MASTER THESIS

Erasmus School of Economics

What are the impacts of Trade Openness on Economic Growth?

Evidence from high income and upper middle income countries

Master: Economics and Business

Specialization: Policy Economics

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Abstract

This study evaluates the impact of trade openness on economic growth and development. Both past theoretical and empirical research suggests that there should be a positive link between the two. This thesis reexamines this relationship by utilizing the most recent panel dataset using a sample of 139 upper middle-income and high-income countries during the recent 25-year (1994-2018) period. The relationship is estimated using panel instrumental variables fixed effects regression because the relationship between trade openness and growth suffers from reverse causality as countries with higher growth might just be more likely to become open. The estimations in this thesis does not provide robust support for the idea of a positive relationship between economic growth and trade openness.

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Section I: Introduction

There is a wide literature dedicated to the study of the relationship between the trade openness and economic growth. Regardless of the wave of globalization undertaken in the past 40 years, the debate on the relationship between trade openness and economic growth is still somewhat open (Rodriguez and Rodrik, 2001). Although most economists argue that trade openness may enhance economic growth (Romer 1990; Grossman and Helpman, 1990; Edwards, 1998; Jones, 1999; Stone and Strutt, 2009; Bruckner and Lederman, 2012), some argue that the empirical literature often suffers from poor data quality and quantity, not always properly correcting for potential endogeneity, and the research is susceptible to confoundedness because there is no universal agreement as to how trade openness should be measured and operationalized (Krugman 1994; Rodrik 1995; Stock and Yogo 2005).

Moreover, this whole issue became more prominent in recent years. This is mainly due to the recent trade war between the US and China started by the president Trump. Furthermore, under the president Trump US generally became more inward looking, so much so that even *The Economist* dedicated most of its July 11th, 2019 special report to this issue just two months after they dedicated earlier May 16th special report just to trade. While economists generally have positive look on free trade (Feenstra, 2015), the recent trade wars and, at least ideological, retreats of globalization in one of the richest nations on this planet made the effects of trade hot topic again.

The aim of this thesis is to contribute to this debate by reexamining the previous results which show a positive relationship between trade openness and economic growth. This research adopts data from 139 developed and developing countries which are obtained from the World Bank, OECD, IMF and other sources detailed later in the methodology section. As such, the data set used focuses on a 25-year period beginning 1994 to 2018 to examine the exact impact of trade openness on economic growth. The econometric technique adopted to do this appraisal is instrumental variable (IV) approach where property rights index and geographical variables such as equatorial distance and coastline are used as instrument for trade openness. This is to control for potential endogeneity between the economic growth measured by growth rate of GDP and trade openness proxied by the share of combined imports and exports of GDP and alternatively also by export to GDP ratio and trade barriers. The IV estimated presented in this work confirm the previous results which show positive relationship.

This thesis is organized as follows. Section II starts by examining literature materials on trade openness from both empirical and theoretical perspective. The section III examines the methodology and provides description of variables, data and its sources. Section IV presents the results and findings. The thesis concludes in Section V.

Section II: Literature Overview

The past half a century has produced significant amount of economic literature concerning the theory of economic growth. Many economists and academics have tried to identify the drivers of economic growth and attempted to find a model that can explain the observed, and sometimes substantial, differences between growth rates and long run growth paths of individual countries. Early models of economic growth focused on exogenous growth such as the famous Solow-Swan model, where growth is exogenously given by for example the rate of technological growth. However, more recently literature shifted to endogenous growth models in which the rate of economic growth can be higher or lower depending on how economy invests into some factors of production like human capital and in which growth rate can be higher if economy opens up.

In the following sections, the main economic growth theory models will be discussed. The next section starts with discussion the classical Solow growth model. Next, the section on international trade and economic growth discusses first traditional international trade models and their conclusions about the link between trade and growth and then contrasts them with modern endogenous growth theories in which trade actually can affect growth. The third part of the literature overview discuss the empirical literature about the relationship of trade openness on economic growth.

The Solow Model

In 1956, Robert Solow and Trevor Swan independently developed a very similar economic growth model, which in academic literature is sometimes referred to as Solow-Swan model. Their main contribution to the growth theory was extending the previous workhorse growth model, the Harrod–Domar model, to include more factors of production than capital.

The standard Solow-Swan model starts with a description of the production function. The production is determined by capital and effective labor. Therefore, the production function is given by the following expression (Blanchard et al. 2010):

$$Y = F(K, L, A) = F(K, AL) \tag{1}$$

Where, Y is the output (real GDP), K is the capital stock, L is the labor and A is the efficiency of labor (available technology). Hence, the AL together is the effective labor. Moreover, the technology stock *A* is given exogenously. The output is increasing in *K, L* and *A*. In this model we assume constant returns to scale, marginal product of each factor is positive and diminishing. In addition, it is useful to express all quantities in the model as per unit of effective labor (following Blanchard et al. 2010). Doing that and further assuming that $F\left(\frac{K}{AL}, 1\right) \equiv f\left(\frac{K}{AL}\right)$ the production function becomes:

$$\frac{Y}{AL} = F\left(\frac{K}{AL}, 1\right) = f\left(\frac{K}{AL}\right) \tag{2}$$

Furthermore, fraction of output is consumed (this fraction depends on marginal propensity of consumption), and the remaining is saved and is denoted by s. The Solow model assumes, that marginal propensity to consume and by extension the savings rate s is exogenously given and is constant over time. We denote the amount that is saved with sY. Since the model assumes a closed economy, saving and investment must be equal (*I*=*S*=*sY)*, in other words saving and investment rates are the same. Using this fact and expressing both investment and savings per effective worker, and substituting the expression (2) for $\frac{Y}{AL}$ we get:

$$\frac{I}{AL} = \frac{sY}{AL} \Rightarrow \frac{I}{AL} = sf\left(\frac{K}{AL}\right) \tag{3}$$

Next following Blanchard et al. (2010) let us examine the level of investment that would keep the output per worker constant. In this case it is important to account not just for depreciation (denoted here as δ) but also for potential growth rates in an effective labor either due to growth of technology (denoted as g_A) or due to the growth of labor force (denoted as g_L). Hence, we get:

$$\frac{I}{AL} = (\delta + g_A + g_L)\frac{K}{AL} \tag{4}$$

Substituting equation (3) into equation (4) will gives us:

$$sf\left(\frac{K}{AL}\right) = (\delta + g_A + g_L)\frac{K}{AL} \Leftrightarrow sf\left(\frac{K}{AL}\right) - (\delta + g_A + g_L)\frac{K}{AL} = 0 \tag{5}$$

The takeaway from the equation 5 is that in order to keep the amount of capital constant the savings rate or investment respectively has to be such to balance the changes in capital due to depreciation technology growth or growth of labor supply. Now in order to simplify the model let's denote $\frac{K}{AL} = k$ to clean up the equation, and instead of looking for a steady state where the change in capital is zero consider possible change in the rate of capital per effective worker accumulation:

$$\Delta k_t = s_t f_t(k_t) - (\delta_t + g_{At} + g_{Lt})k_t \quad (5)$$

Where Δk_t is the change in capital per effective labor. Furthermore, in order to make it possible to give explicit solution to equation 5 we need to make an assumption on production process. A reasonable assumption is that production will follow standard Cobb-Douglas production function $f_t(K_t AL_t) = K_t^{\alpha}(AL_t)^{(1-\alpha)}$ hence once we express all values in terms of effective labor we get $f_t(k_t) = k_t^{\alpha}$ which is reasonable simplifying assumption on the production process (Blanchard et al. 2010). Substituting the expression of production function into equation 5 gives us:

$$\Delta k_t = s_t k_t^{\alpha} - (\delta_t + g_{At} + g_{Lt})k_t \quad (6)$$

The equation 6 in itself already carries some important lessons of the Solow model. First it shows that when saving rate is larger than the sum of technological progress, effective labor growth and capital depreciation, capital per effective worker increases, which creates capital deepening. On the other hand, if savings rate is lower than those factors capital per worker decreases, therefore causing capital widening.

The equation 6 can be solved as an ordinary differential equation (ODE) which allows us to examine of the rate of capital in long run equilibrium (k*). In this case the closed form solution to this problem is given by:

$$\lim_{t \to \infty} k_t = k^* = \left(\frac{s}{\delta_t + \ g_{At} + \ g_{Lt}}\right)^{\frac{1}{1-\alpha}} \tag{7}$$

Hence, in the long run the capital per effective worker depends only on exogenous factors such as the depreciation, growth of technology and growth of effective labor. According to Romer (2011), "since k is constant at k^*, K is growing at rate n + g (that is, $\dot{K}/K$ equals n+g)" [in his work Romer denotes g_{Lt} as n and g_{At} as g]. "With both capital and effective labor growing at rate n+g, the assumption of constant returns implies that output, Y, is also growing at that rate. Finally, the capital per worker, K/L, and output per worker, *Y/L* are growing at rate g."

The savings rate pays a role too but the savings rate, but this variable is restricted to interval [0,1] as at most 100% of all output can be saved and investment (and even this is unrealistic as it assumes no consumption on right boundary). Hence, in Solow-Swan model the long run growth cannot be achieved just through savings and investment as increase in savings rate can at best lead to one off increase in the capital and hence output (that is increase in savings can only affects the level of growth). Furthermore, in the long run equilibrium steady state savings rate and output also depend on choices of rational utility maximizing agents. In optimum the effective labor should growth at the same rate as effective capital, since if this would not be true it would imply that marginal product of capital is either higher or lower than the marginal product of labor and production could be made more efficient by either accumulating less or more capital respectively.

To see more clearly that the equilibrium solution for *k* determines also the rate of economic growth we can substitute the equilibrium steady state back into the production function (Romer 2011) which gives us:

$$\frac{Y}{AL} = f(k^*) = \left(\frac{s}{\delta_t + g_{At} + g_{Lt}}\right)^{\frac{\alpha}{1-\alpha}} \tag{8}$$

According to both Romer (2011) and Blanchard et al. (2010) already the equations (6) and (7) shows the steady state-equilibrium result shows that in the equilibrium the effective output per worker grows at the rate $g_{At} + g_{Lt}$ but the equation (8) makes this explicit by substituting the result for the steady state rate of capital into the production function.

To go even one step further in making the result more explicit our previous assumption that $k = \frac{K}{AL} \Longrightarrow ALk = K$ since along the balanced growth path $k = k^*$ which implies that *k* is a constant, *K* cannot grow just due to *k*, the only other factors determining *K* beside *k* are *A* and *L*. As mentioned in the set up g_{At} is defined as the growth of technology and $g_{Lt}$is by definition the labor-population growth. Hence just by definition the following must hold $\dot{A}/A \equiv g_{At}$ and $\dot{L}/L \equiv g_{Lt}$. Since $ALk = K$ as shown above, and in the steady state *k*=*k** can be considered fixed the only source of growth of *K* can be *A* and *L* which by pure definition grow at the rates g_{At} and g_{Lt} respectively and consequently $\dot{K}/K = g_{At} + g_{Lt}$. Furthermore, in the equation 1 we assumed that $Y = f(K, AL)$ and the production function was assumed to be a standard Cobb-Douglass, which has a property of constant returns to scale (that is $aF(K, L) = F(aK, aL)$ see Varian, 2004) , *Y* must also grow at rate $g_{At} + g_{Lt}$ and $\frac{Y}{L}$ at rate g_{At} as both *K* and *AL* increase with respect to time with the same factor determined by $g_{At} + g_{Lt}$, since $k = \frac{K}{AL} \Longrightarrow F(ALk, AL)$. Also, since we assumed g_{At} and g_{Lt} to be exogenous the growth must be exogenous as well. Finally, expressing everything in per labor terms what is left is A and K/L and hence growth of Y/L can only be g_{At} (Romer, 2011). Thus, this shows that output growth per labor depends on technological growth only and nothing else (at least within the Solow-Swan model).

Since output Y is commonly measured with GDP, this implies that GDP will grow at this rate as well. Again, as argued by Romer (2011), the intuition for this result is the fact that in steady state capital increases with the technological growth and thanks to the assumption of constant returns to scale the output will increase proportionally with the increasing stock of capital. Moreover, since we care about not just about output but output per worker we can use GDP per capita as reasonable approximation. Consequently, the Solow model predicts that growth of effective output per worker, which can be approximately measured by growth of GDP per capita in the long run is determined solely by the growth of technology g_A.

International Trade and Economic Growth

Traditional international trade models, such as the Ricardian model or Heckscher-Ohlin model, did not directly tried to examine economic growth and rather were focused on explaining trade and showing that specialization can increase production.

The Ricardian model of international trade is one of the earliest international trade models and it is based on comparative advantage. A comparative advantage refers to the country's ability to produce goods and services at a lower opportunity cost relative to its trade partners (Krugman, Melitz, & Obstfeld, 2017). In the Ricardian model, once trade is allowed, countries are specializing in the production of the goods they have comparative advantage in, hence allocating their scarce resources, such as labor, to its most productive use. The comparative advantage arises not from the differences in factor endowments but from the differences in relative labor productivity and technologies. Due to comparative advantage, more goods and services are produced and consumed by both countries, compared to when they produce all goods and services themselves in autarky (Van Marrewijk, Ottens & Schueller, 2012)

The Ricardian model concludes therefore that countries improve their welfare gains and benefit from trade. However, without allowing for technological growth the model itself points only toward increase in the level of economic well-being (Van Marrewijk, Ottens & Schueller, 2012). The reason for this is that once country fully specializes in its comparative advantage and as long as the comparative advantage does not change due to some technological or other shock the increase in welfare is just a one-time event. In practice it may take several years for a company to completely shift its production towards sectors with comparative advantage and hence the increase in level can show on national accounts statistics as an increase in economic growth in short run (Krugman, P. R., Melitz, M. J., & Obstfeld, M. 2017; Van Marrewijk, Ottens & Schueller, 2012). However, once the country fully specializes and raises its welfare to new higher level no further growth is possible in the model unless the technology itself improves (Krugman, P. R., Melitz, M. J., & Obstfeld, M. 2017). However, the option of technology improvement just brings us back to Solow-Swan model that already showed the per capita growth depends only on exogenous technology growth.

Another classic and highly influential trade model is the Heckscher-Ohlin (H-O) model. The H-O model focuses on differences in the relative endowment of factors of production. A classic specification of this model focuses on case of two countries, two factors and two goods model. Moreover, as the Ricardo's model of trade the H-O model is also based on comparative advantage but with a twist. Whereas in Ricardian model it is the difference in productivity and technology between the countries which creates comparative advantage in the H-O model it is the different factor endowment (Feenstra, 2015; Bowen, Hollander & Viaene, 1998).

In addition to the afore mentioned assumption of identical technologies between countries, according to Feenstra (2015), the classical H-O model is based on several other important assumptions. First, the classical H-O model assumes that output exhibits constant returns to the scale. Constant returns to scale imply that if we double the factor inputs that enter the production function the output will double as well. Second, assumption according to Feenstra is that the production technologies between the industries that produce the two goods differ. However, note this does not contradict the afore mentioned assumption of countries having the same production technology as this assumption pertains only to the industry. That is if we for example assume that the two goods in the model are wine and cloth this assumption implies that while both countries have the same production technology the wine and cloth industry don't. Third important assumption according to Feenstra (2015) is that factors are perfectly mobile within their respective countries. This implies, again using wine and cloth as an example, that capital and labor can be moved in a costless fashion between wine and cloth production within country. However, the fourth important assumption is that while factors of production can move between the two industries within the country, they can't cross border. Finally, the model also assumes perfect competition and that prices of commodities are everywhere equal, that there are no trade barriers between them and that factor endowments are not exactly equal between the countries (Feenstra, 2015).

