of the shock is going to be absorbed in a year. As the value of lambda approaches one, the adjustment increases its speed. Note that in equation 4.3 the dependent variable is a rate of change of output and not the steady state growth rate (Rao, 2010c) as the aim is to estimate the non-steady state.

Theoretically, the Error correction model, according to Asteriou and Hall (2015), has the following advantages:

- It has a convenient way to provide a measure of adjustment from the disequilibrium of the previews period;
- The problem of spurious regression can be solved.[6] Thanks to cointegration certain trends can be eliminated;
- It is easy to fit in a general to specific approach to find the most parsimonious model given the data;
- The disequilibrium error or error correction term is stationary given cointegration.

4.2 Stationarity and Cointegration

Before proceeding with the estimations, there are two essential concepts that need to be introduced, first the concept of stationarity and then of cointegration. As previously reported cointegration represents a fundamental requirement of the ECM, in particular for the long-run equation. Stationary variables are those with a mean and a variance that do not vary overtime. More precisely, when the mean is constant and the variance is finite and constant.[7] When stationarity is present, said variables can also be said to not

[6] If the data is non-stationary, the classical OLS model may provide significant result even of unrelated variables, leading to incorrect conclusions (Asteriou and Hall, 2015)

[7] This refers to weak stationarity which is enough in most cases and from now on it is what it will be referred to by stationarity. A process is defined as strictly stationary if all the moments of the distribution do not depend on time. See Rao (1997).

possess a unit root. More formally, Asteriou and Hall (2015), lists three main elements that make a time series stationary.

- A mean reversion, meaning that it fluctuates around a constant long-run mean;
- A variance which is finite and does not change with time;
- A theoretical correlogram that declines while increasing the lag length.

Additionally, a time series is said to be integrated of order p, if in order to become stationary, the series would need to be differentiated p times. Formally one would write it as $I(p)$. This concept is important as most economic time series are integrated of order one in level. This means that differentiating them once would be enough to avoid the issues linked to spurious regressions (Asteriou and Hall, 2015).

There are various kinds of tests that can be performed to identify the presence of stationarity. Asteriou and Hall (2015) for example, provides a brief explanation of most of them, including the ADF test that will be used in this research project.

In an ECM, it is possible to introduce the series in levels inside the long-run relationship because of cointegration. This is present if a linear combination of two or more $I(1)$ series, is $I(0)$ hence stationary. Cointegration can be viewed as a *"...technique to estimate the equilibrium or long-run parameters in a relationship with unit root variables."* (Rao, 1997, p.3).

The basic intuition comes from the idea of two associated variables being characterized by a similar trend such that a combination of them may eliminate the non-stationarity.

In this work, the Engle and Granger's two steps method[8] is going to be used with the FMOLS as a method of estimation for the cointegrating equation. There are many other procedures to test for it with their own advantages and disadvantages.[9]

4.3 Engle and Granger cointegration method

Engle and Granger (1987) formalized a simple way of testing for cointegration between variables (Asteriou and Hall, 2015). They took into consideration two main situations.

- One variable is $I(1)$ and the other is $I(0)$;
- Both variables are $I(1)$.

While in the first case, the non-stationary series tends to dominate and the result is a $I(1)$ linear combination, the second case admits possible cointegration since the variables have the same order (Asteriou and Hall, 2015). Hence, the latter case can be tested following the Engle and Granger's two steps method.

[8] See Engle and Granger (1987) for details.
[9] See Bhaskara Rao (2007) for an overview of the most used methods and some examples.

The first step is a stationarity test carried out to verify the order of integration. If the previously mentioned second case is verified, then it is possible to move further to the second step. This being the estimation of the long and potentially cointegrating equation followed by a stationarity test on its residuals[10]. If said residuals are stationary $I(0)$, that is the confirmation of the existence of cointegration and a long-run relationship between the data. Regarding the other alternative outcome of the first step, when all the variables are $I(0)$, the classic OLS techniques can be adopted while, on the other hand, if it resulted in a different level of integration, that means there is no cointegration (Asteriou and Hall, 2015).

This method is very simple but it does not lack flaws. Asteriou and Hall (2015) reports that:

- In the long-run equation, the dependent and independent variables are not specified. This means that the order might matter when it comes to cointegration. However, in economics, it is possible to rely on theory to decide which one is the dependent variable;
- More cointegrating equations may exist for the same data, and the method does not provide the number of cointegrating vectors;
- It is a two step test, meaning that a mistake in the first will be carried on the second.

In the following chapter, the estimations will be carried out in a few steps:

- Test the stationarity of the data using the ADF test;
- Check for the presence of cointegration and find the long-run relationship with the FMOLS method;
- Build the ECM with OLS using the residuals of the cointegrating equation and the short term shocks;
- Finally, test for normality, serial correlation of the residuals and heteroscedasticity.

[10] Asteriou and Hall (2015) mentions how the critical values of this test are slightly different from the classical test. However, most of the times it is still accepted the use of the standard critical values used for the stationarity test.

Chapter 5

Estimations

5.1 Data

The estimations have been carried out using the data from the Penn World Table version 9.1.[11] In the analysis the following time series are used.

- Real GDP;
- Population;
- Real Capital Stock;
- Trade Openness as export plus import over GDP;
- Share of Government consumption.

In the models there are additional dummy variables that will be explained in the country specific parts. The average data of each country over their respective period is summarized in table 5.1.

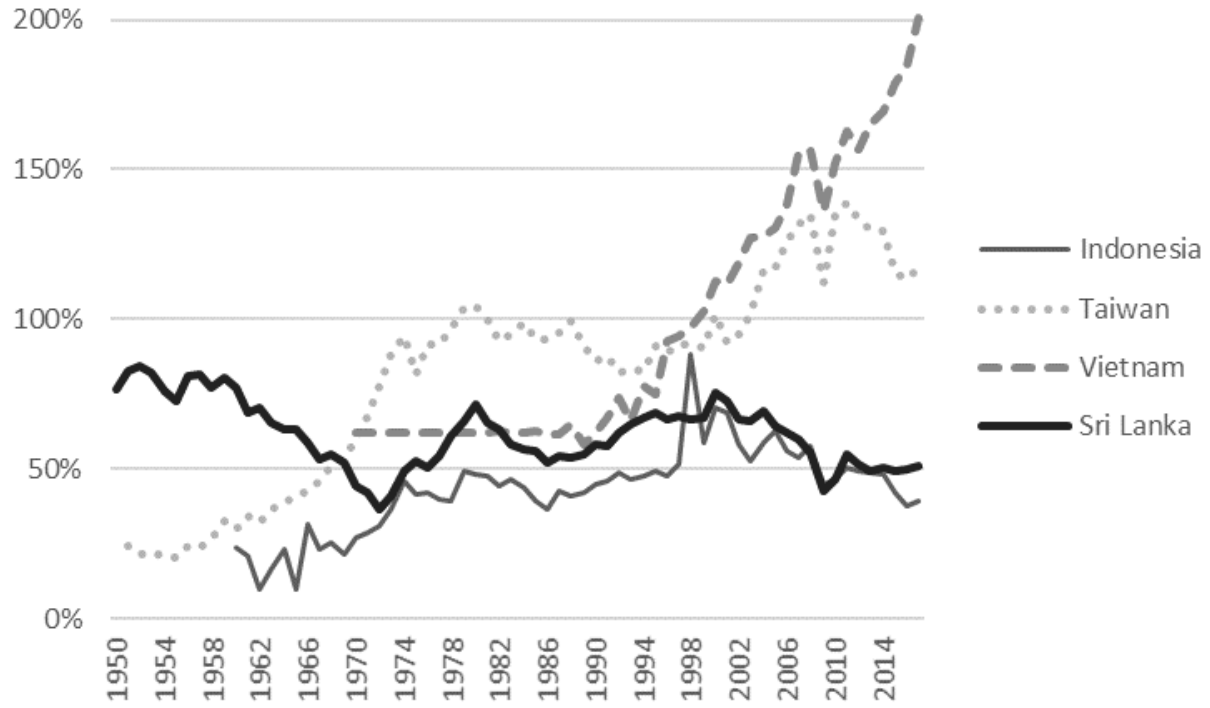
Table 5.1: Summary of the data (average)

