

Non-linear Effects of Trade Openness on Economic Growth

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Abstract

This paper analyzes the effects of trade openness on economic growth in a panel of thirty developed and developing countries. The fixed effects model was estimated using the PSTR technique on data covering the period 1980-2019. The results show that the relationship between trade openness and economic growth is non-linear, and that the effects of external openness on growth depend on the thresholds of national income per capita. Below the estimated national income threshold of 35 118 USD per capita, trade openness has no significant effect on economic growth. Above this threshold, trade openness contributes positively to economic growth. It is suggested that the political authorities implement policies that contribute to increasing national income and improving purchasing power.

Keywords: international trade, economic growth, international economy

1. Introduction

Since Adam Smith's work on international trade, later reinforced by the theories of comparative advantage (Ricardo, 1817) and factor endowments (HOS model - 1941¹), trade openness (or external openness) is considered as one of the determinants of growth along with capital and labor (Ekodo and Ngomsu (2017).

According to Barro and Sala-i-Martin (1997), external openness facilitates the acquisition of goods and services, ensures the efficiency of resource allocation, and improves total factor productivity through technology diffusion. It is therefore important for countries to open up further in order to give their economies the expected performance in terms of economic growth. These arguments are verified in several works including Karras (2003), Yanikkaya (2003), Hye and Lau (2016), and Kevo (2017).

The work of Karras (2003) on two panels (56 countries between 1951 and 1998; 105 countries for the period 1960-1997) shows that an increase in the ratio of trade to GDP of 10% leads to an increase in the real growth rate of GDP from 0.25% to 3%. Similarly, Yanikkaya (2003) uses a sample of 120 countries with data covering the period 1970-1997. The results, using the GMM method, reveal that trade liberalization, measured by exports and imports as a percentage of GDP, has a positive impact on per capita income growth in the long run.

Similarly, Ijirshar (2019), using non-stationary heterogeneous dynamic panel models for the period 1975 to 2017, finds a positive impact of trade openness on growth in ECOWAS countries.

However, the wave of international trade liberalization brought about by the 1995 Marraketch Agreement, which gave birth to the World Trade Organization (WTO), has been contested around the world. Everywhere on the planet, the opening up of foreign markets is sometimes presented as a threat to States by the alterglobalization movements. The latter campaign for the protection of fragile and underdeveloped young nations from the great capitalist powers. In Africa, for example, concerns have long focused on the EU-Africa economic partnership agreements.

Despite everything, trade openness encourages specialization in sectors conferring economies of scale, thereby improving efficiency and productivity in the long run (Krueger, 1978; Bhagwati, 1978). The diffusion of technology that results from the sale of goods is the transmission channel of openness on economic growth. The expected gains for importing countries are both static and dynamic: input acquisitions and productivity increases, local creation of new varieties, imitation and productivity gains (Coe and Helpman, 1995; Grossman and Helpman, 1991; Romer, 1994; Edwards, 1998). Moreover, external openness leads to international capital flows and a reorientation of factor endowments towards the most productive sectors: transfers, foreign investments, etc. (Adhikary, 2011; Osabuohien,

¹ The model derived from the work of Eli Heckscher, Bertil Ohlin and Paul Samuelson

2007).

On the contrary, the results of several studies, such as those of Jafari Samini et al (2012), put into perspective the considerations that some researchers have on the effects of international trade. External openness can be a danger, not a source of benefit, in that it removes barriers put in place by a country to protect itself from foreign competition. This is also the case when a country specializes in sectors where research and development is more important (Almeida and Fernandes, 2008).

The debate on the influence of trade openness on growth is therefore not completely closed. It grows at each major WTO meeting. Nevertheless, countries are tending to free themselves more and more from trade barriers. According to the WTO, between 1950 and 2021, the volume of world trade increased exponentially (about 4,300% during this period).