Given these assumptions once countries are allowed to trade in the H-O model, when opening to trade, countries are predicted to export goods that are intensive in its abundant factors of production and import goods that are intensive in its scarce factors of production (Feenstra, 2015; Bowen, Hollander & Viaene, 1998). For example, if the goods are wine and cloth and factors of production capital and labor and we assume that producing wine is labor intensive and production of cloth capital intensive, then a country with higher labor endowment will specialize in wine and country with higher capital endowment in wine.

The intuition for this result is that if a country has, for example, relatively large abundance of labor compared to capital, the labor in such country must be cheaper than capital (Feenstra, 2015). Consequently, the country will be able to also produce the good whose production is intensive to this factor more cheaply which also implies that the country has a comparative advantage in that particular good. This opens possibility for potentially advantageous trade and as a result, countries are better off with international trade compared to autarky situation, since trade allows for specialization that increases the consumption possibilities of the countries and allows for more efficient production trade can lead to increase in GDP (Krugman and Obstfeld, 2000).

As in the Ricardian case this increase in GDP might sometimes occur over several years as specialization in real life can't happen instantly (Krugman and Obstfeld, 2000). Consequently, such increase in a level of GDP can show up on national accounts as a 'short-run' growth. This should however not be confused with sustained long-term growth as in Solow-Swan model. A sustained economic growth in H-O model would require sustained technological growth which would increase the production given the countries factor endowments, but this again just brings us full circle back to the Solow-Swan model. Hence as we can see standard widely used models of international trade in themselves can't explain sustained economic growth and at a best they can predict short run growth which is just a masked increase in the level of GDP.

Endogenous Growth and Trade Openness

The previous sub-section shown that the two traditional and widely used international trade models, trade and trade openness has no effect on long run economic growth. However, more recently new endogenous growth theories challenged this idea. The endogenous growth theory allows for economic growth to be dependent also on policy choices some of which are connected to the trade openness (Romer, 2011).

According to Romer (2011) the endogenous growth models can be thought of as extensions of the Solow and infinite horizons and overlapping generations models. Romer argues that these models "treat capital accumulation and its role in production in ways that are similar to those earlier models [meaning Solow and overlapping generation models]. But they differ from the earlier models in explicitly interpreting the effectiveness of labor as knowledge and in modelling the determinants of its evolution over time."

In principle the Solow-Swan model can be easily augmented to include knowledge as another factor of human capital, but in Solow-Swan model human capital accumulation is modeled in very similar way to savings and capital accumulation and economic growth is still fully exogenous (Mankiw, Romer, Weil 1992). Hence the distinction, according to Romer (2011) is not just the inclusion of knowledge imbedded in human capital, but also the idea that the accumulation of human capital and knowledge in general is not just exogenous but an endogenous process that depends not just on the share of population devoted to producing new knowledge but also on the policy choices such as whether country engages in international trade.

Romer (2011) argues that a necessary precondition for creating model which can capture the endogenous accumulation of knowledge and consequently growth is to model the accumulation of knowledge separately from production. According to Romer this is in most of the endogenous growth models done by explicitly including separate R&D sector that then interacts with the standard production sector which is modeled in ways more similar to the Solow-Swan model. This is one of the defining features of many endogenous growth models including that of Romer (1990), Grossman and Helpman (1991) or Aghion and Howitt (1992).

Next important feature of the endogenous growth trade models is that the production function for goods and knowledge is not identical (Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1992). To be more specific, the production function for goods still follows the same assumptions as the production function mentioned in the Solow-Swan model above. However, the production function for knowledge cannot anymore assume constant returns to scale as according to Romer (2011) such assumption would in case of knowledge production imply that the same discoveries are made twice. This is so because in constant returns to scale if inputs double the output doubles as well which implies that the new inputs are essentially contributing to the production process in the same way as the old ones. Consequently, another feature of endogenous growth models is that they allow for increasing returns to the scale.

Romer (2011) further argues that in the presence of increasing returns to scale in the production of knowledge there is strictly positive relationship between the economic growth and ever-increasing stock of knowledge. According to Romer in such model in contrary to the Solow-Swan model the economy does not converge to a balanced growth path, but the growth is ever increasing.

However, there is no guarantee that the returns to scale are increasing as model in principle allows for them to be decreasing or constant. In the case of decreasing returns to scale the model just converges to balanced growth path like Solow model above. In the third case where the returns to scale are constant the model prediction is ambiguous and depending on exact assumption on the population growth we can see results similar to the ones under increasing or decreasing returns to the scale (Romer, 2011). What makes the model above endogenous growth model is the fact that output per worker is no longer determined just by the exogenous technology growth, but inside the model by the choices of engaging in the production of knowledge.

A several other versions of the endogenous growth models were developed as well. One example of such model is the Learning-By-Doing model (Romer 2011, Arrow 1962). According to Romer, in the learning by doing models the accumulation of knowledge is not “a result of deliberate efforts, but a side effect of conventional economic activity.” In these models, new knowledge is generated as a side effect of capital cumulation, and consequently capital accumulation plays important role. This is because in such models the “increase in knowledge is a function of the increase in capital, the stock of knowledge is function of the stock of capital” (Romer, 2011).

This implies that in this model the long-run growth is a function of savings rate and the growth rate is endogenously determined by the rate of savings in the economy. According to Romer (2011) the intuition behind this result is that in this model the saving rate affects long run-growth because “the contribution of capital is larger than its conventional contribution.” Capital does not increase output just directly but also by its contribution to the development of new ideas.

The most recent truly influential model of endogenous growth is the Paul Romer’s (1990) endogenous growth model. The distinctive feature of the P. Romer’s model is that it is built on solid micro foundations as in this model R&D is performed by profit maximizing agents. Moreover, the model also assumes that different kinds of knowledge are imperfect substitutes for each other and that the producers of R&D have monopoly rights (i.e. patents/copyrights) over their ideas which creates incentives for them to produce these as now they can earn economic profit from doing so (Romer, 2011; Romer, 1990). Furthermore, Romer focuses especially on the cases where new ideas have increasing return to scale (that is when ideas double the output increases more than just twice). The rest of the economy is assumed to be competitive and have constant returns to scale.

Based on the assumptions above Romer (1990) & Romer (2011) derive results which have several implications for economic growth. First, Romer shows that in his model when individuals are less patient fewer workers engage in R&D and so growth will be lower. Second, he also shows that the growth depends on whether different ideas produced by R&D are closely substitutable or not, the second case leading to lower growth. Third, Romer shows that increase in productivity in the R&D sector increases growth as it allows people to produce more ideas. Fourth, population growth in this model leads to increased economic growth as well as it allows more people to be engaged in R&D.

Furthermore, the model has also implications for the effects of international trade on economic growth once we extend it to the international setting. In fact, virtually all trade theories that imply trade has long term effects on growth are just international extensions of the models above. Romer argues this is because the technological rate and production of R&D depends not just on the investment and rate of interest but also on accumulation of human capital. Since international trade allows human capital and R&D or ideas in general to 'spillover' (Grossman and Helpman, 1990) between countries it makes the increasing returns to production from R&D even higher and hence can lead to higher growth.

Furthermore, the fact that ideas generated by high human capital accumulation are more often than not non-rivalrous implies that economic growth and increasing returns to scale are linked, as we saw above in the exposition of the endogenous growth models, the increasing returns to scale from generating new ideas is what contributes to the effect on growth rates. Hence the higher the level of human capital and R&D spillovers will lead to the higher returns to scale which ultimately leads to higher economic growth. Consequently, a conclusion that one can draw from the endogenous growth models that allow for international trade is that knowledge spillovers and transfers of technology that occur thanks to international trade can accelerate the rate of technological growth itself (Grossman and Helpman, 1990; Jones, 1999). As a result, openness of trade is one of the choice variables available to society that can determine the rate of economic growth.

Empirical Literature

Before the early 90s, the empirical literature on the relationship between trade openness and economic growth was almost non-existent. This is not surprising as it can be attributed to the general scarcity of necessary data. However, this has all changed with the seminal work of Dollar (1992) who provided one of the first cross-country examinations of the effect of trade openness on economic growth. Dollar defined the trade openness using real exchange rate distortion and real exchange rate volatility index.

To be more precise, Dollar calculated the real exchange rate distortion using the "international comparison of prices" (Summers, & Heston, 1988) in several steps. First, Dollar estimated the price levels given the country's resource endowment, based on the data provided by Summers & Heston. Second, Dollar uses this "norm" as a point for measuring the relative over and undervaluation. This provides an indirect measure of openness as Dollar argues that it indicates "the extent to which incentives are geared to the domestic or international market," thereby measuring how much the real exchange rate deviates from its free trade equilibrium. Furthermore, the Dallas also further incorporates real exchange variability as the real exchange rate would have less variability in more protectionist countries that can better sustain the under or overvaluation. An "orientation measure" (i.e. the Dollar's trade liberalization measure) is then constructed by taking a weighted average of the both aforementioned measures.

Using the individual components of this measure Dollar showed that in the period between 1976-1985 economies that were more liberalized experienced also higher economic growth. This was done by regressing the average per capita GDP growth rate, over 1976-1985, on the average share of investment in GDP, the real exchange rate distortion and the real exchange rate volatility over the same period. Dollar further shows that the results are more or less robust across separate subsamples of developed and developing nations, and also shows that the average orientation measure tends to correlate highly with the average growth.

These results were later also corroborated by Sachs and Warner (1995) who also show evidence in support of the notion that trade openness and economic growth are linked. Sachs and Warner define an open country as a country that does *not* have any of the following five policies:

1. Nontariff barriers (NTBs) covering 40 percent or more of trade.
2. Average tariff rates of 40 percent or more
3. A black-market exchange rate that is depreciated by 20 percent or more relative to the official exchange rate, on average, during the 1970s or 1980s.
4. A socialist economic system (as defined by Kornai)[1]
5. A state monopoly on major exports (Sachs and Warner, 1995)

Using this measure the authors show that between 1972 and 1989 on average open developing countries grew more than four times faster than closed developing countries, and open developed countries grew about three times the average of closed developed countries. They show this by regressing the real average GDP per capita growth over 1970-89 on the open dummy, set to one for countries that do not met any of the above 5 criteria and zero otherwise, the natural log of real GDP in 1970, a composite pol-dummy indicating extreme political repression, average

[1] Here the authors refer to the Kornai (1992) definition of socialism as a system resembling the systems of Soviet Union member states.

primary and secondary school enrolment rate, average ratio of government spending to real GDP, the average number of revolutions and coups, average number of assassinations per million people, relative price of investment goods, average of the real gross domestic investment as share of real GDP and finally the population density in 1960.

However, the research of Dollar (1992) and Sachs and Warner (1995) was criticized for their focus on only a narrow set of indicators as well as for not properly accounting for endogeneity. One of the largest of these critics at the time was Rodrik (1995) and Krugman (1994) who argued that the relationship between growth and trade openness is rather tenuous. As can be plainly seen from the aforementioned definitions of openness by Dollar and Sachs and Warner, they are rather loose. For example, the exchange rate over or undervaluation and its variability depend not only on how open a country is but also on the general macroeconomic environment the country finds itself in. When it comes to Sachs and Warner definition one can argue that conditions for country being designated as not open like for example condition of having less than 40% tariff rate are completely arbitrary, as there is no meaningful reason to say that the cut-off should be 40% rather than let's say 45% or 35%, which could, of course, change the results substantially. Other conditions are very subjective, like the condition that the country should not follow a socialist system, defined there are 'soviet like' system, which is not exactly precise definition. Furthermore, both authors performed regressions not accounting for possible endogeneity between openness and income. However, it is entirely plausible that it is not that countries that are open grow faster, but that richer countries just choose to become more open and hence the coefficient estimates of Dollar and Sachs and Warner would be biased (Krugman 1994; Rodrik 1995).

As a response to this critique Edwards (1998) conducted a cross-country study of the effect of trade liberalization on factor productivity growth using multiple different indices and trying to control for endogeneity using instrumental variable (IV) approach. To be more specific, Edwards uses the pre-testing period total factor productivity growth, openness, imports to GDP, exports to GDP and the average black-market premium as well as current index off property rights protection provided by the Heritage Foundation and the change in the terms of trade. Since the first five instruments come from the pretesting period Edwards argues that the exclusion restriction should be satisfied, and these should be valid instruments, since they should no longer be affected by the in-sample period growth. When it comes to the latter two, they are argued to be valid even when contemporaneous variables are used because property rights and change in terms of trade can't be conceivably endogenously determined by growth rates. Consequently, the IV regression should provide consistent estimates of the relationship between openness and GDP growth.

Using the IV approach Edwards finds that even after accounting for endogeneity the relationship is still positive. Furthermore, to address the other critique, Edwards show that the positive relationship is robust across all nine different indices of openness he used. The first indicator is the above explained Sachs and Warner indicator, hence its details will not be restated here. The second indicator is the World Development Report Outward Orientation Index, which classifies countries into 5 categories based on perceived openness (provided by the World Bank). The third indicator is the Leamer's Openness Index (Leamer, 1988), which measures openness by the average residuals from disaggregated trade flows regression. The fourth was the average black-market rate premium for foreign exchange during the 80s (provided by Barro and Lee, 1994), as it is argued that the more open country is the less premium there will be. The fifth measure is the average import tariff for 1982 on manufacturing (provided by UNCTAD and Barro and Lee, 1994). The sixth measure is the average coverage of non-tariff barriers (provided by UNCTAD and Barro and Lee, 1994). The seventh measure is the Heritage foundation index of distortions in international trade, which measures the extent to which government policy distorts trade on scale 1 to 5. The eight measure is the collected trade taxes ratio, which was averaged over the period 1980-85 as a ratio of total revenues on taxes on international trade, including both exports and imports, to total trade (calculated by Edwards based on raw IMF data). The ninth index is the Wolfs (1993) index of import distortions which is a regression-based index of import distortions in 1985.

Furthermore, Edwards (1998) also shows that his results are robust to the functional specification of the model and time period. However, while the Edwards work also made a great deal of progress on dealing with endogeneity the issue could not be fully addressed with the data available to him. This is mainly due to generally small data availability. Most of Edwards regressions include only about 32-71 observations. This is an incredibly small sample. While this is understandable given the constraints of the time it also casts doubts on validity of the study as given the number of coefficients there is not enough data to even justify large sample properties of regression estimators, which according to Verbeek's (2008) handbook, by rule of thumb, require at least 30 observations per independent regressors. Furthermore, Edwards includes only one other controls beside the main variable of interest and the instruments which is the level of human capital based on measurements of Nehru and Dhareshwar (1993). This being said it was still a substantial improvement over the previous literature that was riddled with similar problems and in addition, did not even try to address the endogeneity issue and hence the paper still became very influential. Furthermore, these results were later confirmed by Wacziarg (2001) and Irwin and Terviö (2002) who conducted similar research taking advantage of greater data availability. For example, Irwin and Terviö also estimate IV like Edwards but their dataset already includes between 52-896 observations for cross-sectional analyses and even more for panel data analyses. Furthermore, they also included more controls such as the proximity of countries, dummy for countries sharing a border, log of population and area for both trading partners and the dummy for a landlocked country.

Since Edwards' (1998) influential paper numerous attempts were trying to improve on the drawbacks of the empirical literature. For example, Berg and Krueger (2003) took advantage of greater data availability and analyzed the relationship not just on cross country but also on industry and firm level. This was done by studying how on the firm level productivity changes in responses to trade liberalization. The positive relationship between economic growth and liberalization is inferred from the fact that the productivity is shown to grow faster in sectors engaged in trade that expanded thanks to liberalization. However, their work did not really addressed endogeneity as it was argued that from the firms' perspective the trade liberalization represents exogenous shock as in the research case it was shown it could not be anticipated. This was further corroborated by Lopez (2005) who showed in his literature review of empirical research using the plant-level data on effect of trade liberalization on productivity and economic growth that most studies point toward positive relationship.