Country	Period	GDP growth	Capital stock growth	TO	GS
Indonesia	1960-2017	5,38%	5,70%	43,03%	8,24%
Taiwan	1951-2017	7,86%	7,95%	81,42%	16,82%
Vietnam	1970-2017	5,99%	7,36%	98,71%	6,65%
Sri Lanka	1950-2017	4,66%	4,16%	61,81%	6,63%

[11] Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182, available for download at www.ggdc.net/pwt

Figure 5.1 presents the historical series of trade openness for the selected countries.

Figure 5.1: Trade Openness (%)



From table 5.1 it can be seen how the output of Indonesia grew on average of 5.4% each year in the period under consideration. Apart from a sudden drop in 1998 because of the Asian financial crisis, reaching a negative growth of 13%, the economy recovered immediately. In 2017, the yearly growth rate has been of 5%. The growth rate data does not seem to present a clear trend.

Indonesia seems to be not as open as the other selected countries, with an average TO of 43%. This, can be also the result of its population size as it has a potentially higher interaction between domestic agents compared to small sized countries that tend to rely more on international trade. The openness presents a positive trend starting from 24% in 1960 and reaching in 2017 a value of 40% of GDP. Trade openness grew constantly from 1960 to 1998 at an average growth of 9%, following then a decrease of 3% each year. However, the overall average growth has been of 5% per each year.

Regarding Indonesian capital stock, the average growth rate has been of 5.7% from 1960 to 2017. The country experienced an increase in investments that caused a dramatic rise from 1967 to 1982, after which investments slowed down till 1997. From 1997, the capital stock started to increase again, reaching a growth rate of 6% in 2017 compared to the previews year.

The share of government spending presents a slightly positive trend. The average value over the entire period has been of 8.2%. It started from 11% in 1961 fluctuating around that value until 1986, after which

it fell reaching 5% in 1998 with an average decrease of 5% each year. From 1998, the share of government spending increased continuously at an average of 3% reaching 9% share of GDP in 2017.

The output growth of Taiwan grew at an average yearly rate of almost 7.9% between 1951 and 2017. However, the GDP growth has been following a negative trend, it started from a growth rate of 11% in 1952 while experiencing a growth of 3% in 2017 compared to the previews year. From 1952 to 1997, the growth has been somewhat constant with an average growth rate of 9% while in the second part of the data, 1988-2017, the average growth rate declined to 5%.

Taiwan is the second most open country among the selected ones thanks also to its size. The average TO has been of 81% during the period in consideration, starting from a value of 24% at the beginning and ending with a value of 117% of GDP. TO data results in a positive trend, growing dramatically from 1951 to 1974 at an average rate of 6.4% a year. From 1974 to 1994, it remained constant and after 1994 it increased again growing at an average yearly rate of 1.7%.

The average growth rate of the capital stock has been of 8% and Taiwan experienced a steady increase from 1952 to 1975, interrupted only by a slowdown during the period 1975-1985. From 1990 to 2017 the capital stock grew by 2.6%.

The average GS for Taiwan is 17%. The highest among the countries under study. The share of government consumption is characterized by a minor but consistent decreasing trend. In 1951 the share of government expenditure was 20% and in 2017 the value decrease to 14% of GDP.

Vietnam experienced an average growth rate of 6% from 1970 to 2017. It started from around 4% in 1970 and grew of almost 7% between 2016 and 2017. Vietnam has a tormented history in the period pre-90s made up of many different conflicts, the Vietnam War, the Conflict with China in 1978 and the Cambodian-Vietnamese war from 1977 to 1991. So this period is characterized by strong instability. From 1990 to 2017, the economy grew at an average rate of 6.8% and it presents a positive trend.

The openness is, today and on average, the highest one among the selected countries. The average is 98% of GDP and in 2017, international trade accounted for 200% of GDP. TO grew constantly from 1990 at an average rate of 5% a year.

The stock of capital, suffered the same consequences of GDP, it remained somehow constant till 1991. It peaked at 13.7% between 1995 and 1996. After that, it fell until 2013, year in which the capital stock recovered on average of almost 7% each year.

The share of government spending has been 6.7% on average in the entire period under consideration. In 1990 the value of 7% of GDP but after that it peaked at 8% while then falling till 2004 at a value of 5.5%. However in recent years, GS rose of 1.4% on average every year.

The average GDP growth of Sri Lanka has been of 4.7% and it follows a slightly positive trend. In 2017 the economy grew of 3.3%. The first period 1951-1972 presents an unstable growth, reaching the historical minimum of -12% in 1956. This year is the beginning of a period or riots and cultural conflicts called Anti-

Tamil Pogrom against the Tamil minority detaining the most political power at the time. After 1972, the economy grew at an average rate of 5% per year, with a slowdown starting from 2015. Despite being a small island, TO presents a negative trend. In 1950 TO accounted for 76% of GDP and declined of about 3% on average each year, reaching 37% in 1972. From said year, the TO started rising again at an average rate of 1% per year until 2017. The stock of capital, has been increasing on average of 4% each year. The growth has been stronger until 1980, year in which it grew of 8%. Then it started declining dramatically until 1989. After said year there has been a weaker growth. In 2017 the growth rate has been of 6% The GS average has been of 6.63% and together with Vietnam present the lowest spending per GDP. However, it has been increasing starting from 4% in 1950 to 8% in 2017. Growing of 1.7% on average each year.

5.2 Estimation for Indonesia

Before the estimation, the series' stationarity has been tested using the ADF test. All the series resulted to be integrated of order one $I(1)$ rejecting the null hypothesis of non-stationarity in first difference at 1%, with the exception of the log of capital stock per capita that is integrated of order two. The latter, is a common finding for all the countries under examination as the capital stock's first difference is supposed to represent investments and they are known to be already integrated of order one. Nevertheless, the study of the cointegration is going to be performed using the Fully Modified OLS, which seems to be robust to series integrated of a higher order when cointegration is present. Table 5.2 presents the result of the estimations for Indonesia.