Evolution of world trade, 1950-2021 Volume index, 1950=100

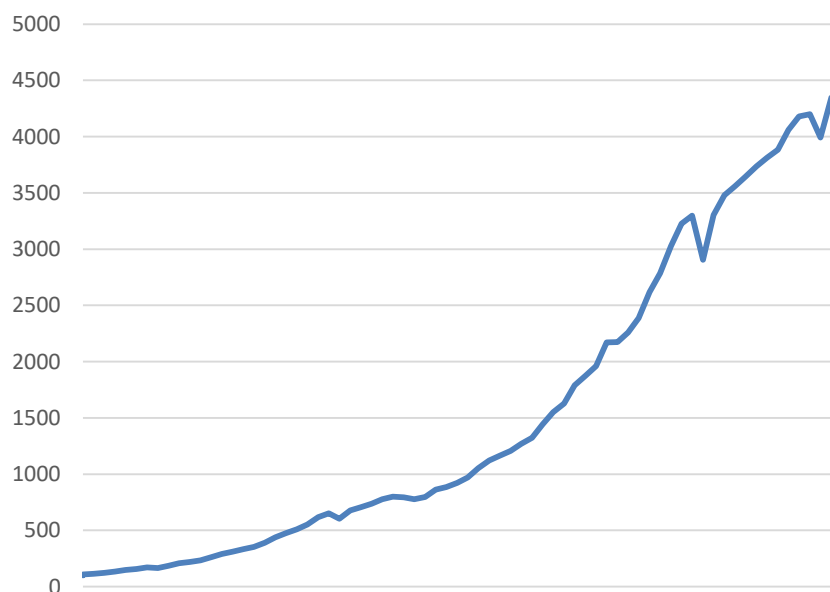


Chart I. Evolution of world trade in volume index

Source : World Trade Organisation 2022

The great powers such as the USA, China and the EU have for several decades adopted strategic trade policies to penetrate the markets of other countries. Emerging countries characterized by high growth rates are also in a logic of great liberalization with opening policies. The same is true **for** developing countries.

Although economic growth in developed and emerging countries is also taking place in parallel with external openness, this growth is not a regular and sustainable. Similarly, in developing countries, the levels of GDP growth do not allow countries to free themselves from the poverty that has persisted since the 1960s. It is undeniable that this irregularity in growth is accompanied by job losses, declining business activity, and even bankruptcies in some cases. These facts reinforce the skepticism about the external opening of nations.

According to Cooke (2010), external openness accelerates inflation and negatively impacts economic growth. External openness subjects economies to global competition that can be harmful to local industries (Vlastou, 2010; Adhikary, 2015; Okombi, 2018). For weak developing country economies specializing in primary commodity exports, lower terms of trade lead to lower revenues (Hausmann et al., 2017).

Several other works lead to negative or insignificant results of trade openness on economic growth. This is the case of the work of Agbahoungba and Thiam (2018) for the CEDEAC between 1996 and 2016, based on the endogenous growth model and the generalized moments technique (GMM). In the same vein, Hye and Lau (2016) regarding India between 1971 and 2009, applied the autoregressive distributional lag technique and sliding window regression on an endogenous growth model. Using the panel cointegration technique and causality tests, Vlastou (2010) shows that

external openness has a negative effect on growth in a representative sample of 34 African countries between 1960 and 2003.

For other economists, however, the contribution of external openness to growth is conditioned by other phenomena. These include the resilience of economies to global competition and new technologies (Jin, 2004). For Berthelemy (2005), if external openness benefits developed and emerging countries, it is because the exports of these countries are more diversified in terms of the number of products exported. Export diversification is presented as a condition that can enable countries, especially developing countries, to stabilize their revenues (Bertinelli, 2006; Levchenko et al. 2008; Huchet-Bourdon et al., 2018; Gaskani et al. 2011; etc.). The level of initial income also plays a role (Fetahi-Vehabi, 2015), as does gross fixed capital formation or total factor productivity (Ramzan et al. 2019).