More recently, Bruckner and Lederman (2012) found that in Africa openness, measured as sum of imports and exports over purchasing power parity (PPP) GDP, increased the long-run economic growth by 0.8 percent. These authors estimate a panel IV regression where they analyze the within-country variation in trade openness using the country's rainfall (which in sub-Saharan Africa is strongly correlated with growth) as an instrument and also control for variables like civil war, average trade weighted OECD GDP growth, Polity IV scores which measures political regime characteristics in terms of how democratic or autocratic they are (See Marshall, Jaggers & Gurr, 2009 which provide the score) and the time invariant unobservables using fixed effects.

However, at the same time, empirical papers are showing that the link between openness and growth is not completely clear cut. For example, Stone and Strutt (2009) show that trade leads to the development of infrastructure which is necessary to carry it, and further argues that it is the continuous infrastructure improvement that creates the link to economic growth. Other authors such as Cheng et al., (2005) also provide empirical support for this idea. Cheng et al. apply the generalized method of moments (GMM). GMM also controls for endogeneity using instruments like IV but it is estimated in semi-parametric way where coefficients are estimated based on the moment conditions as opposed to IV where coefficients are estimated using by minimizing the sum of squares or in some panel settings with maximum likelihood estimator. An advantage of GMM over traditional panel models is that it is consistent and efficient even in cases where maximum likelihood estimator or estimators based on minimizing the squared residuals are not (for more detail see the treatment of GMM in Verbeek, 2008). The authors apply GMM to a large panel of countries and show that the effect of openness on economic growth is conditional on a wide range of factors. Namely, these factors include not just the improvement in infrastructure, but also by deepening markets, freeing labor markets, investments in education and human capital accumulation in general. Yet other scholars like Cauadros et al. (2004) show evidence that trade openness is not enough for sustained growth if it is not accompanied by financial liberalization. Here financial openness refers to process that includes opening up capital markets and removing excessive government regulation and involvement in financial markets as well.

Generally, evidence points towards a positive relationship between trade openness and economic growth. Yet the literature is not completely settled either. The reason for this is that the question is riddled with measurement error and endogeneity issues that are difficult to resolve even with cutting edge econometric techniques. The measurement error issues stem not only from the fact that openness cannot be measured directly and has to be proxied but also from the fact that there is no general agreement on how to measure openness as was shown earlier in this chapter. The endogeneity issue is difficult to solve in general, especially because it is not so easy to find valid instruments that satisfy not just the exclusion criterion but also provide strong and meaningful first stage. Furthermore, especially in the older literature the instruments were often not subject to rigorous testing for these qualities as they are now (Stock and Yogo 2005). Methods such as vector auto-regressions or structural models that do not rely on the use of instrumental variables can be very data intensive which was until recently a serious impediment to empirical analysis in this area and are rarely if ever applied to this problem. These issues make the positive results open to question especially when it comes to the precise nature of the link between economic growth and trade openness. Nonetheless, even despite these concerns the evidence still tilts towards the positive relationship between trade openness and growth.

This analysis tries to improve upon the previous literature by utilizing larger sample and number of control variables than previous research. Especially the latter is quite important as omitting relevant regressors that also affect growth can lead to bias if these excluded regressors correlate with other independent regressors. Furthermore, this work specially focuses on more recent time period (1994-2018) than previous work. Otherwise, this work is closely related to the research of Bruckner and Lederman (2012) which also uses IV approach and measures openness as trade share.

Section III: Methodology and Data

The main objective of this study is to examine the impact of trade openness on economic growth in the country. This is done using a pooled cross-section instrumental variables and panel fixed effects instrumental variables (IV) model. The main reason why pooled cross-section and panel IV is used is the underlaying endogenous relationship between openness and economic growth. As was already pointed out in the previous section, an endogeneity between these two variables is a serious concern, as it is very likely that countries which are richer and grow faster could just be more likely to open up (Krugman 1994; Rodrik 1995; Edwards 1998; Bruckner and Lederman, 2012). Since the variables simultaneously determine each other not correcting for this would bias the coefficient estimates which, in standard regression, are estimated under assumption that the relationship is exogenous. The main reason why one of the model specifications is estimated as pooled cross-section is the inclusion of time invariant geographical variables although also some of the models that do not suffer from this are estimated as a pooled cross-section as well.

The IV approach solves the endogeneity issue by estimating the model in two stages. The first step involves estimating a relationship between exogenous instruments and the endogenous regressor. In second stage regression is performed not with the actual values of the endogenous regressor but with the predicted values of the endogenous regressor. Since the predicted values depend on fully exogenous and exclusive regressors these values represent the exogenous variation in the independent variable (trade openness) and make the second stage less biased compared to OLS with bias going to zero in limit as the strength of the instruments increases (Angrist & Pischke, 2008).

In this work the relationship between the openness and economic growth is estimated using two distinct specifications. The first specification is based on panel fixed effects regression. The second specification pooled cross-section because the instruments used in this specification are geographical and consequently time invariant. Moreover, moving average version of these models and a version that regresses economic growth on growth of openness are estimated as well.

Main Models

The specification of the main models, both the panel fixed effects and pooled cross section which do not involve moving averages are presented below. Moreover, the models below are also tested for non-linearity using Ramsey's general specification RESET test (see the appendix). Since the Ramsey's RESET tests cannot reject the null of no misspecification, the functional form of equations 8 and 9 is likely miss-specified which may indicate that non-linearity might be present (Verbeek, 2008). In order to correct for the potential non-linearity natural logs of all continuous (non-discrete) variables, such as GDP per capita, openness measures, geographical controls and property right index are taken as this was the best way of correcting for potential non-linearity.

Panel Fixed Effects IV Specification:

$$y_{it} = \beta_0 + \beta_1 \hat{O}_{itj} + \beta_2 I_{it} + \beta_3 \pi_{it} + \beta_4 IND_{it} + \beta_5 DC_{it} + \beta_6 FDI_{it} + \beta_7 H1_{it} + \beta_8 H2_{it} + \beta_9 H3_{it} + \beta_{10} H4_{it} + \beta_{11} TFP_{it} + \beta_{12} GR_t + \beta_{13} E_{it} + \beta_{14} G_{it} + + \beta_{15} POP_{it} + a_i + \gamma_t + \varepsilon_{it} \tag{9}$$

$$O_{itj} = \alpha_o + \alpha_1 PRI_{it} + \alpha_2 I_{it} + \alpha_3 \pi_{it} + \alpha_4 IND_{it} + \alpha_5 DC_{it} + \alpha_6 FDI_{it} + \alpha_7 H1_{it} + \alpha_8 H2_{it} + \alpha_9 H3_{it} + \alpha_{10} H4_{it} + \alpha_{11} TFP_{it} + \alpha_{12} GR_t + \alpha_{13} E_{it} + \alpha_{14} G_{it} + + \alpha_{15} POP_{it} + a_i + \gamma_t + e_{it} \tag{10}$$

Non-linearity Adjusted Specification:

$$\ln{(y)}_{it} = \beta_0 + \beta_1 \ln{(\widehat{O})}_{itj} + \beta_2 I_{it} + \beta_3 \pi_{it} + \beta_4 IND_{it} + \beta_5 DC_{it} + \beta_6 FDI_{it} + \beta_7 H1_{it} + \beta_8 H2_{it} + \beta_9 H3_{it} + \beta_{10} H4_{it} + \beta_{11} TFP_{it} + \beta_{12} GR_t + \beta_{13} E_{it} + \beta_{14} G_{it} + + \beta_{15} POP_{it} + a_i + \gamma_t + \varepsilon_{it} \tag{11}$$

$$\ln{(O)}_{itj} = \alpha_o + \alpha_1 \ln{(PRI)}_{it} + \alpha_2 I_{it} + \alpha_3 \pi_{it} + \alpha_4 IND_{it} + \alpha_5 DC_{it} + \alpha_6 FDI_{it} + \alpha_7 H1_{it} + \alpha_8 H2_{it} + \alpha_9 H3_{it} + \alpha_{10} H4_{it} + \alpha_{11} TFP_{it} + +\alpha_{12} GR_t + \alpha_{13} E_{it} + \alpha_{14} G_{it} + \alpha_{15} POP_{it} + a_i + \gamma_t + e_{it} \tag{12}$$

Pooled Cross-Section Specification:

$$y_{it} = b_0 + b_1 \hat{O}_{itj} + b_2 I_{it} + b_3 \pi_{it} + b_4 IND_{it} + b_5 DC_{it} + b_6 FDI_{it} + b_7 H1_{it} + b_8 H2_{it} + b_9 H3_{it} + b_{10} H4_{it} + b_{11} TFP_{it} + b_{12} GR_t + b_{13} E_{it} + \gamma_t + \varepsilon_{it} \tag{13}$$

$$O_{itj} = a_o + a_1 GEO_{ik} + a_2 I_{it} + a_3 \pi_{it} + a_4 IND_{it} + a_5 DC_{it} + a_6 FDI_{it} + a_7 H1_{it} + a_8 H2_{it} + a_9 H3_{it} + a_{10} H4_{it} + a_{11} TFP_{it} + a_{12} GR_t + a_{13} E_{it} + \gamma_t + e_{it} \tag{14}$$

Non-linearity Adjusted Specification:

$$\ln{(y)}_{it} = b_0 + b_1 \ln{(\widehat{O})}_{itj} + b_2 I_{it} + b_3 \pi_{it} + b_4 IND_{it} + b_5 DC_{it} + b_6 FDI_{it} + b_7 H1_{it} + b_8 H2_{it} + b_9 H3_{it} + b_{10} H4_{it} + b_{11} TFP_{it} + b_{12} GR_t + b_{13} E_{it} + b_{14} G_{it} + b_{15} POP_{it} + \gamma_t + \varepsilon_{it} \tag{15}$$

$$\ln(O)_{itj} = a_o + a_1 ln(GEO)_{ik} + a_2 I_{it} + a_3 \pi_{it} + a_4 IND_{it} + a_5 DC_{it} + a_6 FDI_{it} + a_7 H1_{it} + a_8 H2_{it} + a_9 H3_{it} + a_{10} H4_{it} + a_{11} TFP_{it} + a_{12} GR_t + a_{13} E_{it} + a_{14} G_{it} + a_{15} POP_{it} \gamma_t + e_{it} \quad (16)$$

However, these are all the most general specifications as some of the models actually never include all of the variables above. In all specification the first equation is the second stage and second equation the first stage. The dependent variable y_{it} is the real GDP per capita of country *i* at time *t*. The reason why level of GDP per capita was used instead of growth as in rest of the literature is that it was necessary to take the log of GDP per capita in order to circumvent the non-linearity concern. Moreover, even though it is well known level of GDP contains unit root in fixed effect models, time invariant and entity invariant factors are accounted for because of the fixed effects method adopted, so levels can counter the unit root. Furthermore, the reason why the same set of controls was used both in first and second stage is that this thesis tried to be conservative and hence it uses controls that were economically and statistically significant in terms of magnitude and p-value amongst the two stages in order to get conservative estimate for the true effect and consistency.

The main regressor O_{itj} is the measure of trade openness in country *i* at time *t* and using indicator *j* as this thesis, following the past literature, uses multiple indicators of trade openness, namely the trade share and export share, hence *j* = {trade share, export share}. This is done because there is no general agreement on which indicator of openness is the best and consequently most research employs multiple indicators in order to see if the results are robust when the openness is measured in a different way (Frenkel and Romer 1999). Trade share is defined as exports plus imports divided by GDP that is $(X_{it} + M_{it})/GDP_{it}$ for country *i* at time *t*, which is one of the proxies for openness used across the literature (Frankel and Romer, 1999; Menyah, Nazlioglu & Wolde-Rufael, 2014; Bruckner and Lederman, 2012). Next the export share is defined as exports over GDP, that is X_{it}/GDP_{it}. Again, this is one of the common ways to measure economic openness throughout the literature (Frankel and Romer, 1999; Menyah, Nazlioglu & Wolde-Rufael, 2014; Bruckner and Lederman, 2012). It is also worth noting that these are not the only way of measuring openness, and as the literature review of previous empirical work showed many authors choose to define openness in different terms and using different measures openness to see robustness of the results. In fact, since the influential work of Edwards (1998) many authors use more than half a dozen different measures of openness, but due to time constraints this work focuses only at the above mentioned two. Nonetheless, defining openness in these two terms as opposed to other approaches mentioned in previous section has several advantages. First, as opposed to some other measures, described in the previous section, composite data for these measures are easily available. Second, measuring trade openness as a categorical variable using dummy approach often results in a variable that is time invariant as many countries don't change sufficiently to switch categories from trade to no trade (Bruckner and Lederman, 2012). This poses a problem when applying fixed effects models which use the within estimator where all time invariant variables drop out of estimation (Verbeek 2008). The data for the trade share are again obtained from the World Bank (2019) and OECD (2019). As discussed in the previous chapter most research points toward positive relationship between growth and trade openness hence here it is also expected that the estimated relationships will be positive.

To control for the simultaneous relationship between economic growth and openness the second stage uses the estimated values of openness $\hat{O}_{itj}$ and actual openness is used as dependent variable in the first stage where it is regressed on instrument namely the property rights index. The property rights index PRI_{it}, for country i at time t, provided by the Heritage Foundation (2020). The property rights index is a subpart of the overall economic freedom index calculated by the organization and measures how the property rights are protected in a given country (see more detail in Appendix III below). The reason why property right index should be a good instrument is that there should be no endogenous relationship between the rate of growth and the property right index, but strength of property rights should still be good predictor of trade openness. This is because nations with stronger property rights tends to be more open and engage in trade more (Edwards, 1998). However, a downside of the property right index is that it could also affect output through channels different than the just due to openness as arguably institutions affect growth in ways other than through the trade (Acemoglu, & Robinson, 2012). Nonetheless, despite this downside it is also one of the classic instrumental variables used through the past and highly cited work, including Edwards influential work (Edwards, 1998). Furthermore, even the works cited in the empirical section that do not use PRI directly are using different proxies of institutional quality (see Bruckner and Lederman, 2012). Thus, this work includes PRI as an instrument as well. Some models also use log of PRI to correct for non-linearity and because it is a continuous variable.

The second set of instruments that are used in the pooled cross-section models are the geographical variables, coastline measured in km and equatorial distance measured from capital GEO_{ik} of country i, where k= {coastline. equatorial distance}. The data on number of kilometers with coastline, latitude and longitude of capital, which were used to calculate the distance are obtained from the CIA (2020) factbook data. The length of the coastline is measured as the total length of the boundary between the land area (including islands) and the sea. Since sample contains considerable number of countries with no coastline and also few countries with zero equatorial distance but log of the geographic variable had to be taken to correct for non-linearity, these have been excluded for the estimations which is important to keep in mind when interpreting the results. The logarithm was also taken since geography is continuous.

The geography should be able to serve as a valid instrument as it is exogenously determined and geography also effects trade, especially the coastline which allows for sea transport (Krugman et al. 2000). However, as in the previous case an argument could be made that geography can affect GDP even through channels others than trade as Diamond (1998) argues that unfavorable geography stifles economic development. However, the link between geography and development and hence also growth is arguably weaker than for the institutions (Acemoglu, & Robinson, 2012). Consequently, the geography should be more suitable instrument and it is also often included in the previous literature on the topic (see Bruckner and Lederman, 2012). After describing the main variables of interest and the instruments move onto the control variables. The control variables always enter models unadjusted in accordance with the Conditional Independence Assumption the adjustments were only made to the main variables that is the instruments, the independent and dependent variable because we cannot make any causal interpretations of the controls and insofar as they are purposive to control and isolate the effect of the independent variable on the dependent variable we do not need to make any adjustments.

