Can "trade activeness" be an important indicator to growth? Panel Regression Evidence: The case for oil-producing countries.

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Abstract

How vigorous a country is in international trade is a crucial aspect that influences cross-country variation in growth rate. Trade facilitates economic development by bringing in innovative technology and know-how, improving the quality and productivity of both human and physical capital, and through spillover effects. We attempt to give a new insight into the contribution of trade activity to economic growth by introducing a new variable, "trade activeness," which is a combination of four indicators that are believed to influence one's performance in international trade: 1) trade openness 2) net foreign direct investment (FDI), 3) Terms of Trade (TOT), 4) tariffs. This paper aims to evaluate our hypothesis: countries with higher trade activeness tend to have better growth than those with lower trade activeness. Panel data regression on oil-producing countries as a subset will be performed to examine the relationship between economic growth and each of the four indicators, as well as the joint effect of the four indicators on economic growth. The results will show an inverted U-shape for TOT and economic growth, statistically significant and positive relationships between economic growth and FDI outflow and trade openness, and a negative relationship between tariffs and growth.

Introduction

From 1991 to the outbreak, China achieved unprecedentedly rapid economic growth for decades, with an average annual growth rate of about 10% (The World Bank 2022). According to the traditional Solow model, the current account should be negative. In other words, developing countries, such as China, should invest with foreign capital inflows to achieve rapid economic growth in the country. However, China's current account is a perennial surplus. Yu 2017 explained the enormous economic benefits of China's economic institutions since its reform and opening up through trade policies such as Belt and Road Initiative. However, in quantitative terms, what aspects of trade have led to China's rapid growth, and to what extent?

Bassani and Scarpetta (2001), Nasreen and Anwar (2014) and Ramazan, Sheng, Shahbaz, Song, and Jiao (2019) have proved the impact of trade openness and FDI on the long-run economy, but few articles discussing tariffs or terms of trade or comprehensive model. In other words, many previous models have examined a single variable, and few models have utilized diverse variables to shape a comprehensive model to investigate the variable in interest. For example, Aizenman and Noy(2006) only discovered the relationship between FDI and economic growth. Also, Kohli (2001) figured out the importance of one specific variable, TOT, in economic development. This paper will resolve the homogeneity of factors to construct a comprehensive trade indicator, trade activeness.

The study will combine the refined Solow model and Cobb Douglas production function, and it will combine the four trade-related variables of tariffs, terms of trade, trade openness, and foreign direct investment (FDI) in a one-to-one ratio with a comprehensive variable, trade activeness. In this way, our hypothesis is to examine the long-run economic impact of the comprehensive variable, trade activeness. This paper will base on four independent regressions of the four variables to analyze the results. Specifically, the research will include a sub-set that defines the countries with oil rent above 0.1% of GDP as oil-producing countries to assess if oil-producing capabilities have any economic influence on the GDP. Through the integrated model, this paper will provide a reference for policymakers to develop comprehensive

benchmarks for setting the standard of trade indicators. Since the traditional Solow model incorporates human capital, saving, lagged GDP, and population growth (Bassanini and Scarpetta 2003, pg. 25), this model will also refer to these 4 variables to make it comprehensive.

This paper will analyze the impact of trade activeness on long-term economic growth in five parts. Firstly, the introduction part investigates why the authors of this paper desire to study this topic and briefly describe how the research is developed. In the second part, the literature review will utilize 11 peer-reviewed journal papers to introduce the research done by other scholars on the four variables that the writers are studying in this paper and compare the differences between the 11 academic papers and this research horizontally and vertically. The third section, the data section, will introduce the methodology and mathematical functions cited in this paper in detail. The fourth section, results, will provide a detailed data analysis of the regressions conducted in this paper, including coefficients, significance level, subsets, etc. The fifth section, the conclusion, will apply the experimental results of this paper to a real-life scenario and make prospective recommendations on the current trade policy.