Kim and Lin (2009) show that trade openness has more positive effects on economic growth in high-income countries. Initial real income per capita is considered as a threshold variable. These authors argue that for low-income economies, more trade openness leads to negative effects on economic growth. For Ramzan et al. (2019), in a sample of 82 countries and for the period 1980-2014, trade openness does not automatically impact economic growth. The results depend on the level of gross fixed capital formation. When the latter is low, the effects are negative. However, when gross fixed capital formation reaches a certain threshold, the effects become positive. Zahonogo (2016) shows that trade openness impacts growth depending on the threshold. The study covers 42 sub-Saharan African countries between 1980 and 2012. This author uses a dynamic growth model by estimating a Pooled Mean Group. Below the highlighted threshold, the effects of external openness on growth are positive. Above the threshold, more openness leads to negative effects. For Guei and Leroux (2019), according to the ARDL approach and the Common Mean Group model, export diversification would allow external openness to contribute to economic growth in ECOWAS between 1990 and 2016. Without this condition, trade openness has a negative impact.

The different results only amplify the controversy. Moreover, the uncertainty about the true mediation effect of some conditional variables requires further study. It is true that the divergence in methodological approach can also lead to varied results. This argument alone is not sufficient to justify the contradictory results on the effect of external openness on economic growth. It is in this context that the present article is justified.

The objective of this article is to analyze the effects of trade openness on economic growth by taking into account per capita income. The hypothesis is that there is a non-linear relationship between external openness and economic growth. It is the level of per capita income that is decisive between the two phenomena in order to confer positive effects on economic growth.

After this introductory part, the rest of the article presents successively the methodology used, the results obtained, the discussion and the conclusion.

2. Methodology

Our methodology is based on the PSTR "Panel Smooth Threshold Regression" modeling proposed by Gonzalez et al. (2005). The PSTR model presents a smooth transition from one regime to another with parameter values depending on these regimes.

Regime-switching models are relevant to take into account the non-linearity between variables. The PSTR model is able to explain how economic series have different dynamics according to the regimes.

This model is written as follows :

$$Y_{it} = \mu_i + \beta'_0 X_{it} + \beta'_1 X_{it} g(q_{i,t}, y, c) + \varepsilon_{it} \quad (1)$$

With Y the dependent value, i represents the individuals, t the study period, μ is the vector of individual fixed effects, X_{it} is a vector of k explanatory variables, β'_0 and β'_1 are the vector of linear and nonlinear model parameters, respectively, $g(q_{i,t}, y, c)$ having $q_{i,t}$ as the transition variable, c the threshold parameter, and y the parameter that provides the characteristics of the slope of this transition function between two regimes, and finally ε as the error term.

The dependent variable is GDP ($gdpI$) expressed in US dollars (constant 2010 prices). The transition variable, which is also the variable of interest, is external openness (or trade openness) calculated as the sum of exports and imports on GDP. Exports and imports are in US dollars (constant 2010 prices). The expected sign of external openness is a source of controversy. However, according to classical and neoclassical theories of international trade, a positive sign is expected on this variable.

The explanatory variables are investment represented by gross fixed capital formation in constant 2010 base US dollars ($fbcfI$), total reserves in current US dollars ($totaresI$) and national income per capita in constant 2015 base US dollars ($rnhlI$). The positive sign is expected on each of these variables. The lagged variables of the dependent variable ($gdpI$) and the threshold variable are also control variables. The threshold variable is national income per capita ($rnhlI$).

The data are extracted from the World Bank's World Development Indicators (WDI) database (2022) for a panel of 30 countries (list in the appendix in Table 6), including 15 developed countries and 15 developing countries. The observations cover the period from 1980 to 2019 for reasons of data availability. The most recent data in this database are from 2022. We ignored observations from the period 2020-2022 to avoid the bias caused by the COVID-19 pandemic. The period before 1980 is characterized by numerous missing data. The missing data from 1980 onwards for a small number of years were filled by the moving average technique.

The procedure for estimating the PSTR model begins with the Fisher linearity or homogeneity test, to determine the linear or non-linear nature of the relationship between external openness and economic growth. This test also allows us to verify whether the threshold effect is statistically verifiable. Then we determine the number of regimes or the number of transition functions. Finally, the last step is the estimation of the PSTR. The estimation of the PSTR is done with a fixed effects model.