First important control that is included here is investment. Although as Solow-Swan model shows that investment can’t lead to long run growth, it could still lead to a short run growth and hence affect the GDP per capita growth rate positively in some cases. Furthermore, to the extend this investment goes to R&D and other tasks that contribute to accumulation of human capital, it could even have effects on long run growth as shown in endogenous growth models which were discussed in the previous chapter (Romer, 1990; Grossman and Helpman, 1990; Jones, 1999; Adhikary, 2011). The rate of investment, I_{it} for a country *i* at a year *t*, is proxied by the gross capital formation, which is only consists of the domestic investment, the data are retrieved from World Bank (20190 national accounts data and OECD (2019) National Accounts. It is expected that the estimated coefficient of investment on growth will be positive.

Next, inflation π_{it} for country *i* at a year *t* is used as a proxy for macroeconomic stability. The reason why it is important to control for inflation is that while low to moderate inflation might have stimulating effect for economy, as it helps to reduce real wages when nominal wages remain sticky (Romer, 2006), high levels of inflation are detrimental. High levels of inflation introduce additional uncertainty to economy, menu costs (price changing costs), and at very high levels can make transaction physically difficult (Gillman et al., 2004; Fountas et al., 2006; Mankiw 2007). Furthermore, generally high levels of inflation seem to be a symptom of wider macroeconomic problems, since high levels of inflation are results of excessive increases in money supply which usually occur when government is unable to raise enough taxes to cover its expenses and already has large debt (Fountas et al., 2006; Mankiw 2007). Hence it is expected that the inflation rate will be negatively related to economic growth. The inflation is measured as a growth of the GDP deflator by the original sources and the data are retrieved from World Bank (2019) national accounts data, and OECD (2019) National Accounts data.

Another important control is the level of industrialization IND_{it} of country i at time *t*. Controlling for industrialization is important because historically most countries grow after transitioning from preindustrial agrarian societies to industrialized countries. This is not because industrialization itself would necessary increase growth, but rather industrialization is a good proxy for increased stock of technology, urbanization and increase in quality of institutions since these are in most cases factors that allow the industrialization in the first place (Jun, 2002; Moreno-Brid, Santamaria, & Rivas Valdivia, 2005). This research uses industrial share of the GDP in an economy as a proxy for both industrialization and technological advancement. The data for industrial share is again obtained from World Bank (2019) and OECD (2019).

As was explained in the review of empirical literature economic growth is also determined not just by trade openness but also by opening up financial markets (Cauadros et al. 2004). Furthermore, the availability of credit within an economy helps to promote growth and development as it increases access to capital for investments. The banking sector includes monetary institutions and deposit money banks. This is also confirmed by Hassan et al. (2011) who finds that proxies for financial development, such as domestic credit provided to the private sector, are positively related to economic growth. This work is also going to use the domestic credit as a share of GDP DC_{it} for a country *i* at a time *t.* The data domestic credit are retrieved from International Monetary Fund (2019), World Bank (2019) and GDP estimates from OECD (2019). Finally, the last control variable included in this study is the foreign direct investment FDI inflows. FDI inflows FDI_{it} for country *i* at time *t* are here defined as net inflows of investment to acquire a lasting management interest, meaning 10 or more percent of all stocks. The data are obtained from World Bank (2019) and IMF (2019) Li and Liu (2005) find that FDI has a direct positive impact on economic growth, as well as indirectly though interaction with human capital. The mechanism responsible for this is the fact that FDI often imply not just simple movement of money but also knowledge and know how. Moreover, Zhang (2001) finds that FDI boost the host economic growth, however the extent to which FDI is growth-enhancing mainly depend on country-specific characteristics. Particularly FDI is promoting economic growth when host countries improve education and therefore human capital conditions, encourage export oriented FDI, and maintain macroeconomic stability (Zhang, 2001).

Variables $H1_{it}$, $H2_{it}$, $H3_{it}$ and $H4_{it}$ are different measurements of human capital. $H1_{it}$ proxies the human capital by measuring the average years of schooling person in given country gets. To be more specific this is measured as mean years of schooling (ISCED 1 or higher) for population of 25+ years for both sexes. Second, by the proportion of people with bachelor's degree or higher (Educational attainment at least bachelor's or equivalent (ISCED 6 or higher), population 25+ years, both sexes (%)). Third, by the proportion of people having master degree or higher (Educational attainment at least master's or equivalent (ISCED 7 or higher), population 25+ years, both sexes (%)). Fourth, by the proportion of the people having PhD degree or higher (Educational attainment doctoral or equivalent (ISCED 8), population 25+ years, both sexes (%)). These data are collected directly by the UNESCO Institute for Statistics. The past literature did not settle on precise measure of human capital and many past works create extra robustness checks using different measurements. However, this work goes another route and uses all these different proxies for human capital within the same model. This was done because those were revealed to be of statistical significance in the GTOS tests.

Next the total factor productivity, is included as well. The reason why total factor productivity is included is that it is often considered a measure of exogenous technological growth as it is calculated as a residual from estimation of production function where the changes in inputs are accounted for. Consequently, lagged growth of total factor productivity is often used as an explanatory variable when it comes to estimating growth in context of this research they could be considered the portion of the growth explained by exogenous technology growth predicted Solow model (Comin, 2010). In this research the total factor productivity is included on its level and in contemporaneous form however because in this research it is a control variable and thus in accordance with conditional independence assumption it cannot be causally interpreted, and it does not need to be adjusted.

The data on total factor productivity, also known as Multifactor productivity, are obtained from the OECD (2020) multifactor productivity dataset. The total factor productivity reflects the overall efficiency with which labor and capital inputs are used together in the production process. The OECD estimates total factor productivity by measuring the changes in residual GDP growth that cannot be explained by labor and capital inputs. Furthermore, OECD measures it as an index with a base year 2010.

The GR_t is a Great Recession dummy that is set to equal 1 for 2007, 2008 and 2009. The reason why this dummy was included was that one of the tests that were done when estimating the model presented here was the breakpoint test. These tests were performed for several reasons. First, the time series plots of these series that were done as part of the pre-testing show patterns that seem to be consistent with structural break in this series. Second, the sample used in this study spans from 1994-2018. This includes the turbulent years of the Great Recession that started in 2008 and propagated throughout the world (Romer, 2011). Many scholars agree that the Great Recession might plausibly lead to regime change in ways how economy is managed and challenged neoliberal consensus that was dominant in the pre-crisis era. For example, there is clear evidence for a regime change in a ways how monetary policy (Davig & Doh, 2014; Baumeister, & Benati, 2010), fiscal policy and even attitude towards trade and globalization in the post crisis period (Eichengreen, 2014, Steger, 2017).

Moreover, some scholars also argue that recently many countries, especially the developed countries that comprise significant portion of the sample used in this study, entered an era of secular stagnation, where the growth is permanently lower due to the fact that technological growth is reaching its limits (Gordon, 2017). This has implications for endogenous growth theories as well as they depend on the assumption that the R&D has increasing returns to scale which might no longer hold if economy is in secular stagnation.

This poses a significant challenge for estimation the IV model as in the presence of structural break the regression coefficient estimates are generally unstable, inconsistent and depending on exact model, and model specification even biased (Hansen, 2001). Structural breaks are especially problematic in instrument-based estimators as recent research shows (Chowdhury & Russell, 2018), and it is important to pay attention to it even in panel data. Furthermore, although the issue of structural breaks is of higher importance in economic forecasting than in standard estimations not done for forecasting (Carnot, Koen, & Tissot 2011), structural break still implies that the true coefficients might be different before and after the break occurs and consequently ignoring them would lead to wrong inference. Furthermore, since these breaks might occur for different countries at different times it is not simply enough to include year fixed effects in regression which assume the effect of different years is homogenous across all panel members (Pesaran, 2015). Hence, even when we use the fixed year effects it is still important to test for these and adjust the models for structural changes accordingly. In fact, this is the reason why many models examining growth and international trade and time series analysis in general, nowadays use regime switching models that easily accommodate such potential structural changes (See Jeanne and Masson, 2000; Cerra, 2005; Hamilton, 2005; Buckle, Haugh, & Thomson, 2002; for discussion and application of regime switching models). Most of the research usually corrects for this by interaction analysis or by examining how robust the coefficients are with respect to the sample, but this work implement crisis dummy as in without collecting more variables this is the best approach.

Furthermore, $E_{it}$is the exchange rate, the fixed country effects a_i capture the time invariant unobservables of each individual country as they allow each country to have its own country specific dummy which explicitly controls for all time invariant country specific effects. It is reasonable to assume that these play significant role as countries differ significantly in their cultures and other hard to measure factors that can be thought of (at least on time scales considered here) time invariant and which could potentially affect economic growth. In addition, G_{it} the government spending and POP_{it} which is population growth were also included. Fixed year effects γ_t are included as well. These control for all year specific effect that are homogenous across all countries. Finally, ε_{it} and e_{it} are the independent and identically distributed (iid) errors from the second and first stage respectively.

Moving Average Models

In order to examine the robustness of the results 3 year centered moving average models are estimated as well. The centered 3 year moving average is given by: $x_{3ma} = (x_{t+1} + x_t + x_{t-1})/3$. The centered moving average was applied to all continuous variables and in the regressions that correct for non-linearity to also the natural logs of the variables.

Since the models perfectly mimic the methodology of the models above with only change being that all continuous variables are estimated using the centered three-year moving average the model specifications will not be explicitly showcased here in order to avoid repetition.

Growth Models

Since the models above do not examine the effect of trade openness on growth directly as they are all estimated in levels an extra robustness checks that try to correct for this are estimated as well. In these checks the levels of real GDP per capita, trade openness and property right index are replaced with their respective natural log growth rates Δy, ΔO and ΔPRI respectively. All controls are in levels since they are only controls and not the main variable of interest only to serve conditional independence assumption.

These models still do not estimate the effect of openness on economic growth directly as they regress the growth of GDP per capita on the growth of openness, but they come closer to the rest of literature by estimating the effect of variables on actual growth.

General To Specific Checks

In addition to testing robustness of the results using the above-mentioned methodology, general to specific robustness (GTOS) tests are performed as well. This is because many empirical handbooks including Verbeek's (2008) guide to modern econometrics argue that GTOS checks are an important part of model selection process. The reason for this is that even though the general specifications are made based on economic theory this does not mean that there is no uncertainty about underlaying data generating process. This is for two reasons. First, estimations such as done here are not based necessarily on some unified consistent theory but rather variables that are considered important based on many different international trade and macro theories. This was done because it is far more important to avoid omitted variable bias even at the cost of parsimony but it also it is also possible that the models are overfitted.

This is especially concerning in this case as many models with large number of coefficients here are estimated over samples that are barely larger than 40. Even in the better cases where the sample sizes are larger the sample is still not so large as to make the loss of degrees of freedom inconsequential.

Moreover, many papers listed in the empirical section of literature review apply in more or less direct way (see the empirical papers cited in the section II). Some of the papers do not explicitly mention it but the use of this approach is evident from the output they present. Even those paper that do not follow the methodology at all perform at least some sort of robustness with more parsimonious versions of their models.

Descriptive Statistics

The above described model is being estimated on a dataset consisting 139 upper middle-income and high-income countries. The full list of countries is presented in Appendix I. The data was chosen for a 25-year period (1994-2018). The variable definitions are presented in the appendix III.

TABLE 1. DESCRIPTIVE STATISTICS

This table contains the descriptive statistics for variables included in this study. the descriptive statistics is based on the 1994-2018 sample where the total number of observations is 57. the panel is not perfectly balanced because some countries miss data in some years.

	Mean	**Std. Dev.**	**Min.**	**Max.**
LN(O) (TRADE SHARE)	85.39563	40.29097	26.491	191.537
GEO COASTLINE	8185.526	9217.84	0	25760
H1	12.27907	1.133629	8.99254	14.20745
H2	25.52247	5.79797	12.25237	36.94929
H3	9.984819	3.455237	2.15021	19.01053
H4	.9863889	.5084537	.45222	2.97441
TFP	101.2908	3.105953	91.05544	107.1568
I	22.02267	4.199494	10.21701	32.95883
G	20.69861	3.933345	11.93307	26.30324
π	1.189652	1.139603	-2.821741	3.878167
E	98.33545	9.620867	84.29257	148.836
IND	21.86591	4.559887	14.18766	35.1298
POP	.6776135	.5699421	-.6588614	2.099357
DC	109.52931	.75776	49.82963	174.8817
FDI	3.731337	7.989366	-7.977802	41.91158

Section IV: Empirical Results

This section discusses the results obtained from the pooled cross-section and panel fixed effect IV regression models, as well as from the robustness checks that estimates the models with applying moving averages to all continuous variables which were described in greater detail in the previous section. In all cases models' residuals were tested for autocorrelation and heteroskedasticity using Wooldridge panel autocorrelation test and a modified Wald statistic for groupwise heteroskedasticity as well as Berush-Pagan multiplicative heteroskedasticity tests are performed as they were simple to do. The results of these tests are shown in the appendix V and no matter the results all models report errors clustered on country level which adjust for both autocorrelation and heteroskedasticity. Furthermore, the models were also checked for multicollinearity, but were not adjusted based on the results because multicollinearity is a problem and given the scope of this paper the problem stemming from multicollinearity cannot be completely eliminated. Finally, for the first stage Wald test was applied to get the F-statistics for the relevant instruments.

Moreover, non-linearity was always tested using the Ramsey's functional specification RESET test (results also shown in appendix V). Nonlinearity was always solved by taking natural logarithm of the main continuous variables as mentioned in the methodology section.

Main Results

The main results for property right index are not reported here but in appendix VI because the first stage showed that it is not significant, and F-statistics was low (F-value was less than 10, it was deduced that PRI is not a good instrument). Hence this section will focus mainly on the pooled cross-section results using the geography as instruments. The table 2 showcases the results of pooled dataset where the coastline was used as an instrument for trade openness.

The results below show that only the coefficient of natural logarithm of trade openness is statistically significant. In model I and III the coefficient of trade openness is statistically significant at 5% significance level and in the model III only at 10% level. The estimated coefficients are all quite close to 0.5 and they imply that 1% increase in openness leads to 0.5% increase in log of GDP per capita. While this effect is statistically significant it does not seem to be economically meaningful as its important to keep in mind that this is the average effect of openness on the level of GDP per capita over period of more than twenty years. Thus, its effect on growth must have been miniscule at best. The similar results are also shown in more general models presented in appendices. This being said the results are not fully in line with other results, such as the results where property right index is used as an instrument where openness has negative effect on the GDP per capita. Nonetheless, the results using PRI as an instrument have to be taken with a grain of salt as the Wald F-statistics applied separately to the PRI instrument was not significant.

The output on table 2 further shows that none of the other variables are significant. The robustness checks show that FDI inflows sometimes are significant, but they become insignificant in the more parsimonious results below. Moreover, the joint significance of the coefficients was not tested but given the fact that R^2 in model I and III are close to zero it is likely that the models are not statistically significant. The between and within R^2 for the second model are higher but given that for pooled cross section these R^2 are not properly defined it does not make sense to interpret them. Given this the results have to be interpreted very carefully.

Table 2. Results of IV Regression Estimation with Coastline Instrument

Regression of trade openness on GDP per capita using coastline as an instrument with (one-way) as well GTOS checks with reduced form. Structural break financial crisis dummy cannot be used with fixed effects so without any fixed effects it is provided (model III). The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II instead of overall R_2 the within and between R_2 are reported respectively.