Equation IDN_I, is the baseline equation with TO as the only enhancing variable.[12] The equation with GS linked to TO did not provide good results so, for Indonesia, equation IDN_II, has been estimated adding a shift intercept variable of GS, and a trended GS variable. The dummy variable DUMOIL has been added to account for the oil glut of 1982 after the 70s energy crisis. Crude oil represents one of the top three exports of Indonesia.

In Equation IDN_I, the coefficients seems to be all significant at 1%, the trend is positive, but the interaction between trend and TO presents a negative sign meaning that trade openness affects the steady state growth rate in small but negative way. An increase of TO of 10% in fact, should result in a decrease of the SSGR of about 0.07%. TO seems to have an even higher short-run negative effect. The adjustment coefficient, lambda, is 0.33 in absolute value, meaning that the economy is readjusting to its steady state at about 33% each year.

The second equation's coefficients are all significant at 1%. The share of profits coefficient remained similar, far from the stylized value of one third, to the value it has in the baseline equation. The value of trend almost tripled; the coefficient associated to the openness almost doubled reaching a negative 0.013

[12] See equation 4.3 but with only TO

Table 5.2: Indonesia output regression

ECT	IDN_I	IDN_II
Dep. Var:	lny	lny
c	2.272	2.561
	(0.609)**	(0.577)**
lnk	0.589	0.518
	(0.072)**	(0.066)**
Trend	0.013	0.032
	(0.003)**	(0.005)**
Trend*TO	-0.007	-0.013
	(0.002)**	(0.003)**
GS		3.517
		(0.839)**
Trend*GS		-0.146
		(0.036)**
Observations:	57	57
Adjusted R-squared	0,989	0,992

ECM	IDN_I	IDN_II
Dep. Var:	D(lny)	D(lny)
c	-0.024	-0.005
	(0.008)**	(0.005)
λ	-0.332	-0.205
	(0.080)**	(0.065)**
D(lnk)	3.150	3.035
	(0.246)**	(0.269)**
D(lnk(-1))	-1.766	-2.088
	(0.310)**	(0.292)**
D(TO)	-0.064	-0.061
	(0.025)*	(0.027)*
DUMOIL	-0.059	-0.060
	(0.016)**	(0.017)**
D(GS)		0.352’
		(0.206)
Observations:	56	56
Adjusted R-squared	0,819	0,799
SSGR:	1,028%	1,458%

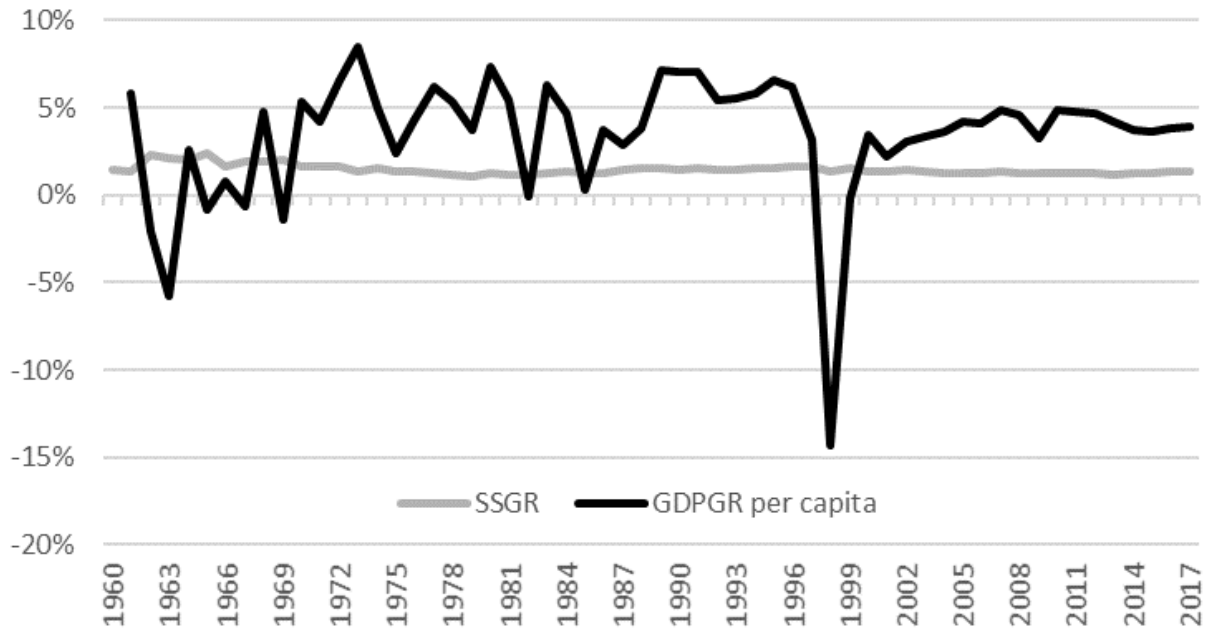
Notes: Standard errors are in round brackets. The level of significance of the coefficients are ** 1%, * 5%, ’ 10%. The ECT is estimated using FMOLS with Newey-West automatic bandwidth selection in for the long-run variance matrix. The ECM is estimated using OLS.

meaning a drop of 0.13% in SSGR while increasing TO by 10%. The share of government spending seems to produce a strong positive effect on the level of income and a strong negative effect on trend. The latter means that an increase in the share of expenditure would affect negatively the SSGR. Its effect on the rate of growth seems far more powerful than the one of TO. Lambda falls at 20% in the second equation meaning a slower adjustment to shocks.

Regarding the average SSGR, equation IDN_II presents a higher level at 1.46% meaning that the difference can be attributed to the decrease of the share of spending in Indonesia. However the adjusted R squared seems to assume a slightly lower value in equation IDN_2.