Descriptive statistics and stationarity tests are performed beforehand. The stationarity tests are those of Im, Pesaran and Shin (2003) and Levin, Lin and Chu (2002).

The estimation of the PSTR is done in several steps: the Fisher linearity and regime number tests, and then the estimation of the PSTR model parameters. The decision about the tests is made on the *p-value*.

3. Results

The first results presented are the descriptive statistics (Table 1). Those of the stationarity tests are placed in appendix (table 5).

Table 1. Descriptive statistics

Variable	Mean	Std. Dev	Min	Max
<i>totares1</i>	3.98e+10	7.49e+10	5.771342	5.74e+11
<i>fbcf1</i>	2.70e+14	8.20e+15	7.60e+08	2.81e+17
<i>pibcons1</i>	2.60e+15	5.47e+16	1.02668	1.50e+18
<i>dego1</i>	2.51e+09	7.72e+09	0.0016789	7.66e+10
<i>rnh1</i>	22416.17	22554.43	356.2903	95443.97

Source: Author, based on data from WDI 2022

The descriptive statistics reveal a very high degree of dispersion in the gross fixed capital formation (*fbcf1*) and external openness (*dego1*) series. Since the panel is categorized into two types, developed and developing countries, the values of these two series are certainly very different depending on the country category. The difference is also significant for GDP (*gdp1*) and total reserves (*totares1*). However, with respect to national income per capita (*rnh1*), the dispersion is relatively high compared to the other variables.

Table 2 below presents threshold values of national income per capita for the fixed effects model.

Table 2. Threshold values of national income per capita

Model	Threshold	Lower	Upper
Threshold -1	35 502.0703	35 486.4727	35 586.9063
Threshold -21	35 502.0703	35 112.5781	35 5869063
Threshold -22	35 118.6680	35 112.9609	35 992.3516
Threshold -3	49 394.5039	49 323.8398	49 430.1055

Source: Author, based on data from WDI 2022

Several threshold values appear. The following table shows that two thresholds are significant at the 1% level. The corresponding values are 35 502.0703 and 35 118.6680 US dollars of national income (threshold variable or *rnh1*). The upper and lower values are very close to these threshold values. The trend in GDP in relation to external openness differs depending on whether the values are below or above these thresholds.

The following table 3 presents the results of the linearity and threshold effects tests respectively. Only the results with the statistically significant threshold variable are retained. The threshold variable giving statistically significant results is lagged national income. The transition variable is external openness.

Table 3. Results of the linearity and threshold effects tests

Threshold	RSS	MSE	F-statistic	P-value	Crit10	Crit5	Crit1
Single	1.34e+36	2.58e+33	3.27	0.7867	14.7608	19.4131	52.1472
Double	1.17e+36	2.26e+33	73.90	0,0000***	45.1904	54.2333	67.8654
Triple	1.16e+36	2.25e+33	3.20	0.8833	23.3744	38.2868	61.7711

*** Significant at the 1% level

Source: Author, based on data from WDI 2022

The Fisher statistic of 73.90 with a probability of 0.0000 does not validate the null hypothesis of non-linearity between external openness and economic growth. The relationship between external openness and economic growth is statistically non-linear for all individuals in the panel.

Two thresholds are statistically verifiable, but no single or triple thresholds. The threshold values are 35 502.0703 and 35 118.6680 between 35 112.5781 and 35 586.9063 respectively, then 35 118.6680 and 35 992.3516. These values of national income per capita are benchmarks of GDP regime change. It is important to analyze the parameters of the estimation of the model that was chosen, namely the panel fixed effects model.