Literature Review

The backbone of this paper is the selection of indicators that represent how vigorous countries are in international trade, which is referred to as "trade activeness". The four indicators that define trade activeness are 1) trade openness, 2) net foreign direct investment (FDI), 3) Terms of Trade (TOT), and 4) tariffs. Each of the four indicators is regressed on the variables consistent with the neoclassical Solow growth model (population growth, accumulation of human capital, Lagged GDP, and saving) to see if each indicator has a positive correlation with the growth of GDP per capita.

Why Oil-Producing countries?

For the subset of countries, this paper uses oil-producing countries which are determined by using the "oil rent" indicator available on the World Bank database. The oil rent measures the contribution of oil production to generating national income. Countries that score over 0.1% in the oil rent indicator are treated as oil-producing countries. Those countries are worth evaluating because there are studies that show a

positive relationship between oil production and the growth of GDP. Nasreen and Anwar (2014) mention that both consumption and production of energy such as crude oil is an important aspect of an expansion in trade and GDP, because countries need sources of energy to get full advantage of inflows of new technology and both physical and human capital. By analyzing statistical data collected from OPEC Statistical Bulletin, Eregha and Mesagan (2020) find that from 1980-to 2017, amongst oil-rich African nations, including Algeria, Angola, Egypt, Libya and Nigeria, oil production was positively related to GDP growth in the long run except for Nigeria. Based on the data collected from various sources, such as British Petroleum Energy Statistical Review, World Development Indicators and China Statistic Yearbook, Rahman, Khattak, Ahmed, Khan (2019) successfully find a long-term positive relationship between economic growth and energy production, as 1% increase in oil production led to a 0.497% increase in GDP growth in China, using FMOLS estimations. However, there is a counter-argument made by Van Der Ploeg (2011) which finds that natural resource dependence negatively correlates with economic growth, as many factors that lead to growth, such as school enrollment and financial system development. This phenomenon is known as the "resource curse".(Van der Ploeg, 2011; pg. 402)

Since there are mixed observations on the relationship between the natural resource consumption/production and economic growth, it would be meaningful to see the differences in GDP-Trade activeness nexus between oil-producing and non-oil producing countries.

Trade Openness vs Growth: evidence of a positive relationship

Trade openness was chosen because many studies recognized the positive relationship between trade openness and growth as well as real exchange rate fluctuations, and CA improvement. The degree of trade openness also shows how dependent a country is on trade when generating national income. Bassani and Scarpetta (2001) and Nasreen and Anwar (2014) and Ramazan, Sheng, Shahbaz, Song, and Jiao (2019) state that how open one's economy is also affects the level of competition between domestic and foreign producers, the volume of diffusion of

technology and accumulation of both physical and human capital. Thus trade openness is an important indicator that allows countries to have more inflows of capital, wealth, and technology, which drives economic growth. By using quarterly data from the IMF-IMS database on 181 developed countries, Romeli, Terra, and Vansconcelos (2018) show that especially in times of crisis, countries with higher trade openness are more prepared for negative effects brought by sudden stops, or sharp depreciation of their currencies by finding a positive relationship between the CA-GDP ratio and both trade openness and change in the real exchange rate (RER). This means that open economy-oriented countries recover faster during the recession because they experience more improvement in their current account balance after the depreciation of their currencies. The same study also shows that countries that are in the 75th percentile of trade openness saw a 2.6% raise or improvement after a 1% depreciation of their currency, as opposed to a 1.7% improvement on CA after the same magnitude of depreciation of currencies in countries that are in 25th percentile of trade openness. Moreover, the degree of trade openness determines the price of exported goods in terms of foreign currencies. (Romeli, Terra and Vansconcelos, 2018; pg.154). Since trade openness poses an effect on CA balance as well as RER which is a determinant of the value of both exports and imports, it is included as an important indicator of trade activeness, as well as economic growth.