	DEPENDENT VARIABLE: (NATURAL LOGARITHM) GROSS DOMESTIC PRODUCT PER CAPITA					
	I	**II**	**III**	**IV**	**V**	**VI**
LN(O)	0.498**	0.460*	0.493**			
(TRADE SHARE)	(0.23)	(0.24)	(0.23)			
LN(GEO)				-0.000***	-0.000***	0
(COASTLINE)				(0)	(0)	(0)
H1						-0.2478
						(0.2)
H2						-0.0072
						(0.02)
H3						0.0396
						(0.04)
H4						-0.2268
						(0.51)
TFP						0.1435***
						(0.04)
I						-0.0562
						(0.05)
G						0.0217
						(0.08)
π						-0.049
						(0.12)
E						0.030*
						(0.02)
IND						-0.014
						(0.04)
POP						0.0203
						(0.37)
DC						-0.0004
						(0)
FDI	-0.0012	-0.0009				0.0066
	(0)	(0)				(0.01)
CONS.	-1.199	-0.9059	-1.186	2.4950***	1.7728***	-9.4939**
	(1)	(0.99)	(1)	(0.12)	(0.52)	(3.62)
COUNTRY FIXED EFFECTS	No	No		No	No	No
YEAR FIXED EFFECTS	No	Yes		No	Yes	Yes
N	1618	1618	1618	2853	2853	57
R2	0.005	0.1209/0.0184	0.006	0	0.072	0.519

Next set of models is presented in the table 3 below. These regressions differ from the model above in that they use log of equatorial distance as an instrument instead of coastline. However, even though the results from the Wald F-statistics applied to equatorial distance only are significant and F-statistics is quite high none of the results in the second stage are significant at any standard confidence level (save few results in the robustness checks shown in appendix). Hence in all cases we cannot reject the null hypothesis that the individual coefficients are equal to zero.

Table 3. Results of IV Regression Estimation with Equatorial Distance Instrument

Regression of trade openness on GDP per capita using equatorial distance as an instrument with (one-way) time fixed-effects and relevant controls. Models V-VIII report GTOS robustness checks with reduced form where log of equatorial distance is directly used. Structural break financial crisis dummy cannot be used with fixed effects so without any fixed effects it is provided (model IV). The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II and III instead of overall R_2 the within and between R_2 are reported respectively.

	DEPENDENT VARIABLE: (NATURAL LOGARITHM) GROSS DOMESTIC PRODUCT PER CAPITA							
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
LN(O)	-0.587	-0.610	-2.446	-0.621				
(EXPORT SHARE)	(1.34)	(1.15)	(2.8)	(1.4)				
LN(GEO)					0.001***	0.001***	0.001***	0.001***
(EQT. DIST.)					(0)	(0)	(0)	(0)
H1			0.196		-0.798***	-0.734***	-0.649***	-0.506***
			(0.32)		(0.13)	(0.1)	(0.09)	(0.08)
H3			0.268		0.048*	0.041**	0.029	
			(0.25)		(0.02)	(0.02)	(0.02)	
H4			-2.012		-0.149***	-0.131***	-0.104***	-0.079***
			(1.43)		(0.04)	(0.03)	(0.03)	(0.02)
TFP			-0.0031		0.283***	0.258***	0.235***	0.216***
			(0.15)		(0.05)	(0.03)	(0.03)	(0.04)
G			0.0665		-0.229***	-0.194***	-0.176***	-0.148***
			(0.13)		(0.06)	(0.04)	(0.03)	(0.04)
E			0.0329		-0.010			
			(0.02)		(0.01)			
IND			0.0115		-0.063***	-0.059***	-0.063***	-0.072***
			(0.09)		(0.02)	(0.02)	(0.02)	(0.02)
DC			0.0096		-0.005*	-0.005*		
			(0.01)		(0)	(0)		
FDI					0.020**	0.018**	0.013	
					(0.01)	(0.01)	(0.01)	
GR				0.182				
				(0.13)				

CONS	3.572	3.487	4.824	3.702	-13.350***	-12.776***	-11.569***	-10.350***
	(5.92)	(4.79)	(17.99)	(6.15)	(2.86)	(2.7)	(2.85)	(2.79)
N	1970	1970	54	1970	58	58	58	59
R2	N/A	0.071/ 0.014	0.182/ 0.501	N/A	0.601	0.597	0.577	0.541

The set of results showcased below is an additional robustness check of the results presented in the table 2 using different proxy for trade openness namely the log of export to GDP ratio. However, this time around the coefficient of trade openness proxied by the log of export to GDP ratio is not significant at 5% significance level. In the model I and II the coefficient is statistically significant at 10% and the coefficient magnitude is similar to the previous results. That is, these coefficients again show that on average one percent increase in trade openness leads to about half percent increase in GDP per capita. This being said since the results are significant only at 10% level they should not be given too much weight.

Next the effects of total factor productivity and exchange rate on log of GDP per capita are both significant at 1% significance level. The coefficient estimate for total factor productivity of 0.1 implies that on average during the period considered an increase in total factor productivity by 1 would increase the GDP per capita by little over 10%. This is quite a large amount, but it also makes sense that the effect will be considerable as contemporaneous total factor productivity depends on the GDP. The exchange rate coefficient of about 0.02 implies that on average increase of exchange rate by 1 increases the GDP per capita by about 2%.

All other results are not statistically significant and hence in those cases we cannot reject the null hypothesis of no effect. Moreover, again results must be interpreted cautiously as joint significance was not tested. The extra robustness checks presented in appendix VII are generally consistent with the results below.

Table 4. Results of IV Regression Estimation with Coastline Instrument

Regression of export to GDP on GDP per capita using coastline as an instrument with (one-way) time fixed-effects and relevant controls. Models V-VII report GTOS robustness checks with reduced form where the log of coastline is directly used. Structural break financial crisis dummy cannot be used with fixed effects so without any fixed effects it is provided (model IV). The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II and III instead of overall R_2 the within and between R_2 are reported respectively.

	DEPENDENT VARIABLE: (NATURAL LOGARITHM) GROSS DOMESTIC PRODUCT PER CAPITA						
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**
LN(O)	0.539*	0.407	0.106	0.535*			
(EXPORT SHARE)	(0.31)	(0.32)	(0.17)	(0.32)			
LN(GEO)					0	0	-0.000***
(COASTLINE)					(0)	(0)	(0)
H2			-0.025				
			(0.02)				
H4			0.012				
			(0.32)				
TFP			0.096***		-0.053*	-0.051*	
			(0.03)		(0.03)	(0.03)	
I			-0.0114				
			(0.03)				
E			0.022***		-0.0033		
			(0.01)		(0.01)		
IND			-0.0256				
			(0.02)				
FDI			0.010				
			(0.01)				
GR				0.065			
				(0.08)			
CONS	-0.998	-0.430	-9.378***	-0.990	8.053***	7.536***	1.773***
	(1.13)	(1.06)	(1.85)	(1.13)	(3.06)	(2.37)	(0.52)
COUNTRY FIXED EFFECTS	No	No	No		No	No	No
YEAR FIXED EFFECTS	No	Yes	Yes		Yes	Yes	Yes
N	1725	1725	49	1725	560	560	2853
R2	N/A	0.112/ 0.002	0.146/ 0.743	N/A	0.51	0.51	0.072

The last set of main results is shown on table 5 below. These results try to check the robustness of the results relaying on equatorial distance instrument with respect to using alternative measure of openness namely the export to GDP ratio. However, as in the previous case no results are statistically significant at 5% level. Thus, in none of the cases we can reject the null hypothesis that the true coefficients are zero at that level. The only result that is significant at any conventional significance level is the crisis dummy which is significant at 10% level with coefficient estimate of about 0.16. Such estimate shows that on average during the crisis period the GDP was about 17% higher relative to non-crisis periods. This result does not make any sense whatsoever. One potential explanation could be that some countries might have experienced expansion during those years as Great Recession did not necessary affected all economies at the same time. However, given that the effect is significant only at 10% level it should not be given too much attention, especially given that nothing else is significant as well.

Table 5. Results of IV Regression Estimation with Equatorial Distance Instrument
Regression of export to GDP on GDP per capita using equatorial distance as an instrument with (one-way) time fixed-effects and relevant controls. Structural break financial crisis dummy cannot be used with fixed effects so without any fixed effects it is provided (model IV). The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II and III instead of overall R_2 the within and between R_2 are reported respectively.

	DEPENDENT VARIABLE: (NATURAL LOGARITHM) GROSS DOMESTIC PRODUCT PER CAPITA			
	I	**II**	**III**	**IV**
LN(O)	-0.5305	-0.5036	33.3249	-0.5573
(EXPORT SHARE)	(1.17)	(0.89)	(159.23)	(1.21)
H1			-0.8621	
			(3.97)	
H2			0.0957	
			(0.58)	
H3			-2.6978	
			(13.16)	
H4			8.0158	
			(46.13)	
TFP			1.2641	
			(4.85)	
G			-1.6621	
			(7.25)	
E			-0.178	
			(0.91)	
IND			-1.0064	
			(4.48)	
DC			-0.1163	
			(0.52)	
GR				0.1612*
				(0.1)
CONS	2.9286	2.6567	-151.56	3.0109
	(4.31)	(3.04)	(644.05)	(4.45)
N	1970	1970	54	1970
R2	N/A	0.0773/0.0158	0.0349/0.0317	N/A

Moving Average Pooled Cross-section IV Results

This section showcases the robustness checks where the series of all continuous variables are smoothed out using the centered moving average. Only the pooled cross-section results are presented in the main text while the panel regression results are presented in the appendix VI, as the Wald F-statistics for the instrument itself was not significant.

The estimated coefficient for MA of log of trade openness measured as share of exports and imports to the GDP, instrumented by the MA log of coastline, in the model I and II shown on table below is statistically significant at 5% level in both cases. The estimated coefficients of 0.62 and 0.52 imply that on average over the period included in the model one percentage increase in the MA of share of exports plus imports to GDP leads to 0.62 and 0.52 percent increase in the MA of the level of GDP per capita. However, although the coefficients are statistically significant the magnitude of the effect is less so given that the dataset spans several decades. As a consequence, if we could assume that this level change was homogenously spread over the period under consideration it would be hardly noticeable.

The coefficient estimate of the MA of log of FDI is not statistically significant in either the model I or model II at any conventional significance level. This means we cannot reject the null hypothesis that the true coefficient in both cases is zero. However, both this and previous result above have to be interpreted cautiously because individual significance does not necessary implies joint significance.

Table 6. Results of IV Regression Estimation Using MA Variables

This table contains the regression of MA of natural logarithm of trade openness (measured by share of exports and imports of GDP) on the MA of natural logarithm of GDP per capita instrumented by the MA of natural log of coastline in models I-III and MA of natural log of equatorial distance in models IV-V. Natural logarithms are used to correct for nonlinearity. The pooled cross section regression I is estimated without any fixed effects while the model II is estimated with year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II, IV and V instead of overall R_2 the within and between R_2 are reported respectively.

DEPENDENT VARIABLE: (NATURAL LOGARITHM) GROSS DOMESTIC PRODUCT PER CAPITA

	Openness Instrumented by Moving Average of log of Coastline			**Openness instrumented by Moving Average of log of Equatorial Distance**	
	I	**II**	**III**	**IV**	**V**
LN(O)_MA	0.6213**	0.5254**	-0.7572	-0.0996	-6.6306
(TRADE SHARE)	(0.31)	(0.26)	(2.02)	(0.99)	(19.87)
LN(FDI)_MA	0.0136	0.0462			
	(0.09)	(0.05)			
H1_MA					0.4949
					(1.46)
H2_MA					0.6296
					(1.75)
H4_MA					-3.5807
					(8.17)
TFP_MA					-0.2275
					(1)
G_MA					0.1871
					(0.73)
E_MA					0.0468
					(0.11)
IND_MA					0.1252
					(0.56)
DC_MA					0.023
					(0.07)
CONS	-1.615	-1.0086	4.4352	1.5564	33.2636
	(1.31)	(1.08)	(8.92)	(4.25)	(124.14)
COUNTRY FIXED EFFECTS	No	No	No	No	No
YEAR FIXED EFFECTS	No	Yes	No	Yes	Yes
N	989	989	1289	1289	45
R2	N/A	0.1948/0.0773	N/A	0.0479/0.0873	0.0520/0.0953

Next the robustness of the results is also checked by estimation where the instrument is replaced by the MA of log of the equatorial distance and where the functional specification is also extended to include multiple other variables that the previous estimations did not. However, as the table 7 below shows none of the results presented are statistically significant at any conventional confidence level. Consequently, the results from the previous estimations do not seem to hold up in these checks. At the same time these estimations do not use the same number of observations or functional form and consequently one should not read too much into them.

Another set of robustness checks estimated models similar to those above using exports to GDP as another proxy for openness. These results seem to be more or less consistent with the previous results in this chapter although again one must be careful when interpreting them as the functional form and number of observations change. The table 7 below shows that the effect of MA of the natural log of export to GDP ratio, instrumented by the MA of the natural log of coastline is significant in model I and III at 5% significance level and II at 10% significance level. The coefficient estimates vary a considerably though from around 0.7 to about 0.25. This implies that on average during the sample period considered here 1% increase in MA of trade openness measured as exports to GDP would lead to between around 0.7-0.25% increase in the MA of GDP per capita. This result is more or less consistent with all of the above results even though the magnitude of the result here is less robust compared to the previous estimations. This being said, again given that this is the average change in GDP per capita over period of more than 20 years the implied effect on growth is miniscule.

Next the coefficient of MA of total factor productivity is statistically significant at 1% level with the estimated coefficient of 0.0755. This means that on average increase in the MA of total factor productivity index by 1 the MA of GDP per capita is expected to increase by almost 8%. This is again relatively large effect compared to others. Next the MA of exchange rate also has statistically significant effect at 1% level, with its coefficient estimate implying that increase in MA of exchange rate of 1 increases the growth rate of about 2%.

The coefficient of MA of FDI inflows is significant as well but only at 10% confidence level. The coefficient estimate of about 0.006 implies that increase in the MA of FDI inflows of 1 increases the MA of GDP per capita by about 0.6%. This is quite small from economic perspective, although the coefficient estimate should not be given too much weight as it is only statistically significant at 10%.

All other coefficients are not statistically significant and thus in all other cases we cannot reject the null hypothesis of true coefficients being equal to zero. Moreover, the joint significance of the coefficient was not tested but it looks likely from the results below that the coefficients in each model might not be jointly significant, so these estimates must be interpreted with a great caution. The additional robustness checks based on the same model specification showcased in appendices seem to be more or less consistent with these results.

Table 7. Results of IV Regression Estimation Using MA Variables

This table contains the regression of MA of natural logarithm of trade openness (measured as exports to GDP ratio) on the MA of natural logarithm of GDP per capita instrumented by the MA of natural log of coastline in models I-III and by MA of natural log of equatorial distance in models IV-VII. Natural logarithms are used to correct for nonlinearity. The pooled cross section regression I is estimated without any fixed effects while the model II is estimated with year fixed effects and III has year fixed effects as well as additional variables. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II and III instead of overall R_2 the within and between R_2 are reported respectively. For, models IV-VII no R_2 could be obtained.

DEPENDENT VARIABLE: (NATURAL LOGARITHM) GROSS DOMESTIC PRODUCT PER CAPITA						
	Openness Instrumented by Moving Average of log of Coastline			Openness instrumented by Moving Average of log of Equatorial Distance		
	I	II	III	IV	V	VI
LN(O)_MA	0.7272**	0.6020*	0.2407**	-0.6729	-0.0875	-17.1289
(EXPORT SHARE)	(0.34)	(0.32)	(0.12)	(1.72)	(0.75)	(102.91)
H1_MA						1.2267
						(7.72)
H2_MA			-0.0199			0.0042
			(0.02)			(0.26)
H3_MA						1.6137
						(9.48)
H4_MA			0.1257			-7.9548
			(0.22)			(42.6)
TFP_MA			0.0755***			-0.7499
			(0.02)			(5.29)
I_MA			-0.0231			
			(0.03)			
E_MA			0.0193***			0.0903
			(0)			(0.49)
IND_MA			-0.0257			0.5028
			(0.02)			(3.43)
FDI_MA			0.0059*			
			(0)			
DC_MA						0.0687
						(0.43)
G_MA						0.6086
						(4.1)
CONS	-1.5589	-0.9143	-7.2821***	3.5634	1.4365	82.2687
	(1.24)	(1.12)	(1.64)	(6.29)	(2.63)	(548.91)
COUNTRY FIXED EFFECTS	No	No	No			
YEAR FIXED EFFECTS	No	Yes	Yes			
N	1127	1127	41	1289	1289	45
R2	N/A	0.1934/0.0498	0.0923/0.7523	N/A	N/A	N/A

Finally, the last set of models estimates shown in the table 7 above (Models IV, V and VI) does not show any statistically significant results. Hence in all cases we cannot reject the null hypothesis that the true coefficients are equal to zero and none of the variables has any effect.