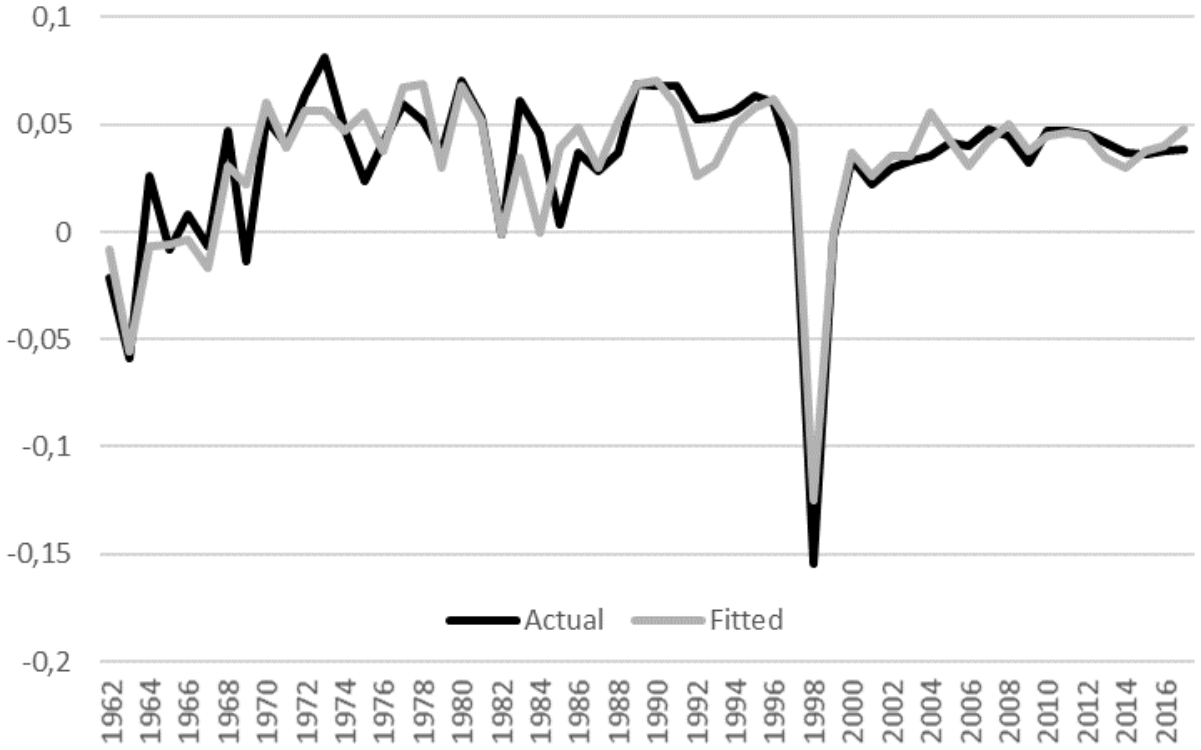
Concerning the cointegration, the test on the residuals of equation IDN_II seem to reject more strongly the non-stationarity null hypothesis at 1%, implying a stronger cointegration among the variables. Equation IDN_I, seems to be cointegrated only at 5%. Both models pass the Jarque-Bera normality test and the autocorrelation LM test, meaning that the residuals are approximately normally distributed and serially uncorrelated. The Breusch Pagan Godfrey test confirms the homoscedasticity of the residuals. Figures 5.2 and 5.3 show the SSGR series and the actual and fitted values of equation IDN_2.

Figure 5.2: SSGR and GDP growth rate per capita for Indonesia



Considering the second equation as the best one, in 2017, the SSGR was 1.38% with a trade openness of almost 40% and a GS of 9%. Reducing TO to half its value, 20%, would increase the SSGR to 1.65%. A SSGR of 2% could be achieved by additionally lowering the GS to about 6%. Still, by looking at the regression

Figure 5.3: IDN_2 Actual and Fitted Values for Indonesia



output, it is clear how the GS effect is the strongest, meaning that even without modifying the value of TO, lowering the GS to 6% would be enough to achieve a 1.83% SSGR.

5.3 Estimation for Taiwan

Table 5.3 contains the results of the models for Taiwan. Compared to the other countries, Taiwan's data fits well in a higher variety of specifications. All the variables result as stationary in first difference but the capital stock per capita.

Specifications TWN_I and TWN_III contain a linear effect of TO while TWN_II and TWN_IV are the equations in which a non-linear version of TO has been adopted. Common to all the models, there a dummy for the energetic crisis in 1974.

In all the four equations, the coefficients are significant. Regarding the long-run relationships, all models present a positive trend that increases slightly following the introduction of GS as a control variable.

Equation TWN_I has low but still negative effect of TO on the trend. Implying that TO is able to reduce the SSGR of the country. On the other hand, the TO seems to influence considerably the change in income per capita in the short-run.

Equation TWN_II, is the version with a non-linear TO, meaning that its effect changes for low and high values of openness. The coefficient is positive 0.003. This means that as TO increases, its effect tend

Table 5.3: Taiwan regression output

ECT	TWN_I	TWN_II	TWN_III	TWN_IV
Dep. Var:	lny	lny	lny	lny
c	3.103	2.824	3.974	4.039
	(0.294)**	(0.310)**	(0.381)**	(0.378)**
lnk	0.499	0.531	0.426	0.501
	(0.036)**	(0.038)**	(0.042)**	(0.035)**
Trend	0.030	0.022	0.032	0.024
	(0.003)**	(0.003)**	(0.003)**	(0.003)**
Trend*TO	-0.004		-0.015	
	(0.001)**		(0.004)**	
Trend*(1/TO)		0.003		-0.024
		(0.001)*		(0.007)**
Trend*TO*GS			0.086	
			(0.029)**	
GS			-1.429	-5.701
			(0.519)**	(1.056)**
Trend*(1/TO)*GS				0.160
				(0.038)**
Observations:	66	66	66	66
Adjusted R-squared	0.998	0.998	0.999	0.999

ECM	TWN_I	TWN_II	TWN_III	TWN_IV
Dep. Var:	D(lny)	D(lny)	D(lny)	D(lny)
c	0.009	0.005	0.013	0.012
	(0.007)	(0.009)	(0.005)*	(0.005)*
λ	-0.170	-0.180	-0.204	-0.181
	(0.075)*	(0.089)*	(0.063)**	(0.066)**
D(lny(-1))	0.311	0.322	0.311	0.396
	(0.106)**	(0.112)**	(0.094)**	(0.108)**
D(Lnk)	1.150	1.199	1.140	1.089
	(0.221)**	(0.229)**	(0.215)**	(0.219)**
D(lnk(-1))	-0.672	-0.664	-0.729	-0.728
	(0.211)**	(0.213)**	(0.212)**	(0.215)**
D(TO)	0.127	0.127	0.121	0.115
	(0.035)**	(0.036)**	(0.032)**	(0.032)**
D(TO(-1))	-0.075	-0.081		-0.067’
	(0.037)*	(0.037)*		(0.035)
DUMOIL	-0.066	-0.064	-0.074	-0.072
	(0.017)**	(0.018)**	(0.016)**	(0.016)**
D(GS)			-0.478’	-0.560
			(0.258)	(0.254)*
D(GS(-1))			0.518	0.539’
			(0.253)*	(0.274)
Observations:	65	65	65	65
Adjusted R-squared	0,685	0,679	0,723	0,722
SSGR:	2,709%	2,667%	3,083%	3,236%

Notes: Standard errors are in round brackets. The level of significance of the coefficients are ** 1%, * 5%, ’ 10%. The ECT is estimated using FMOLS with Newey-West automatic bandwidth selection in for the long-run variance matrix. The ECM is estimated using OLS.

to tapper off. TO produces, in fact, a negative effect on the SSGR. However, such effect is greater for small values of TO and lower for high values.

Equation TWN_III introduces a GS shift variable and the interaction of GS with the effect of TO. In this equation the effect of TO changes to a negative 0.015 which means that an increase of TO of 10% generates a decrease of the SSGR of about 0.15% without GS.

The coefficient of the interaction term *Trend*to*gs* is 0.086 and positive. The result is that, Gs influences the effect of openness. In this specific case, for example, moving from 117% to 200% of TO while keeping the GS at 14%, would decrease the SSGR.

Equation TWN_IV is the extended version of the baseline equation TWN_II. In this case the coefficient of non-linear TO linked with trend is negative at 0.024. This seems more reasonable as it means that low values of TO affect more the SSGR and, as its value increases, the lower its contribution gets. Still, the coefficient of the GS interaction is positive.