The results of the estimation of the fixed effects panel model are presented in Table 4

Table 4. Results of the panel fixed effects model

<i>Variables</i>	<i>Coefficients</i>	<i>Standard deviation</i>	<i>P-value</i>	
<i>Rnh1</i>	1.12e+10	3.82e+11	0.977	
<i>Totares1</i>	-168944.5	55028.93	0.002**	
<i>Fbcf1</i>	5.223476	0.1708112	0.000***	
<i>Degol</i>				
	0	34.48406	28.27264	0.223
	1	-328.831	46.75186	0.000***
	2	39.68523	21.85694	0.070*
	3	0	(omitted)	
<i>Cons</i>	1.10e+16	8.98e+15	0.219	
<i>F test = 1.84</i>				
<i>Prob > F</i>	0.0308			
<i>R² overall</i>	0.62			
<i>R² within</i>	0.65			

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Source: Author, based on data from WDI 2022

The estimation of the fixed effects model gives satisfactory results. This is because the Fisher test shows a value of 1.84 with a significant probability at the 5% level. Moreover, the global R^2 is 0.62 and the R^2 within is 0.65.

There is a transition function with two regimes of external openness. The first regime is a decay phase. The second regime is an ascending phase. In the first regime, an increase in external openness leads to a decrease in GDP with a probability significant at the 1% level, while in the second regime, an increase in external openness leads to an increase in GDP with a probability significant at the 10% level.

The threshold of 35 118.6680 also allows us to make a clear distinction between high-income and low-income countries. Below this threshold are low-income countries, mostly developing countries. Above the threshold, there are the rich countries, which are the developed countries.

External openness is associated with lower GDP when the threshold value is less than or equal to 35 118.6680. The positive effect of openness on economic growth begins to show up at values above the threshold. This result is close to that of Zahonogo (2016) who shows that the impact of trade openness on growth depends on the value of its threshold.

External openness explains economic growth in its low and high openness phases. It is from the second regime onwards that external openness contributes positively to GDP.

This result is consistent with our initial hypothesis in which we assumed that the influence of external openness on growth depends on the value of national income per capita. High income is a high purchasing power that allows the acquisition of productive and consumer goods, resulting in high export and import values.

The value of investment has the expected sign, but not that of total reserves (*totares1*), which has a negative sign. Investment, represented by gross fixed capital formation (*fbcf1*), contributes positively to GDP with a significance level of 1%. This result is consistent with the studies we have exploited on the effect of investment on GDP.

Total reserves (*totares1*) have a negative effect on GDP. This result is ambiguous and the studies on this subject are not consistent. National income per capita is not significant.

Investment remains one of the main channels of economic growth. It contributes, together with external openness, to the formation of the global product, associated with a high level of per capita income. Trade liberalization promotes investment by allowing domestic agents to import relatively cheaper and more efficient goods, thus eliminating structural constraints on investment and increasing the efficiency of the economy.

External openness influences growth through national income per capita. Foreign trade has negative effects on economic growth in low-income countries. But in high-income countries, the impacts are positive.

This confirms classical and neoclassical theories of international trade. International trade facilitates technology transfers through the import of capital goods, and increases innovation because of the larger markets. It facilitates the specialization of countries, which is supposed to lead to higher GDP growth.

4. Discussion

The results obtained are consistent with both our hypothesis and with the works pinpointed in the literature review. Also, the reality of the international economy helps to explain our results.

The nonlinear effects of trade openness on economic growth highlight the condition of the required level of national income per capita for openness to have significant effects on growth. These effects are consistent with the current reality of the international economy. In fact, countries with a high level of national income per capita are those characterized by a long tradition of high GDP (several decades of high growth rates during the "Thirty glorious years" in particular), a high level of investment and external openness that affects not only the real sphere of goods and services, but also that of capital.

The methodology used, which consists of having a single panel for all the countries studied, has been beneficial. The results showed this contrast of countries through the prism of national income per capita, confirming the relevance of the descriptive statistics and the estimates obtained. The distinction of the category of countries is also perceptible through the dispersion of the series of gross fixed capital formation, external openness, GDP and total reserves.

Referring to the theory of specialization and comparative advantage, developed countries benefit from external openness from their technology and by highlighting the more abundant factors in their countries.

It is important to understand the growing commitment to external openness of developing countries characterized by low levels of per capita income. The behavior of these States is driven by theories of international trade whose dominant arguments are the advantages and benefits that states would derive from external openness. Despite the enthusiasm of developing countries, the results show that external openness does not contribute to growth in developing countries with low levels of national income per capita. These countries have also embarked since several years on a dynamic of regional integration with greater trade openness, removing obstacles to the free movement of people and goods in the hope of trading with their closest neighbors and reducing their transport and transaction costs.