The significance of not having FDI restrictions on growth

Secondly, the connection between FDI and trade as well as growth might not be obvious, but there is supporting evidence that shows such a relationship. Employing data samples available in the 2001 edition of the World Bank's World Development Indicator (WDI), Aizenman and Noy(2006) evaluate the linkage between FDI and trade, show that developing countries that have lower restrictions on foreign asset inflows/outflows attract more volume of both vertical FDI and international trade, which leads to improved productivity and growth. More specifically, those countries that allow their companies to employ foreign workers experience the greater value of international trade and eventually lead to higher growth after seeing the demand for skilled workers increase, which leads to more efficient production and higher returns

from human capital. Developed countries follow the same effect, but are smaller than developing countries. (Aizenman, Noy 2006; pg.324)

From the data collected from Eurostat, Jimborean and Kelber (2017) find that by using a dynamic panel data analysis using central and Eastern European countries over the period between 1993 and 2014, there is a positive relationship between FDI inflows and economic growth. Specifically, their research result reveals that a 1% increase in FDI results in around 0.18-0.23% increase in real GDP, clearly stating the evidence that having fewer restrictions on the inflow/outflow of foreign assets has a positive relationship with the growth of GDP. But Jimborean and Kelber (2017) also mention that FDI could also hurt resource allocation and slow growth. Also, even for CEECs, the linkage between FDI and growth has been controversial as well, as the benefit through FDI is only available for countries with a minimum threshold of human capital, infrastructure, and the level of an institutional framework. Thus FDI is an interesting indicator that can be included in the trade activeness composition, and see if it poses a positive effect on the growth of oil-producing countries.

Trade Protectionism (tariff) and Growth:

Conventional economic teachings often assume that tariff imposition - growth is negative, as the application of tariff increases the price of imported goods, and therefore hinders the chance of acquiring new technology, products, and ideas coming into the country that is essential not only for economic growth but also for improving productivity. (Roy, 2013, pg.250). In addition, Dollar and Kraay (2004) with data available in OECD data, compare the growth of both poor and rich countries (24 rich and 73 poor or developing) that chose to open up their economy to international trade to the growth of those who remained close, using 101 developing countries in total. This study finds out, that not only that more-globalized countries experience a significant increase in the trade-GDP ratio between the 1970s and 1990s (16% to 33% of GDP), but also enlightened the fact that more open countries experienced higher per-capita growth (0.5% to 2.0% per annum between 1970s to 1990s), supporting the claim that getting rid of protectionist policy to form a more open economy leads to greater economic growth.

How modern GDP calculations do not incorporate the improvement of TOT

Lastly, the reason why Terms of Trade (TOT) were chosen is that the fluctuation of TOT has an important implication for real income and welfare, which are important aspects that measure standards of living. (Kohli 2001, pg.85). An improvement of TOT implies that a country can accumulate more capital and wealth than they spend on purchasing imported goods. (Kohli 2001, pg.87). However, because the focus is on production per se when we measure GDP, especially by a Laspeyres quantity index which most countries do, an improvement in terms of trade would lead to a fall in real GDP. (Kohli 2001, pg. 93). Kohli (2001) finds from data accumulated by the U.S. Bureau of Economic Analysis that real GDP growth was underestimated by 4.3% in Portugal, 3.8% in Switzerland, and 3.2% in Luxembourg because traditional command-based measures of real GDP did not include their TOT improvements over the 1980-96 period, even these countries experienced annual growth of 2.50%, 3.77% and 1.08% of trading gains which incorporate improvements in TOT. On the other hand, they found an overestimation of the measure of real GDP in countries such as Norway, Mexico, and Ireland by 7.5%, 4.0%, and 3.2% respectively. These results imply that if we incorporate TOT more in the measurement of real GDP, i,e regress the TOT indicator with the traditional neoclassical growth model variables, we would expect the country variations in TOT should affect the growth in real GDP, and it is meaningful to test such correlation.