For all four equations, the adjustment mechanism remains around 20% indicating a slow adjustment to shocks. Specifications TWN_III and TWN_IV seem to have a higher explanatory power given their adjusted R squared, explaining as much as 72%.

All models pass the cointegration test with respectively 5% for the baseline equations TWN_I and TWN_II and 1% for equations TWN_III and TWN_IV.

The average steady state is reported in the output table as well. The last two models have the highest SSGR and are respectively 3.08% for TWN_III and 3.24% for the TWN_IV. It seems that GS indeed has a role on the effect of TO.

All models pass the tests of normality, serial correlation and heteroscedasticity tests of residuals.

Equations TWN_IV's SSGR and GDP growth are presented in figure 5.4. While the actual and fitted values are in figure 5.5.

Figure 5.4: SSGR and GDP growth rate per capita for Taiwan

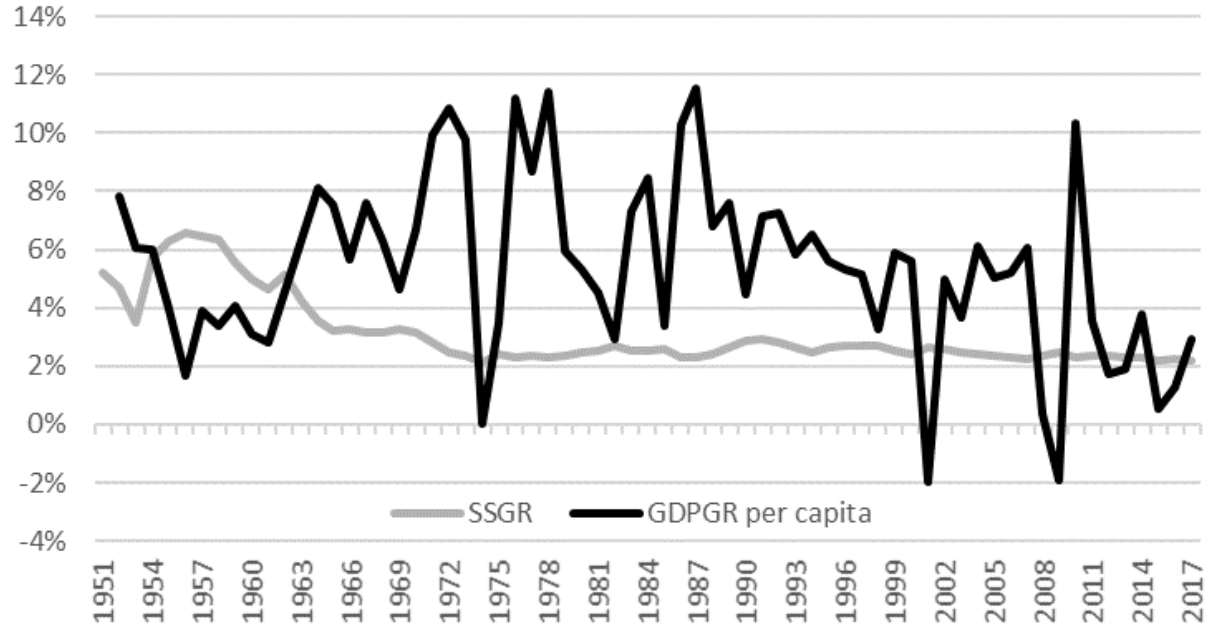
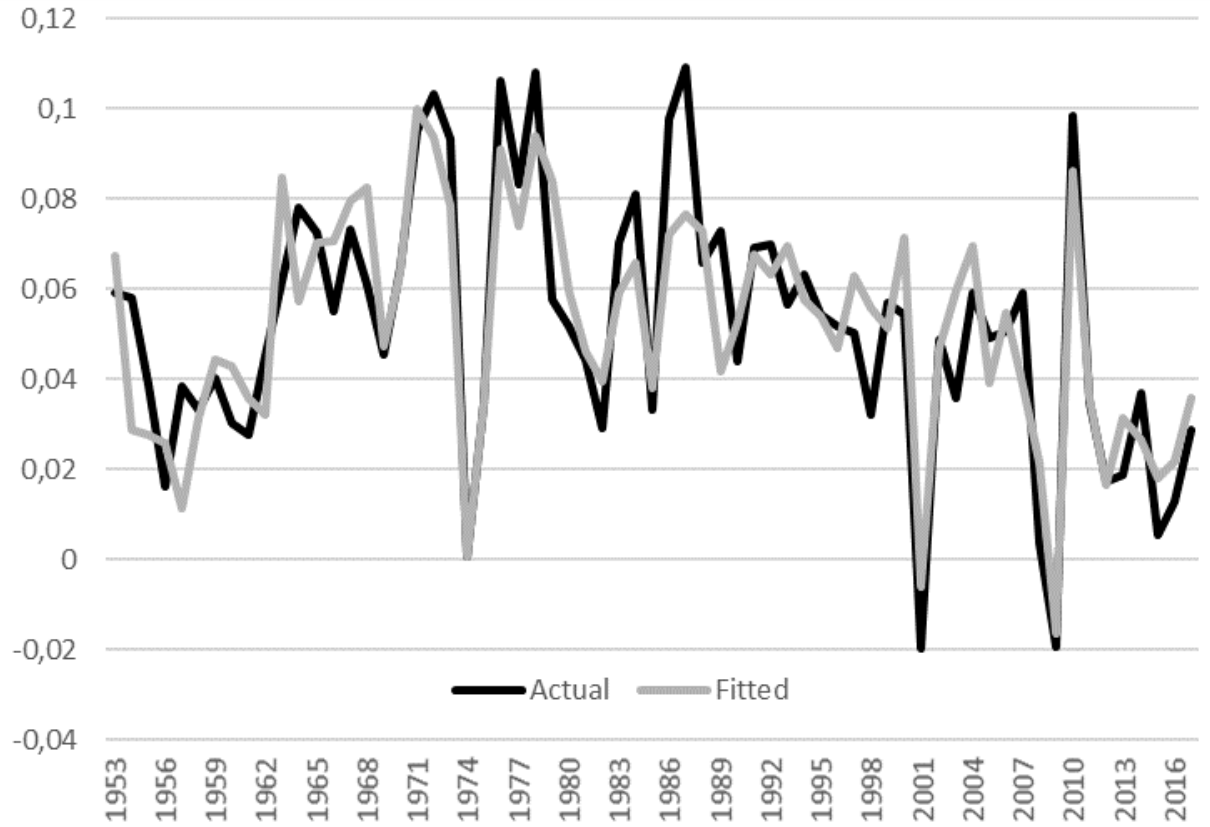


Figure 5.5: TWN_IV Actual and Fitted Values for Taiwan



Taking the fourth specification as the better model, given the high level of TO, 117% of GDP in 2017, an ulterior increase may produce smaller and smaller positive effects on the SSGR. For instance, moving from a TO of 117% to 120% and keeping the GS as it is, 14%, would increase the SSGR only by 0.004%. On the other hand, given the same TO, increasing GS may enhance its effect on the long-run growth. For example, keeping TO at 117%, but bringing the GS from 14% of GDP to 20% would likely allow the SSGR to pass from 2.2% to 3%.