Section V: Conclusion

After all, does trade openness lead to economic growth? This thesis attempted to find answer to this highly debated question by estimating panel fixed effects IV model, which controls for endogeneity between the trade openness and economic growth, on data form 139 developed and developing countries (see the full list in appendix I) over 25-year period (1994-2018).

The evidence from earlier studies suggest a positive relationship between trade openness and economic growth but this study finds that trade openness has mainly a level effect on the real GDP per capita but not a growth effect. Furthermore, even this result is not very robust as the effect often disappears when small changes to the model specification are made or when different proxies to measure trade openness are used. The results from the regressions where all continuous variables were smoothed using centered 3-year MA are inconsistent as well. This is further confirmed by all other results presented in appendixes. Moreover, this work tried to estimate also the effect of growth of trade openness on economic growth, but the models do not generally find statistically significant effect of the growth of openness on economic growth. Consequently, this work seems to suggest that any effect of trade openness on economic growth is either very limited or not there.

This being said the work in this thesis is not definitive. First, in this research we decided not to examine the effect of openness on growth directly but always in indirect way either by examining the effect of openness on GDP per capita or examining the effect of growth of openness on growth of GDP per capita. The log levels are used to circumvent non-linearity concern, while the growth rates were used to circumvent the unit root problem. However, future research should also consider estimating directly the effect of openness on economic growth as done in wider literature. Second, this thesis only looked at a few measures of trade openness and there is no guarantee the results would be robust if openness would be measured in a different way and future research should try to include more different measures following the wider literature. Clearly further research is needed to provide definitive answer to the question whether openness leads to higher economic growth.

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Appendices

Appendix I. The List of Included Countries

This appendix provides a list of the 139 high-income and upper-middle income countries included in the study (classification by the World Bank):

Countries used in the study			
Albania	Algeria	American Samoa	Andorra
Antigua and Barbuda	Argentina	Armenia	Aruba
Australia	Austria	Azerbaijan	Bahamas, The
Bahrain	Barbados	Belarus	Belgium
Belize	Bermuda	Bosnia and Herzegovina	Botswana
Brazil	British Virgin Islands	Brunei Darussalam	Bulgaria
Canada	Cayman Islands	Channel Islands	Chile
China	Colombia	Costa Rica	Croatia
Cuba	Curacao	Cyprus	Czech Republic
Denmark	Dominica	Dominican Republic	Ecuador
Equatorial Guinea	Estonia	Faroe Islands	Fiji
Finland	France	French Polynesia	Gabon
Georgia	Germany	Gibraltar	Greece
Greenland	Grenada	Guam	Guatemala
Guyana	Hong Kong SAR, China	Hungary	Iceland
Iran, Islamic Rep.	Iraq	Ireland	Isle of Man
Israel	Italy	Jamaica	Japan
Jordan	Kazakhstan	Korea, Rep.	Kosovo
Kuwait	Latvia	Lebanon	Libya
Liechtenstein	Lithuania	Luxembourg	Macao SAR, China
Malaysia	Maldives	Malta	Marshall Islands
Mauritius	Mexico	Monaco	Montenegro
Namibia	Nauru	Netherlands	New Caledonia
New Zealand	North Macedonia	Northern Mariana Islands	Norway
Oman	Palau	Panama	Paraguay
Peru	Poland	Portugal	Puerto Rico
Qatar	Romania	Russian Federation	Samoa
San Marino	Saudi Arabia	Serbia	Seychelles
Singapore	Sint Maarten (Dutch part)	Slovak Republic	Slovenia
South Africa	Spain	Sri Lanka	St. Kitts and Nevis
St. Lucia	St. Martin (French part)	St. Vincent and the Grenadines	Suriname
Sweden	Switzerland	Thailand	Tonga
Trinidad and Tobago	Turkey	Turkmenistan	Turks and Caicos Islands
Tuvalu	United Arab Emirates	United Kingdom	United States
Uruguay	Venezuela, RB	Virgin Islands (U.S.)	

Appendix II. Variables Key

This appendix contains the variables keys for the appendix.

VARIABLES KEY

trade_open	**Trade Share**
coastline	**Coastline**
eqd	**Equatorial Distance**
pri	**Property Rights Index**
m_edu	**H1**
bc_pc	**H2**
ms_pc	**H3**
dr_pc	**H4**
tfp	**Total factor productivity**
investment	**Investment**
gov_spending	**Government spending**
inflation	**Inflation**
exchange_rate	**Exchange rate**
ind_share	**Industry share**
pop_growth	**Population growth**
dom_credit	**Domestic credit**
fdi_inflows	**Foreign Direct Investment inflows**
fincrisis	**Financial Crisis dummy**
lnetgdp	**Natural Logarithm Export share to GDP**
netgdpavg	**Natural Logarithm Export to GDP average**
tradegrowth	**Trade Growth**
etpgdpgrowth	**Export share to GDP growth**

Appendix III Explanation of Property Rights Index

This appendix contains the explanation for the property rights index ranking provided by the Heritage Foundation (2020) metadata. The index does not necessary scale in 10-point increments. Values between the 10-point increments are assigned based on how close the situation in country resembles the increment. For example, value 94,5 would imply that the country's situation is somewhere between 100 and 90 but closer to 90.

Score:	Description of Situation as Described by Heritage Foundation (2020):
100	Private property is guaranteed by the government. The court system enforces contracts efficiently and quickly. The justice system punishes those who unlawfully confiscate private property. There is no corruption or expropriation.
90	Private property is guaranteed by the government. The court system enforces contracts efficiently. The justice system punishes those who unlawfully confiscate private property. Corruption is nearly nonexistent, and expropriation is highly unlikely.
80	Private property is guaranteed by the government. The court system enforces contracts efficiently but with some delays. Corruption is minimal, and expropriation is highly unlikely.
70	Private property is guaranteed by the government. The court system is subject to delays and is lax in enforcing contracts. Corruption is possible but rare, and expropriation is unlikely.
60	Enforcement of property rights is lax and subject to delays. Corruption is possible but rare, and the judiciary may be influenced by other branches of government. Expropriation is unlikely.
50	The court system is inefficient and subject to delays. Corruption may be present, and the judiciary may be influenced by other branches of government. Expropriation is possible but rare.
40	The court system is highly inefficient, and delays are so long that they deter the use of the court system. Corruption is present, and the judiciary is influenced by other branches of government. Expropriation is possible.
30	Property ownership is weakly protected. The court system is highly inefficient. Corruption is extensive, and the judiciary is strongly influenced by other branches of government. Expropriation is possible.
20	Private property is weakly protected. The court system is so inefficient and corrupt that outside settlement and arbitration is the norm. Property rights are difficult to enforce. Judicial corruption is extensive. Expropriation is common.
10	Private property is rarely protected, and almost all property belongs to the state. The country is in such chaos (for example, because of ongoing war) that protection of property is almost impossible to enforce. The judiciary is so corrupt that property is not protected effectively. Expropriation is common.
0	Private property is outlawed, and all property belongs to the state. People do not have the right to sue others and do not have access to the courts. Corruption is endemic.

Appendix IV. Breakpoint Tests

This Appendix presents breakpoint tests of the GDP growth rate (Δy) and the openness measures O_{itj}.

Table 9. This table shows the results of the Andrew's (1993) supremum Wald endogenous structural break tests extended to panel setting. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

	GDP Growth		Openness 1 (M+X share) test		Openness 2 (X share)	
Country	wald ch2	break	wald ch2	break	wald ch2	break
Albania	10.673	2014	270.238	2000	70.244	1999
Algeria	0.790	2004	47.130	2000	74.132	2001
Antigua and Barbuda	4.751	2007**	75.547	2000	67.826	2000
Argentina	15.664	2008***	258.437	2002	41.499	2000
Armenia	4.980	2015	5.734	2012	76.169	1999
Australia	1.571	2002	27.324	2000	89.582	2001
Austria	6.851	2014	87.635	2000	77.073	2007***
Azerbaijan	1.720	2001	11.809	2009***	66.515	2007***
Bahamas, The	6.312	2005	239.391	1997	38.973	1997
Bahrain	2.914	2013	31.584	2011	63.879	1999
Barbados	19.782	2007***	4.716	2014	75.637	1999
Belarus	1.972	2014	1.432	2013	103.852	2014
Belgium	1.336	2009**	77.294	2000	96.595	2004
Belize	1.874	2013	6.373	2011	61.638	2011
Bosnia and Herzegovina	1.478	2013	27.288	2007***	44.837	2013
Botswana	4.814	2001	1.596	2015	116.117	2012
Brazil	6.882	2002	236.174	1999	69.421	2004
Brunei	8.102	2009***	53.139	1998	57.607	1998
Bulgaria	6.421	2013	67.820	2005	99.967	2011
Canada	3.936	2015	39.982	2006	72.429	1999
Chile	1.480	2013	60.977	2000	69.034	1999
China	11.605	1999	44.938	2000	68.746	1999
Colombia	1.114	2002	14.876	2003	67.102	1999
Costa Rica	2.073	2008***	242.761	2009***	64.410	2014
Croatia	11.018	2011	55.067	2015	158.739	2001
Cuba	0.513	2007***	13.945	2005	81.860	1999
Cyprus	33.946	1999	50.978	2002	76.561	2014
Czech Republic	4.527	2001	109.934	2004	68.097	2008***
Denmark	2.549	2013	128.418	2000	99.280	2011
Dominican Republic	5.753	2006	99.979	2005	67.638	2003
Ecuador	23.678	1998	53.679	1999	68.646	1998
Estonia	3.033	2002	23.569	2011	100.800	2009***
Finland	7.972	2012	52.099	2000	77.218	2011
France	6.973	2004	57.341	2011	103.942	2004
Gabon	1.023	1999	51.550	2001	86.211	2012
Georgia	2.465	2008***	76.239	2002	95.998	2014
Germany	1.460	2014	91.477	2000	68.225	2007***
Greece	3.490	1999	86.653	1999	87.134	2008***

Greenland	14.886	2014	12.488	2015	45.924	2005
Grenada	12.222	1999	4.555	2013	30.683	1999
Guam	2.872	2014	51.512	2007***	32.992	2006
Guatemala	2.938	2004	56.103	1999	69.720	1999
Guyana	4.789	2009***	237.655	2006	71.949	2002
Hong Kong SAR, China	6.763	1999	146.822	2003	60.249	2011
Hungary	2.595	2008***	65.962	2007***	79.400	2011
Iceland	4.542	2005	101.320	2008***	97.281	2001
Iran, Islamic Rep.	82.590	2011	69.138	2000	71.635	2011
Iraq	5.911	2006	93.400	2006	12.829	2002*
Ireland	5.234	2004	101.341	2015	106.416	2002
Israel	3.267	2000	26.189	2014	81.473	1999
Italy	6.806	2001	57.299	2000	76.783	1999
Jamaica	2.145	2013	17.800	2009**	7.841	2000*
Japan	5.805	2012	95.753	2005	73.302	2000
Jordan	16.915	1998	16.098	2004	40.899	2001
Kazakhstan	50.006	2001	46.215	2013	117.114	2014
Korea, Rep.	1.898	2010**	49.527	2007***	71.390	2000
Kosovo	0.739	2015	24.270	2007***	40.983	2013
Latvia	2.466	2007***	160.226	2011	86.368	2009***
Lebanon	52.025	2008***	118.409	2004	49.724	1998
Libya	4.728	2008***	2.257	2007***	8.666	2015
Lithuania	4.464	2004	116.545	2011	104.398	2010
Luxembourg	2.706	2009***	49.468	1999	76.744	2008***
Macao SAR, China	8.695	2002	32.601	2014	66.008	1999
Malaysia	5.228	2005	120.738	2009***	66.879	2014
Maldives	6.107	2008***	3.904	2016	35.384	2008***
Malta	2.376	2012	94.884	2008***	87.324	2013
Mauritius	0.697	1999	56.775	2015	96.237	1999
Mexico	4.865	2005	75.142	2015	33.300	2001
Montenegro	1.196	2015	7.556	2005	74.711	2010
Namibia	1.954	2005	25.892	2007***	87.426	2013
Netherlands	9.588	2011	138.894	2011	109.503	2004
New Zealand	25.555	2001	23.157	2014	68.941	2000
North Macedonia	2.494	2005	45.431	2007***	60.890	2012
Norway	3.158	2004	10.069	2009**	84.278	2003
Oman	4.163	1998	9.149	2004	45.523	1998
Panama	5.722	2012	29.766	2014	62.330	2014
Paraguay	10.033	1999	44.081	1999	70.739	2000
Peru	0.574	2011	133.729	2004	72.356	1999
Poland	2.220	2014	71.378	2003	76.715	2000
Portugal	8.710	2001	84.656	2012	110.261	2011
Puerto Rico	6.553	2007***	49.606	1999	171.261	2000
Romania	0.900	2002	207.495	2011	92.453	2011
Russian Federation	11.753	2015*	35.622	2007***	75.772	2007***
Samoa	2.582	2008***	1.583	2013	47.338	2005
Saudi Arabia	10.047	2006	5.704	2014	38.509	2011
Serbia	9.742	2010	52.196	2015	76.061	2008***
Seychelles	0.821	2013	24.393	2001	24.076	2012

Singapore	9.240	2005	29.040	2015	80.850	2003
Slovak Republic	4.597	2008***	97.782	2004	111.202	2011
Slovenia	4.671	2008***	91.847	2005	92.401	2003
Spain	3.333	2010	61.426	2014	94.004	2011
Sri Lanka	2.520	2015	209.930	2009***	158.087	2000
Sweden	1.642	2013	45.539	2000	79.960	2004
Switzerland	2.985	2001	94.621	2006	78.133	2001
Thailand	4.512	2015	93.862	2000	85.187	2011
Tonga	4.405	2003	13.073	2011	82.471	2014
Turkey	5.281	2003	10.252	2011	67.227	2000
Turkmenistan	1.482	2012	14.764	2016	67.351	2006
United Arab Emirates	10.248	2009***	62.140	2004	44.159	2004
United Kingdom	5.138	2015	84.890	2010	89.983	2009***
United States	1.331	2002	63.686	2005	83.007	2004
Uruguay	1.340	2006	53.415	2002	69.929	2002
Venezuela, RB	24.445	2011	4.081	2009***	44.115	2003

Appendix V. Residual Diagnostics, Multicollinearity and Instrument Testing

This appendix contains the residual diagnostics, multicollinearity testing using VIF, and for some of the models used in this study together with the auxiliary regressions with unadjusted errors to which the tests were applied.