The enthusiasm of developing countries for external openness is difficult to understand in relation with our results. It is at this level that we can establish a limit to our study, which cannot explain why developing countries are adopting open trade policies, exposing their fragile economies to competition from firms of the great economic powers and emerging countries. This issue could be the subject of further research.

The contribution of investment (represented by gross fixed capital formation) to economic growth is undeniable. It is supported by classical, neoclassical and Keynesian theories. The majority of empirical studies also confirm it. The strong dispersion observed on this variable between individuals confirms the distinction between the two categories of countries in the panel. Developed countries are characterized by high investment values, unlike developing countries.

Investment and external openness drive economic cycles and greatly explain the dynamics of economic growth in developed countries. The need for reconstruction after the World War Two led to the implementation of construction and modernization plans and programs. The successive investments made continue to drive large-scale production to satisfy the needs of more numerous populations scattered around the planet: diversity of products, diversity of preferences of many consumers, diversity of markets, etc.

The resulting mass production accelerates cycles, hiring and wages. Such dynamics in open economies lead to more exports and imports of equipment and consumer products.

5. Conclusion and Policy Implications

The objective of this article was to analyze the effects of trade openness on economic growth. International trade theories, through the models of comparative advantage, factor endowments and endogenous growth, predict that external openness contributes positively to GDP growth.

These early theories of international trade are the subject of theoretical and empirical controversy. External openness is seen as a danger that reduces customs revenues and exposes firms in fragile countries. The debate is that, for other economists, the contribution of external openness to growth is conditioned, among other factors, by the diversification of economies and initial income.

In this paper, we use a PSTR methodology of Gonzalez & al (2005). The fixed-effects model, used with a panel of thirty countries composed of fifteen developed and fifteen developing countries, yielded results that confirm the hypothesis supported at the outset, precisely the effect of external openness on growth is conditioned by the threshold of national income per capita.

The effect of external openness on growth is analyzed in a non-linear relationship that justifies the use of a PSTR. The effects of trade openness on economic growth depend on econometrically significant thresholds of estimated national income per capita. Moreover, there is a transition function with two regimes of external openness: a declining regime at the beginning, giving way to a growing regime afterwards. The threshold value of national income per capita is estimated at 35 118 USD per capita. This is a very decisive value for the desired effect. This result is close to that of Zahonogo (2016) who shows that the impact of trade openness on growth depends on the value of its threshold.

Developing countries, disadvantaged with low technical and financial capital, do not enjoy the same advantages compared to developed countries with high technical and financial resources.

We recommend that the authorities develop policies to improve the purchasing power and increase the national income per capita of their country.

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Appendices

Table 5. Unit root tests in panel

Variables	IPS		LLC		Decisions
	At level	At difference	At level	At difference	
Totares1	-0.4541 (0.3949)	-16.6889 (0.0000)	5.5461 (1.0000)	-5.9345 (0.0000)	I (1)
Fbcf1	-5.8416 (0.0000)		-3.7517 (0.0001)		I (0)
Pibcons1	-20.9050 (0.0000)		-4.2414 (0.0000)		I (0)
Rnh1	12.6184 (1.0000)	-14.5947 (0.0000)	3.6999 (0.9999)	-8.4365 (0.0000)	I (1)
Dego1	-7.7021 (0.0000)		19.0900 (1.0000)	-10.0631 (0.0000)	I (1)

*** Significant at the 1% level. P-values are in brackets

Source: Author, based on data from WDI 2022

Table 6. List of countries in the panel

Pays développés :	France, Allemagne, Pays-Bas, Italie, Espagne, Canada, USA, Japon, Espagne, Royaume Uni, Finlande, Grèce, Irlande, Luxembourg, Portugal, Norvège
Pays en développement :	Afrique du Sud, Kenya, Côte d'Ivoire, Nigeria, Maroc, Singapour, Malaisie, Inde, Indonésie, Brésil, Argentine, Bolivie, Équateur, Égypte.

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