5.4 Estimation for Vietnam

Table 5.4 contains the estimations. Equation VTN_I, as always, represents the baseline equation while, on the other hand, equation VTN_II contains the enhanced ones. Unfortunately, in the latter, the coefficient linked to GS is not significant and every attempt in linking GS to the trend failed. Hence, in this case, the following comments will refer only to the baseline equation VTN_I. All the variables result as stationary in first difference but the capital stock per capita.

For the model, given Vietnamese history, three dummies are needed in order for the ECM to be built correctly. DUMCHI refers to the conflict and cut in commercial relationship with China in 1978, DMREF refers to the start of market oriented reforms after the first five year program in 1980 and then DUMWAR for the years linked to the Vietnam war.

In equation VTN_I, the share of profits is very close to the normal stylized value of one third. The coefficient that refers to the implicit trended variables is a positive 0.020 and the coefficient that links trend with TO has positive but small value of 0.002. This means that an increase of TO of 10% generates an increase of the growth rate of about 0.02%. This, together with equation TWN_IV of Taiwan, are the only ones with a positive effect of TO on the SSGR. An element which is different from what was previously reported for the other countries, is a very high value of lambda which means that the economy comes back to its SSGR after a shock in almost a year. The model seems to explain 84% of the variation of income per capita and the average SSGR is of 2.18%. The model passes all the tests related to the residuals, normality, serial correlation and heteroscedasticity. The variables are cointegrated at 5%.

Figure 5.6 and 5.7 show respectively the SSGR and the actual growth rate of GDP, and how the model fits the data.

Table 5.4: Vietnam regression output

ECT	VTN_I	VTN_II
Dep. Var:	lny	lny
lnk	0.345	0.366
	(0.029)**	(0.034)**
Trend*TO	0.002	0.002
	(0.001)**	(0.003)
c	4.256	4.056
	(0.206)**	(0.247)**
Trend	0.020	0.019
	(0.001)**	(0.001)**
Trend*TO*GS		-0.002
		(0.048)
GS		0.684
		-1.467
Observations:	47	47
Adjusted R-squared	0,998	0.998

ECM	VTN_I	VTN_II
Dep. Var:	D(lny)	D(lny)
c	0.008	0.013
	(0.006)	(0.006)
λ	-0.803	-0.779
	(0.116)**	(0.109)**
D(lny(-1))	0.570	0.534
	(0.078)**	(0.074)**
D(lny(-2))	0.333	0.280
	(0.095)**	(0.087)**
DUMCHI	-0.056	-0.052
	(0.013)**	(0.013)**
DUMREF	-0.059	-0.061
	(0.014)**	(0.014)**
DUMWAR	-0.028	-0.033
	(0.009)**	(0.008)**
Observations:	45	45
Adjusted R-squared	0,846	0,873
SSGR:	2,177%	2,104%

Notes: Standard errors are in round brackets. The level of significance of the coefficients are ** 1%, * 5%, ' 10%. The ECT is estimated using FMOLS with Newey-West automatic bandwidth selection in for the long-run variance matrix. The ECM is estimated using OLS.

Figure 5.6: SSGR and GDP growth rate per capita for Vietnam

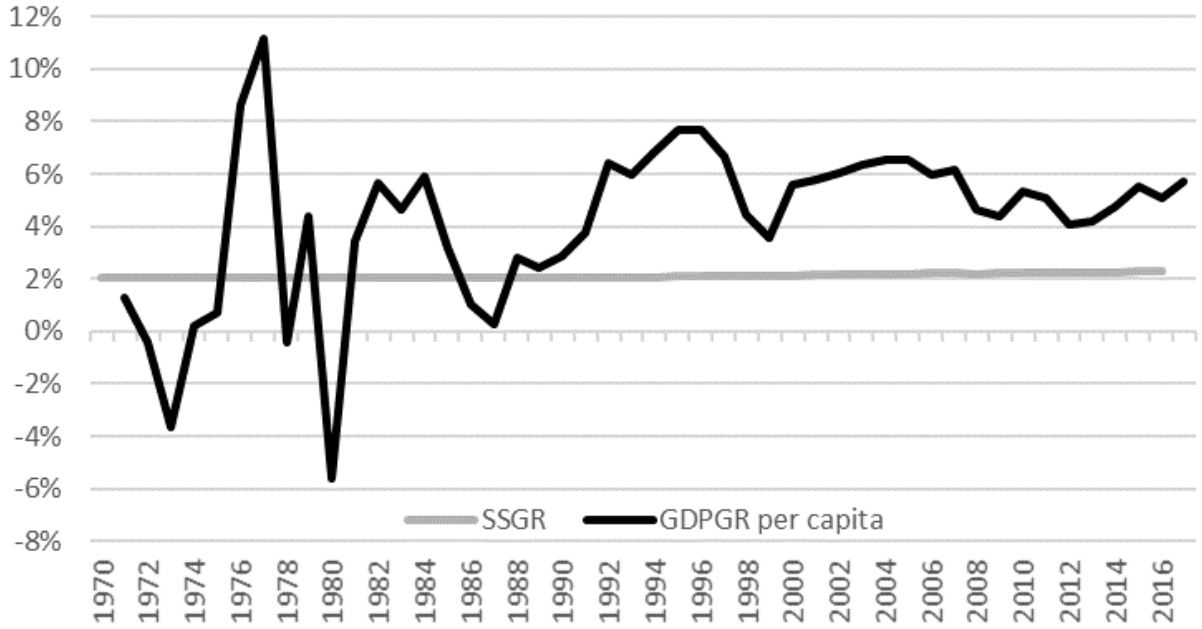
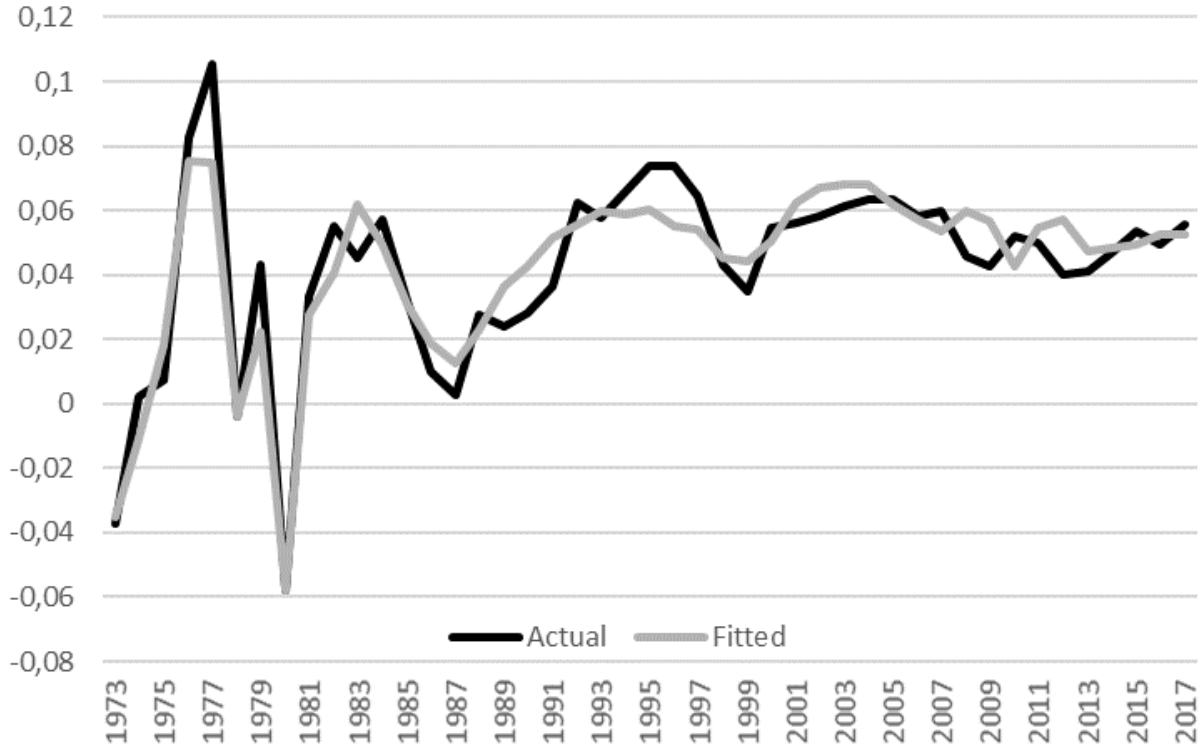