Table 10. This table contains the auxiliary first stage regression where trade openness is regressed on the instrument of property right index Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : Trade openness			
PRI	0.1070		
	(0.09)		
_cons	79.4756***		
	(6.11)		
Country Fixed-effect	Yes		
Year Fixed-effects	Yes		
N	2177		
r2	0.143		
F-statistics:			
(1)	PRI	= 0	
	=	F(1.41	1, 100)
	=	0.2377	Prob > F

Summary statistics			Number of obs =		2,177
	Number of clusters			=	101
	Obs per cluster: min			=	5
	avg	=	21.6		
	max	=	24		
Variable	Mean	Std. Dev.	Min		Max
Trade_Open	95.89049	61.86403	.0268885		442.62

PRI	57.68401	24.47786	0	98.4

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model
H0: sigma(i)^2 = sigma^2 for all i
chi2 (101) = 1.3e+05
Prob>chi2 = 0.0000
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
F(1, 100) = 222.764
Prob > F = 0.0000

Table 11. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	*VIF*	*1/VIF*
PRI	*1.03*	*0.974279*
year		
1996	*2.30*	*0.434788*
1997	*2.33*	*0.429140*
1998	*2.38*	*0.420855*
1999	*2.41*	*0.415575*
2000	*2.41*	*0.415532*
2001	*2.42*	*0.412976*
2002	*2.45*	*0.407453*
2003	*2.44*	*0.410005*
2004	*2.41*	*0.415092*
2005	*2.43*	*0.412316*
2006	*2.44*	*0.409706*
2007	*2.44*	*0.409530*
2008	*2.44*	*0.409575*
2009	*2.55*	*0.392310*
2010	*2.55*	*0.392310*
2011	*2.53*	*0.394637*
2012	*2.53*	*0.394649*
2013	*2.55*	*0.392176*
2014	*2.57*	*0.389766*
2015	*2.55*	*0.392099*
2016	*2.55*	*0.392034*
2017	*2.56*	*0.391189*
2018	*2.27*	*0.440647*

Mean VIF	*2.40*	

Table 12. This table contains the second stage of previous regression. Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : Gross Domestic Product Per Capita	
PRI	**-0.0357****
	(0.01)
_cons	**5.4029*****
	(0.99)
Country Fixed-effect	**Yes**
Year Fixed-effects	**Yes**
N	**2243**
r2	**0.116**

Modified Wald test for groupwise	heteroskedasticity
in fixed effect regression model	
H0: sigma(i)^2 = sigma^2 for all i	
chi2 (102) = 53556.53	
Prob>chi2 = 0.0000	
Wooldridge test for autocorrelation	in panel data
H0: no first-order autocorrelation	
F(1, 101) = 0.017	
Prob > F = 0.8969	
Summary statistics:	

Number of obs =		**2,243**			
Number of clusters		**=**	**102**		
Obs per cluster: min		**=**	**5**		
avg	**=**	**22.0**			
max	**=**	**24**			
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	
GDP_pc	2.487958	5.271998	-62.37808	121.7795	
PRI	57.70852	24.32527	0	98.4	

Table 13. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	*VIF*	*1/VIF*
PRI	*11.01*	*0.090811*
year		
2012	*3.65*	*0.273608*
2013	*3.55*	*0.281564*
2014	*16.24*	*0.061590*
2015	*25.55*	*0.039134*
2016	*26.05*	*0.038390*
2017	*19.94*	*0.050151*
2018	*8.45*	*0.118339*
m_edu	*10.52*	*0.095070*
bc_pc	*3.34*	*0.299351*
ms_pc	*5.65*	*0.176941*
dr_pc	*6.86*	*0.145691*
tfp	*3.40*	*0.294064*
Investment	*7.43*	*0.134663*
Gov_Spending	*5.05*	*0.198029*
Inflation	*2.04*	*0.489094*
Exchange_Rate	*2.41*	*0.414665*
Ind_Share	*4.48*	*0.222969*
Pop_Growth	*8.03*	*0.124470*
Dom_Credit	*2.97*	*0.337258*
FDI_inflows	*1.43*	*0.697075*
Mean VIF	*8.48*	

Table 14. Regression of trade openness on GDP per capita using property rights index as an instrument with (two-way) time and country fixed-effects and all controls. Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : Trade openness	
PRI	0.1422
	(0.18)
m_edu	4.6639
	(5.22)
bc_pc	0.3086
	(0.77)
ms_pc	-0.3141
	(3.50)
dr_pc	0.3277
	(5.95)
tfp	-0.8817
	(0.78)
Investment	1.2939
	(0.89)
Gov_Spending	0.4417
	(1.39)
Inflation	0.0443
	(0.37)
Exchange_Rate	-0.1103
	(0.11)
Ind_Share	0.1788
	(0.56)
Pop_Growth	-1.1217
	(4.96)
Dom_Credit	-0.0266
	(0.13)
FDI_inflows	-0.0483
	(0.07)
_cons	92.8501
	(116.05)
Country fixed-effects	Yes
Year fixed-effects	Yes
N	57
Within r2	0.875
Between r2	0.055
F-statistics: (1) PRI = 0	

	F(1,17)	=	0.65			
		Prob	> F	=	0.4320	
	Number of obs		=	57		
	Number of clusters		=	18		
	Obs per cluster: min =			1		
	avg =	3.2				
	max =	5				
Summary statistics						
Variable	Mean	Std. Dev.		Min	Max	
Trade_Open	**85.39563**		**40.29097**	**26.491**		**191.537**
PRI	**83.58421**	**11.41333**		**40**	**95**	
m_edu	**12.27907**	**1.133629**		**8.99254**	**14.20745**	
bc_pc	**25.52247**	**5.79797**		**12.25237**	**36.94929**	
ms_pc	**9.984819**	**3.455237**		**2.15021**	**19.01053**	
dr_pc	**.9863889**	**.5084537**		**.45222**	**2.97441**	
tfp	**101.2908**	**3.105953**		**91.05544**	**107.1568**	
Variable	Mean		Std. Dev.	Min		Max
Investment	**22.02267**		**4.199494**	**10.21701**		**32.95883**
Gov_Spending	**20.69861**		**3.933345**	**11.93307**		**26.30324**
Inflation	**1.189652**		**1.139603**	**-2.821741**		**3.878167**
Exchange_Rate	**98.33545**		**9.620867**	**84.29257**		**148.836**
Ind_Share	**21.86591**		**4.559887**	**14.18766**		**35.1298**
Pop_Growth	**.6776135**		**.5699421**	**-.6588614**		**2.099357**
Dom_Credit	**109.529**		**31.75776**	**49.82963**		**174.8817**
FDI_inflows	**3.731337**		**7.989366**	**-7.977802**		**41.91158**
Modified Wald test for groupwise heteroskedasticity						
in fixed effect regression model						
H0: sigma(i)^2 = sigma^2 for all i						
chi2 (18) = 9.8e+53						
Prob>chi2 = 0.0000						
Wooldridge test for autocorrelation in panel data						
H0: no first-order autocorrelation						
F(1, 100) = 222.764						
Prob > F = 0.0000						

Table 15. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	*VIF*	*1/VIF*
PRI	*11.01*	*0.090811*
year		
2012	*3.65*	*0.273608*
2013	*3.55*	*0.281564*
2014	*16.24*	*0.061590*
2015	*25.55*	*0.039134*
2016	*26.05*	*0.038390*
2017	*19.94*	*0.050151*
2018	*8.45*	*0.118339*
m_edu	*10.52*	*0.095070*
bc_pc	*3.34*	*0.299351*
ms_pc	*5.65*	*0.176941*
dr_pc	*6.86*	*0.145691*
tfp	*3.40*	*0.294064*
Investment	*7.43*	*0.134663*
Gov_Spending	*5.05*	*0.198029*
Inflation	*2.04*	*0.489094*
Exchange_Rate	*2.41*	*0.414665*
Ind_Share	*4.48*	*0.222969*
Pop_Growth	*8.03*	*0.124470*
Dom_Credit	*2.97*	*0.337258*
FDI_inflows	*1.43*	*0.697075*
Mean VIF	*8.48*	

Table 16. Second stage of previous regression. Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable: Gross Domestic Product Per capita	
PRI	0.0716
	(0.04)
m_edu	-4.4685**
	(1.84)
bc_pc	0.6124*
	(0.30)
ms_pc	-1.4937**
	(0.67)
dr_pc	0.7533
	(1.46)

tfp	0.3730**
	(0.15)
Investment	-0.1224
	(0.19)
Gov_Spending	-0.7546
	(0.45)
Inflation	0.0131
	(0.09)
Exchange_Rate	-0.0833***
	(0.03)
Ind_Share	-0.0496
	(0.21)
Pop_Growth	-2.8201**
	(1.28)
Dom_Credit	-0.0402
	(0.05)
FDI_inflows	0.0034
	(0.01)
_cons	42.8940
	(38.65)
Country fixed-effects	Yes
Year fixed-effects	Yes
N	57
Within r2	0.681
Between r2	0.028

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model
H0: sigma(i)^2 = sigma^2 for all i
chi2 (18) = 691.04
Prob>chi2 = 0.0000
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
F(1, 101) = 0.017
Prob > F = 0.8969

Summary Statistics:	**Number of obs**	**=**	**57**
	Number of clusters	**=**	**18**
	Obs per cluster: min	**=**	**1**
	avg	**=**	**3.2**
	max	**=**	**5**

Variable	Mean	Std. Dev.	Min	Max
GDP_pc	1.259097	.8929545	-1.214216	3.357808
PRI	83.58421	11.41333	40	95
m_edu	12.27907	1.133629	8.99254	14.20745
bc_pc	25.52247	5.79797	12.25237	36.94929
ms_pc	9.984819	3.455237	2.15021	19.01053
dr_pc	.9863889	.5084537	.45222	2.97441
tfp	101.2908	3.105953	91.05544	107.1568

Variable	Mean	Std. Dev.	Min	Max
Investment	22.02267	4.199494	10.21701	32.95883
Gov_Spending	20.69861	3.933345	11.93307	26.30324
Inflation	1.189652	1.139603	-2.821741	3.878167
Exchange_Rate	98.33545	9.620867	84.29257	148.836
Ind_Share	21.86591	4.559887	14.18766	35.1298
Pop_Growth	.6776135	.5699421	-.6588614	2.099357
Dom_Credit	109.529	31.75776	49.82963	174.8817
FDI_inflows	3.731337	7.989366	-7.977802	41.91158

Table 17. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	VIF	1/VIF
PRI	11.01	0.090811
year		
2012	3.65	0.273608
2013	3.55	0.281564
2014	16.24	0.061590
2015	25.55	0.039134
2016	26.05	0.038390
2017	19.94	0.050151
2018	8.45	0.118339
m_edu	10.52	0.095070
bc_pc	3.34	0.299351
ms_pc	5.65	0.176941
dr_pc	6.86	0.145691
tfp	3.40	0.294064
Investment	7.43	0.134663
Gov_Spending	5.05	0.198029
Inflation	2.04	0.489094
Exchange_Rate	2.41	0.414665

Ind_Share	4.48	0.222969
Pop_Growth	8.03	0.124470
Dom_Credit	2.97	0.337258
FDI_inflows	1.43	0.697075
Mean VIF	8.48	

Table 18. Regression of trade openness on GDP per capita using coastlines an instrument with (one-way) time fixed-effects (no country-fixed effects due to time-invariance of coastline) and all controls. Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : Trade openness	
coastline	-0.0042***
	(0.00)
m_edu	-0.6070
	(3.58)
bc_pc	4.0465***
	(0.47)
ms_pc	0.8357
	(0.75)
dr_pc	-40.2970***
	(6.59)
tfp	-3.9284***
	(0.84)
Investment	3.0398***
	(1.08)
Gov_Spending	-1.6733
	(1.10)
Inflation	-3.6109
	(2.59)
Exchange_Rate	-1.1921***
	(0.26)
Ind_Share	1.0684*
	(0.62)
Pop_Growth	14.2955
	(8.52)
Dom_Credit	-0.0473
	(0.07)
FDI_inflows	0.3907**
	(0.15)
_cons	452.1653***
	(64.31)
Country fixed-effects	No

Year fixed-effects	Yes
N	57
Within r2	0.945

F-statistics				
(1) coastline = 0				
	F(1,	35)	=	254.12
	Prob	> F	=	0.0000

Estimation sample regress Number of obs = 57

Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
Trade_Open	85.39563	40.29097	26.491	191.537
coastline	8185.526	9217.84	0	25760
m_edu	12.27907	1.133629	8.99254	14.20745
bc_pc	25.52247	5.79797	12.25237	36.94929
ms_pc	9.984819	3.455237	2.15021	19.01053
dr_pc	.9863889	.5084537	.45222	2.97441
tfp	101.2908	3.105953	91.05544	107.1568
Investment	22.02267	4.199494	10.21701	32.95883
Gov_Spending	20.69861	3.933345	11.93307	26.30324
Inflation	1.189652	1.139603	-2.821741	3.878167
Exchange_Rate	98.33545	9.620867	84.29257	148.836
Ind_Share	21.86591	4.559887	14.18766	35.1298
Pop_Growth	.6776135	.5699421	-.6588614	2.099357
Dom_Credit	109.529	31.75776	49.82963	174.8817
FDI_inflows	3.731337	7.989366	-7.977802	41.91158

Number of obs = 57
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Trade_Open
chi2(1) = 0.08
Prob > chi2 = 0.7764
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
F(1, 110) = 277.020
Prob > F = 0.0000

Table 19. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	*VIF*	*1/VIF*
coastline	*4.36*	*0.229209*
year		
2012	*3.50*	*0.285877*
2013	*4.55*	*0.219893*
2014	*23.28*	*0.042962*
2015	*37.32*	*0.026796*
2016	*38.09*	*0.026257*
2017	*30.31*	*0.032996*
2018	*12.33*	*0.081132*
m_edu	*6.57*	*0.152170*
bc_pc	*2.98*	*0.335859*
ms_pc	*3.99*	*0.250542*
dr_pc	*4.97*	*0.201341*
tfp	*2.84*	*0.352585*
Investment	*7.88*	*0.126908*
Gov_Spending	*6.62*	*0.151028*
Inflation	*1.98*	*0.506308*
Exchange_Rate	*3.78*	*0.264400*
Ind_Share	*3.90*	*0.256199*
Pop_Growth	*6.58*	*0.151930*
Dom_Credit	*2.53*	*0.395195*
FDI_inflows	*1.41*	*0.707480*
Mean VIF	*9.99*	

Table 20. Second stage of previous regression. Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : Gross Domestic Product Per Capita	
coastline	0.00002
	(0.00)
m_edu	-0.2478
	(0.20)
bc_pc	-0.0072
	(0.02)
ms_pc	0.0396
	(0.04)
dr_pc	-0.2268

	(0.51)
tfp	0.1435***
	(0.04)
Investment	-0.0562
	(0.05)
Gov_Spending	0.0217
	(0.08)
Inflation	-0.0490
	(0.12)
Exchange_R~e	0.0304*
	(0.02)
Ind_Share	-0.0141
	(0.04)
Pop_Growth	0.0203
	(0.37)
Dom_Credit	-0.0004
	(0.00)
FDI_inflows	0.0066
	(0.01)
_cons	-9.4939**
	(3.62)
Country fixed-effects	No
Year fixed-effects	Yes
N	57
r2	0.519

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity				
Ho: Constant variance				
Variables: fitted values of GDP_pc				
chi2(1) = 0.63				
Prob > chi2 = 0.4278				
Wooldridge test for autocorrelation in panel data				
H0: no first-order autocorrelation				
F(1, 118) = 0.601				
Prob > F = 0.4398				
Estimation sample	regress Number		of obs =57	
Variable	Mean	Std. Dev.	Min	Max
GDP_pc1.259097	**.8929545**	**1.214216**	**3.357808**	
coastline	**8185.526**	**9217.84**	**0**	**25760**

m_edu	**12.27907**	**1.133629**	**8.99254**	**14.20745**
bc_pc	**25.52247**	**5.79797**	**12.25237**	**36.94929**
ms_pc	**9.984819**	**3.455237**	**2.15021**	**19.01053**
dr_pc	**.9863889**	**.5084537**	**.45222**	**2.97441**
tfp	**101.2908**	**3.105953**	**91.05544**	**107.1568**
Investment	**22.02267**	**4.199494**	**10.21701**	**32.95883**
Gov_Spending	**20.69861**	**3.933345**	**11.93307**	**26.30324**
Inflation	**1.189652**	**1.139603**	**2.821741**	**3.878167**
Exchange_R~e	**98.33545**	**9.620867**	**84.29257**	**148.836**
Ind_Share	**21.86591**	**4.559887**	**14.18766**	**35.1298**
Pop_Growth	**.6776135**	**.5699421**	**.6588614**	**2.099357**
Dom_Credit	**109.529**	**31.75776**	**49.82963**	**174.8817**
FDI_inflows	**3.731337**	**7.989366**	**7.977802**	**41.91158**

Table 21. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	VIF	1/VIF
coastline	4.36	0.229209
year		
2012	3.50	0.285877
2013	4.55	0.219893
2014	23.28	0.042962
2015	37.32	0.026796
2016	38.09	0.026257
2017	30.31	0.032996
2018	12.33	0.081132
m_edu	6.57	0.152170
bc_pc	2.98	0.335859
ms_pc	3.99	0.250542
dr_pc	4.97	0.201341
tfp	2.84	0.352585
Investment	7.88	0.126908
Gov_Spending	6.62	0.151028
Inflation	1.98	0.506308
Exchange_R~e	3.78	0.264400
Ind_Share	3.90	0.256199
Pop_Growth	6.58	0.151930
Dom_Credit	2.53	0.395195
FDI_inflows	1.41	0.707480
Mean VIF	9.99	

Table 22. Regression of trade openness on GDP per capita using equator to distance as an instrument with (one-way) time fixed-effects and GTOS decided-controls Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Dependent variable: Trade openness	
	IV
eqd	-0.0358***
	(0.01)
m_edu	28.4452***
	(3.17)
ms_pc	14.4230***
	(1.25)
dr_pc	-57.2067***
	(9.57)
tfp	-10.4577***
	(1.50)
Gov_Spending	12.6931***
	(1.61)
Exchange_Rate	1.8501***
	(0.39)
Ind_Share	2.7685***
	(0.90)
Dom_Credit	0.2867**
	(0.12)
_cons	469.1932***
	(111.48)
Country fixed effects	No
Year fixed effects	Yes
N	57
r2	0.825

F-statistic (1)	eqd	= 0			
	F(	1, 2563)	=	18.88	
		Prob > F	=	0.0000	

Number of obs =	**57**			
Variable	Mean	Std. Dev.	Min	Max
Trade_Open	85.39563	40.29097	26.491	191.537
eqd	5338.689	1195.384	2987.63	7099.854
m_edu	12.27907	1.133629	8.99254	14.20745
ms_pc	9.984819	3.455237	2.15021	19.01053
dr_pc	.9863889	.5084537	.45222	2.97441
tfp	101.2908	3.105953	91.05544	107.1568
Gov_Spending	20.69861	3.933345	11.93307	26.30324
Exchange_Rate	98.33545	9.620867	84.29257	148.836
Ind_Share	21.86591	4.559887	14.18766	35.1298
Dom_Credit	109.529	31.75776	49.82963	174.8817

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Trade_Open

chi2(1) = 1.61
Prob > chi2 = 0.2041
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
F(1, 109) = 275.692
Prob > F = 0.0000

Table 22. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	*VIF*	*1/VIF*
eqd	*1.00*	*0.998599*
year		
1995	*1.99*	*0.503389*
1996	*1.99*	*0.503389*
1997	*1.99*	*0.503389*
1998	*1.99*	*0.503389*
1999	*1.99*	*0.503389*
2000	*1.99*	*0.503369*
2001	*2.00*	*0.500945*
2002	*2.03*	*0.491501*
2003	*2.04*	*0.489164*

2004	*2.04*	*0.489164*
2005	*2.06*	*0.484650*
2006	*2.08*	*0.480215*
2007	*2.08*	*0.480215*
2008	*2.08*	*0.480215*
2009	*2.09*	*0.478021*
2010	*2.09*	*0.478021*
2011	*2.08*	*0.480207*
2012	*2.08*	*0.480207*
2013	*2.08*	*0.480207*
2014	*2.07*	*0.482424*
2015	*2.05*	*0.486904*
2016	*2.05*	*0.486904*
2017	*2.04*	*0.489175*
2018	*1.83*	*0.545790*
Mean VIF	*1.99*	

Table 23. Second stage of previous regression. Below summary statistics, heteroskedasticity and autocorrelation tests are reported. The unadjusted standard errors are reported in parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : Gross domestic product per capita	
eqd	0.0005***
	(0.00)
m_edu	-0.5063***
	(0.08)
ms_pc	-0.0790***
	(0.02)
tfp	0.2163***
	(0.04)
Gov_Spending	-0.1481***
	(0.04)
Ind_Share	-0.0717***
	(0.02)
_cons	-10.3502***
	(2.79)
Country fixed effect	No
Year fixed effect	Yes

N	59
r2	0.541

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity					
Ho: Constant variance					
Variables: fitted values of GDP_pc					
chi2(1) = 0.01					
Prob > chi2 = 0.9427					
Wooldridge test for autocorrelation		in	panel	data	
H0: no first-order autocorrelation					
F(1, 116) = 0.594					
Prob > F = 0.4423					
Summary Statistics					
Estimation sample		regress Number of obs =		59	
Variable	Mean	Std. Dev.	Min	Max	
GDP_pc	1.255315	.8820748	-1.214216	3.357808	
eqd	5351.204	1180.192	2987.63	7099.854	
m_edu	12.31074	1.1353	8.99254	14.20745	
ms_pc	10.13858	3.589758	2.15021	19.01053	
tfp	101.3494	3.074201	91.05544	107.1568	
Gov_Spending	20.63173	4.078671	11.93307	26.30324	
Ind_Share	21.88274	4.503138	14.18766	35.1298	

Table 24. This table contains the multicollinearity tests based on auxiliary pooled cross section with fixed effects.

Variable	VIF	1/VIF
eqd	5.56	0.179795
year		
2012	2.25	0.443482
2013	2.45	0.407747

2014	10.12	0.098786
2015	17.37	0.057580
2016	17.13	0.058362
2017	15.61	0.064069
2018	6.48	0.154328
m_edu	2.50	0.399532
ms_pc	2.26	0.442960
tfp	2.57	0.388444
Gov_Spending	5.22	0.191687
Ind_Share	2.05	0.488975
Mean VIF	7.04	

Appendix VI. Results from Models Using Property Rights as IV

This appendix showcases the results from all models where trade openness was instrumented using the property right index with an exception of the ‘growth models’ which are all together presented in the appendix VII.

Table #. Regression of trade openness on GDP per capita using property rights index as an instrument with (two-way) time and country fixed-effects. Natural logarithm of the instrument, dependent and main independent variable is taken for non-linearity. Structural break financial crisis dummy cannot be used with fixed effects so without any fixed effects it is provided (model III). The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable: (Natural logarithm) Gross Domestic Product per capita		
	I	II
lntradeopen	-2.2545*	-8.2314
	(1.17)	(9.41)
_cons	10.9218**	36.3463
	(5.10)	(40.07)
Country fixed effects	No	Yes
Year fixed effects	No	Yes
N	1714	1714
r2	N/A	0.002

Dependent variable: (Natural logarithm) Gross Domestic Product per capita	
	III
lntradeopen	-2.1877**
	(1.11)
fincrisis	0.2772**
	(0.13)
_cons	10.6002**
	(4.85)
N	1714
r2	N/A

Table 25. Regression of exports to GDP on GDP per capita using property rights index as an instrument with (two-way) country and time fixed-effects. Natural logarithm of the instrument, dependent and main independent variable is taken for non-linearity. Structural break financial crisis dummy cannot be used with fixed effects so without any fixed effects it is provided (model III). The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity,

are reported in the parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable: (Natural logarithm) Gross Domestic Product per capita		
	I	II
lnetgdp	-1.8027**	-3.7262
	(0.79)	(2.66)
_cons	7.6320***	14.3840
	(2.86)	(9.36)
Country fixed-effect	No	Yes
Year fixed-effect	No	Yes
N	1714	1714
r2	N/A	0.0013

Dependent variable: (Natural logarithm) Gross Domestic Product per capita	
	III
lnetgdp	-1.7547**
	(0.75)
fincrisis	0.2493**
	(0.12)
_cons	7.4304***
	(2.73)
N	1714
r2	N/A

Moving Average Models

Table 26. This table contains the regression of moving average of the natural logarithm of trade openness (measured as sum of export and imports over GDP) on the moving average of natural logarithm of GDP per capita instrumented by the property right index. Natural logarithms are used to correct for nonlinearity. The panel regression model I is estimated without any fixed effects while the model II is estimated with both country and year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable: (Natural logarithm) Gross Domestic Product per capita		
	I	II
lntradevg	-2.8082	-9.6323
	(1.87)	(23.85)
_cons	13.4632	42.4175
	(8.21)	(101.82)
Country fixed effects	No	Yes
Year fixed effects	No	Yes
N	1134	1134
r2	N/A	0.0102

Table 27. This table contains the regression of moving average of natural logarithm of trade openness (measured by exports to GDP) on the moving average of natural logarithm of GDP per capita instrumented by the property right index. Natural logarithms are used to correct for nonlinearity. The panel regression model I is estimated without any fixed effects while the model II is estimated with both country and year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II instead of overall R_2 the within and between R_2 are reported respectively. The stars signify significance at the following levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Dependent variable: (Natural logarithm) Gross Domestic Product per capita		
	I	II
lnetgdpavg	-2.0721*	-2.4706
	(1.07)	(2.15)
_cons	8.7146**	9.9922
	(3.89)	(7.59)
Country fixed effects	No	Yes
Year fixed effects	No	Yes
N	1134	1134
r2	N/A	0.0126/0.051

Appendix VII. Growth Models

This appendix presents the results from estimating the estimating the effect of growth of openness on economic growth. All regressions are based on IV even though the first stages are not reported. More detail is in each case provided in table description.

Table 28. This table contains the regression of trade openness growth (measured as growth of export plus import to GDP ratio) on GDP growth per capita using property rights index growth as an instrument with (two-way) time and country fixed-effects. Natural logarithms are used to correct for nonlinearity. The panel regression model I is estimated without any fixed effects while the model II is estimated with both country and year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II instead of overall R_2 the between R_2 is reported respectively. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable: Gross Domestic Product growth per capita (Natural logarithm)		
	I	II
tradegrowth	7.3940	13.8520
	(7.34)	(26.18)
_cons	-0.1632	-0.6510
	(0.14)	(0.58)
Country fixed effects	No	Yes
Year fixed effects	No	Yes
N	1391	1391
r2	N/A	0.0132

Table 29. This table contains the regression of trade openness growth (measured as growth of export plus import to GDP ratio) on GDP growth per capita using coastline as an instrument with time fixed-effects. Natural logarithms are used to correct for nonlinearity. Control variables are in levels since they are only controls and not the main variables of interest. The panel regression model I is estimated without any fixed effects while the model II is estimated with both country and year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II instead of overall R_2 the between R_2 is reported respectively. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable: Gross Domestic Product growth per capita(Natural logarithm)		
	I	II
tradegrowth	-20.0863	-537.9929
	(37.17)	(19006.81)

FDI_inflows	0.0057	0.1322
	(0.01)	(4.66)
_cons	0.1389	12.5160
	(0.34)	(435.36)
N	1311	1311
r2	N/A	0.0010/0.0004

Table 30. This table contains the regression of trade openness growth (measured as growth of export plus import to GDP ratio) on GDP growth per capita using the equatorial distance as an instrument with time fixed-effects. Natural logarithm of instrument, and natural logarithm growth rates of dependent variable and independent variable are taken. Control variables are in levels since they are only controls and not the main variables of interest. The pooled cross-section regression model I is estimated without any fixed effects while the model II and III are both estimated with year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II and III instead of overall R_2 the between and within R_2 is reported respectively. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable: Gross Domestic Product Growth Per Capita (Natural Logarithm)			
	I	II	III
Tradegrowth	1.7643	1.1055	-19.9539
	(1.44)	(1.92)	(38.46)
m_edu			-0.2532
			(0.33)
ms_pc			0.0437
			(0.07)
dr_pc			0.1629
			(0.63)
tfp			-0.0291
			(0.05)
Gov_Spending			0.0385
			(0.05)
Exchange_Rate			-0.0181
			(0.04)
Ind_Share			0.0707
			(0.07)
Dom_Credit			-0.0058
			(0.00)
_cons	-0.0629**	0.0729	7.2576

	(0.03)	(0.18)	(12.49)
Country-fixed effects	**No**	**No**	**No**
Year fixed effect	**No**	**Yes**	**Yes**
N	1588	1588	50
r2	N/A	0.0915/ 0.0363	0.0111/0.2214

Table 31. This table contains the regression of trade openness growth (measured as growth of exports to GDP ratio) on GDP growth per capita using the growth of property right index as an instrument with (two-way) time and country fixed-effects. Natural logarithm of instrument, and natural logarithm growth rates of dependent variable and independent variable are taken. The panel regression model I is estimated without any fixed effects while the model II is estimated with both country and year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. The stars signify significance at the following levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Dependent variable: Gross Domestic Product Growth Per Capita (Natural Logarithm)		
	I	II
etpgdpgrowth	5.6775	14.2257
	(5.60)	(28.36)
_cons	-0.1374	-0.7174
	(0.11)	(0.74)
Country fixed effects	**No**	**Yes**
Year fixed effects	**No**	**Yes**
N	1391	1391
r2	N/A	0.0128

Table 32. This table contains the regression of trade openness growth (measured as growth of exports to GDP ratio) on GDP growth per capita using the coastline as an instrument with time fixed-effects. Natural logarithm of instrument, and natural logarithm growth rates of dependent variable and independent variable are taken. The regression model I is estimated without any fixed effects while the model II and III are estimated with year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II and III instead of overall R_2 the between and within R_2 is reported respectively. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : Gross Domestic Product Growth Per Capita (Natural Logarithm)			
	I	II	III
etpgdpgrowth	1.8306	2.1506	17.7230
	(1.77)	(1.91)	(15.07)
bc_pc			-0.0073
			(0.02)
dr_pc			0.2929
			(0.47)
tfp			-0.0357
			(0.03)
Investment			0.0231
			(0.03)
Exchange_Rate			0.0142
			(0.01)
Ind_Share			0.0044
			(0.03)
FDI_inflows			-0.0047
			(0.02)
_cons	-0.0698***	0.1043	-1.5201
	(0.02)	(0.16)	(2.11)
Country fixed effects	No	No	No
Year fixed effects	No	Yes	Yes
N	1387	1387	46
r2	N/A	0.0454/ 0.0102	0.1122/ 0.2258

Table 33. This table contains the regression of trade openness growth (measured as growth of exports to GDP ratio) on GDP growth per capita using the equatorial distance as an instrument with time fixed-effects. Natural logarithm of instrument, and natural logarithm growth rates of dependent variable and independent variable are taken. The regression model I is estimated without any fixed effects while the model II and III are estimated with year fixed effects. The country level clustered errors, used to adjust for autocorrelation and heteroskedasticity, are reported in the parentheses. In the model II and III instead of overall R_2 the between and within R_2 is reported respectively. The stars signify significance at the following levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

Dependent variable : (Natural logarithm) Gross Domestic Product growth per capita			
	I	II	III
lnetgdp	-0.5305	-0.5036	33.3249
	(1.17)	(0.89)	(159.23)
m_edu			-0.8621
			(3.97)
bc_pc			0.0957
			(0.58)
ms_pc			-2.6978
			(13.16)
dr_pc			8.0158
			(46.13)
tfp			1.2641
			(4.85)
Gov_Spending			-1.6621
			(7.25)
Exchange_Rate			-0.1780
			(0.91)
Ind_Share			-1.0064
			(4.48)
Dom_Credit			-0.1163
			(0.52)
_cons	2.9286	2.6567	-151.5595
	(4.31)	(3.04)	(644.05)
Country fixed effects	No	No	No
Year fixed effects	No	Yes	Yes
N	1970	1970	54
r2	N/A	0.0773/0.0158	0.0349/0.0317