Figure 5.7: VTN_I Actual and Fitted Values for Vietnam



The model show that, if possible, given the already extremely high value of openness, an increase to 260% of GDP would move the steady SSGR only by 0.1 from 2.4% to 2.5%.

5.5 Estimation for Sri Lanka

Tables 5.5 the output of the estimation for Sri Lanka. All series seem to be $I(1)$ but the capital stock per capita that is $I(2)$.

Equation SRK_I is the baseline equation, while equation SRK_II and SRK_III present respectively two specifications with the share of government spending GS. All coefficients are significant. The DUMRIOT dummy presents the social and economic instability of the previously mentioned Anti-Tamil Pogrom. The share of profit is getting closer to the stylized value of one third in equation SRK_III. The trend presents a positive sign in all specifications but with a higher value in equation SRK_III of 0.02.

The TO seems to have a negative effect on SSGR in all the specifications and the negative effect decreased to -0.031 in equation the last equation. A 10% increase in TO, according to this equation, would result in a decrease of 0.3% in the SSGR.

Equation SRK_II and SRK_III contain additionally the effect of GS on TO. Both with positive signs but with drastically different values. Passing from 0.111 to 0.399 after adding a shift variable of GS to the model.

The adjustment mechanism, lambda, remains around 20%, implying a rather slow adjustment. TO seems to have negative effects in the short-run as well. Equation SRK_II seems to possess the higher explanatory power, 77%, while equation SRK_III presents the highest average SSGR, at about 1.55%. All models pass the cointegration test at 5% for equations SRK_I and SRK_II and 1% for the SRK_III equation and the diagnostic tests as well.

Figures 5.8 and 5.9 show the SSGR and the actual GDP growth rate and the fit of the model of SRK_III.

Considering SRK_III as the best one because of the higher level of cointegration, the effect of TO on the trend changes according to the value of GS. Given the situation in 2017, hence TO of 50% and GS of 8.4%, an increase in TO would push the SSGR higher. For example, increasing openness to 80% would move the growth rate from 2.08% to 2.15%. The threshold seems to be when GS assumes a value around 7%. For which the effect of increasing TO becomes negative.

Table 5.5: Sri Lanka regression output

ECT	SRK_I	SRK_II	SRK_III
Dep. Var:	lny	lny	lny
c	0.442	0.980	3.267
	(0.676)	(0.719)	(0.809)**
lnk	0.787	0.726	0.501
	(0.080)**	(0.085)**	(0.088)**
Trend	0.012	0.012	0.020
	(0.003)**	(0.003)**	(0.003)**
Trend*TO	-0.006	-0.012	-0.031
	(0.003)*	(0.004)**	(0.006)**
GS			-6.650
			(1.588)**
Trend*TO*GS		0.111’	0.399
		(0.056)	(0.082)**
Observations:	67	67	67
Adjusted R-squared	0.994	0.994	0.996

ECM	SRK_I	SRK_II	SRK_III
Dep. Var:	D(lny)	D(lny)	D(lny)
c	0.005	0.004	0.010
	(0.004)	(0.004)	(0.004)*
λ	-0.184	-0.237	-0.170
	(0.049)**	(0.053)**	(0.063)**
D(lnk)	2.853	2.696	2.642
	(0.332)**	(0.329)**	(0.345)**
D(lnk(-1))	-2.016	-1.782	-1.915
	(0.320)**	(0.320)**	(0.340)**
D(TO)	-0.202	-0.199	-0.158
	(0.056)**	(0.054)**	(0.057)**
D(TO(-2))	-0.086’	-0.085’	
	(0.051)	(0.050)	
DUMRIOT	-0.131	-0.130	-0.147
	(0.020)**	(0.019)**	(0.020)**
D(GS(-1))		-0.807’	
		(0.458)	
Observations:	65	65	66
Adjusted R-squared	0,760	0,777	0,729
SSGR:	0,834%	0,895%	1,55%

Notes: Standard errors are in round brackets. The level of significance of the coefficients are ** 1%, * 5%, ’ 10%. The ECT is estimated using FMOLS with Newey-West automatic bandwidth selection in for the long-run variance matrix. The ECM is estimated using OLS.

Figure 5.8: SSGR and GDP growth rate per capita for Sri Lanka

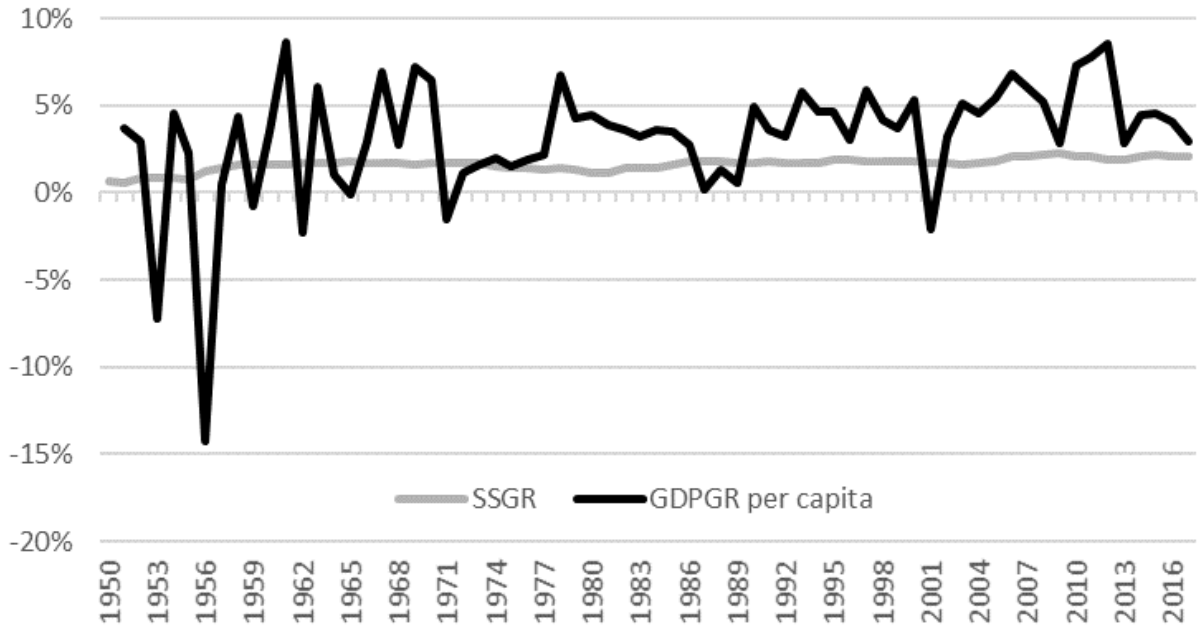
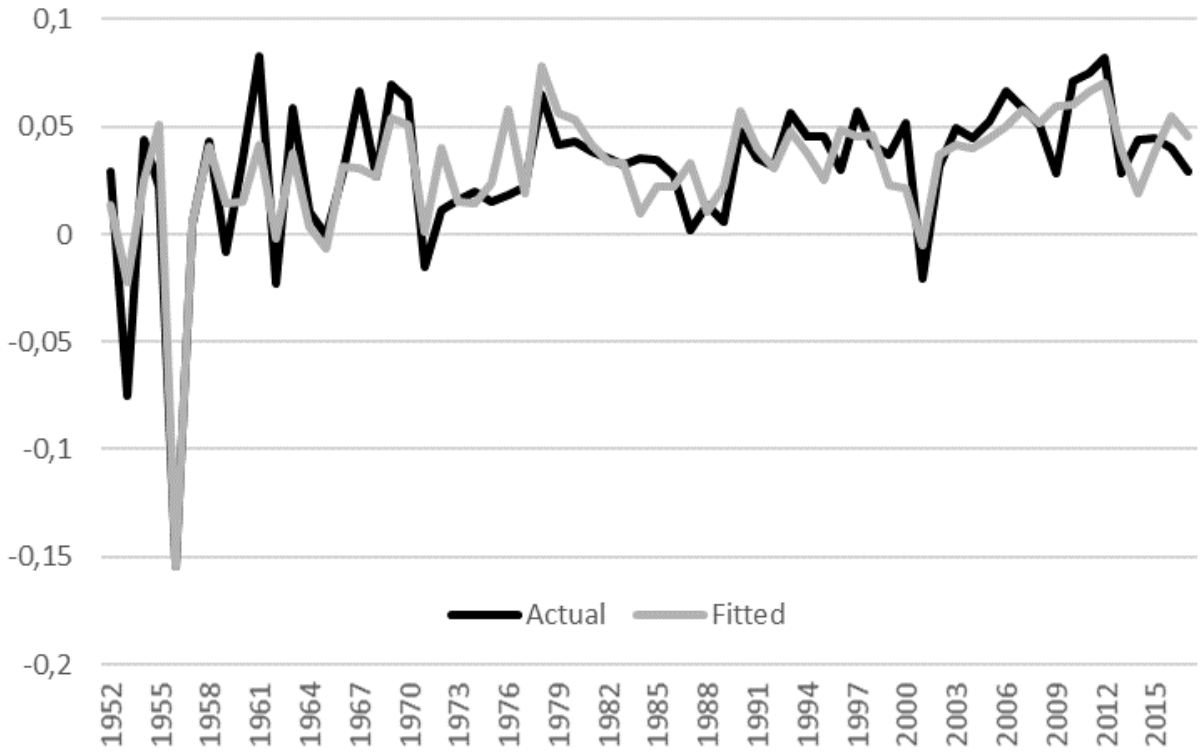


Figure 5.9: SRK_III Actual and Fitted Values for Sri Lanka



Chapter 6

Conclusion

This research project attempts to explain the effect of trade openness on the steady state growth rate of four south Asian countries with the extension of the Solow model of growth in an ECM framework.

Based on the final specifications, two countries, Indonesia and Sri Lanka, present a significant negative small effect of TO on growth. While for the other two, Vietnam and Taiwan, a positive effect has been found. For only two countries, Taiwan and Sri Lanka, the share of Government consumption is able to influence the effect of trade.

It is important to notice that the aforesaid countries can be grouped depending on the goods they trade.

The first group is composed by Sri Lanka and Indonesia, which exports commodities and agricultural products such as tea, oil, palm oil, textile, and similar. Their imports are represented by goods with higher value such as refined petroleum, cars, vehicle parts and telephones. The second group, Vietnam and Taiwan, presents a slightly different pattern. They export goods such as, integrated circuits, office machines, phones and import integrated circuits, refined petroleum, coal and phones.[13]

These differences in trade patterns may justify the effect of TO in this analysis. The main benefit of trade liberalization lies with the ability to import foreign technology and implement it inside firms. Vietnam and Taiwan may have been more capable in taking and using these technologies than Sri Lanka and Indonesia. Still, their positive trade effect is small, and they have already reached a high level of TO. Therefore, an additional increase in openness will not be able to contribute much. This means that they may have not been able to exploit completely these opportunities because of their economic structure or the human capital availability.

For Sri Lanka and Indonesia, additionally, there is the need to introduce or improve policies aimed at using available technology in order to avoid the trap cited, among others, by Grossman and Helpman (1991). Policymakers should be willing to sacrifice part of the short-run effects on growth derived from efficiency gains to allocate resources to potential higher added value sectors that could provide faster

[13] According to the Observatory of Economic Complexity website www.oec.world, visited the 01-28-2021.

growth in the long-run.

Empirically speaking, while the models pass all the tests, they are not immune to shortcomings. The first is the usage of TO as the share of exports plus imports over GDP. Ulasan (2012) argues how this index represents trade volumes and not trade intensity, and it can be affected by many other factors such as the size of the country, the distance and the transportation costs necessary to reach trading partners and so on, implying that adding proxies for said variables may result in an insignificant effect of trade openness on growth.

Another problem might be related to the data. Not all countries present the same quantity and quality of data. In this case, for example, Vietnam had the shortest series, going from 1970 to 2017. In addition, accounting methods may have changed during the years.

To conclude, trade openness presents, generally speaking, an ambiguous relationship with growth and, since the nineties, economists tried to prove one and for all its positive effect by attempting to fix most of the robustness and methodological issues reported since Rodriguez and Rodrik (2000)'s paper. Still, time series approaches, and in particular the one of Rao (2010c), may be helpful for policy suggestions more than solving the aforesaid controversy.

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Appendix A

Data appendix

Y is the real GDP at constant national prices (in mil. 2011US$);

K is the capital stock at constant 2011 national prices (in mil. 2011US$);

L is the population (in mil.);

y and k are the per capita versions, obtained dividing Y and K by L;

TO is computed by dividing the sum of exports at current national prices and imports at current national prices by GDP at current national prices;

GS is the result of Government consumption at current national prices over GDP at current national prices.

All the data has been taken by the PWT 9.1 (Feenstra and Timmer, 2015).