Why should you read and evaluate our research paper: the gap

This paper contributes to the work of past literature by finding new insight into what determines economic growth, by introducing a new variable called trade activeness that has never been assessed. Most of the past literature concentrates on the effect of one variable or two at most, on economic growth. using a subset of countries in a similar level of income group especially the developing countries, as well as the region which usually is grouped by each continent. For example, some studies assess the relationship between economic growth and TOT OR between GDP and trade openness but are not assessed jointly as one indicator. Some studies only concentrate in one specific country or countries in similar income groups which fail to expand its

findintheirto global perspectives. Since we believe that there are many aspects that influence one's trade activity, this paper seeks to investigate the joint effect of four indicators on economic growth, using a subset of countries with different stages in income levels as well as regions, ahaveng an abundance of oil in one country does not depend on the continent it is in or how developed one country is, to gain more globalized perspectives.

Data

Based on previous empirical and theoretical studies in similar categories regarding to trade, the model examining the effect of trade activeness on economic growth is derived from the Cobb-Douglas production function.

The Cobb-Douglas production function is:

$$Y = AL^{\beta}K^{\alpha}$$

Where Y denotes the gross domestic product, L denotes the labour input measured by human capital and growth of population and the K denotes the capital input measured by gross savings. The variable A represents the total factor productivity. Variable A controls for the economic factors affecting economic performance as explained by endogenous growth theories. The four economic indicators trade openness, net FDI outflow, term of trade and tariff are controlled through variable A in the model.

With previous discussion in the field (Nasreen and Anwar 2014), (Jimborean and Kelber 2017), (Roy, 2013), (Kohli 2001, 85), the variables used in this paper are defined as follows. First, tariff rate, as key indicator of trade activeness, measures the average tariff rate of all traded goods in different countries. Trade openness is quantified by the sum of exports and imports as a percentage of total GDP. The terms of trade are defined as the export price divided by the import price. Foreign direct investment data are mainly collected for investments in foreign capital. Intuitively, countries with abundant natural resources, such as oil-producing countries, will have an edge in the trade market. The research will also include subsets of oil-producing countries to delve into whether the four indicators of the oil-producing countries are consistent with the general trend. Moreover, the four variables will be combined to

trade activeness to evaluate the combined effect of four indicators on economic growth.

Regression Model

The weight of each indicator contributes to the primary indicator of trade activeness evenly. The gross domestic product per capita is used as a proxy for economic growth. With consideration of the Solow Growth model to the Cobb-Douglas production function, the indicator for saving, growth of population and human capital is taken into consideration as well from the structure of the previous study to capture the overall trend of economic growth with the consideration our research of interest (Bassanini & Scarpetta 2003).

Each indicator will be evaluated individually and together to evaluate our comprehensive indicator trade activeness. The following regression model equations are obtained, and the full explanation of the variable is in Chart 1.

$$lnY_t = \beta_0 + \beta_1 lntot_t + \beta_2 lntot_t^2 + \beta_3 lntariff_t + \beta_4 lnfdi_t + \beta_5 lntropen_t + \beta_6 lnsaving_t + \beta_7 grpop_t + \beta_8 lnhc_t + \beta_9 Y_{t-1} + \epsilon$$

Term of Trade:

$$lnY_t = \beta_0 + \beta_1 lntot_t + \beta_2 lntot_t^2 + \beta_3 lnsav_t + \beta_4 grpop_t + \beta_5 lnhc_t + \beta_6 Y_{t-1} + \epsilon$$

Net FDI outflow:

$$lnY_t = \beta_0 + \beta_1 lnfdi_t + \beta_2 lnsav_t + \beta_3 grpop_t + \beta_4 lnhc_t + \beta_5 Y_{t-1} + \epsilon$$

Tariff:

$$lnY_t = \beta_0 + \beta_1 lntariff_t + \beta_2 lnsav_t + \beta_3 grpop_t + \beta_4 lnhc_t + \beta_5 Y_{t-1} + \epsilon$$

Trade Openness:

$$lnY_t = \beta_0 + \beta_1 lntraop_t + \beta_2 lnsav_t + \beta_3 grpop_t + \beta_4 lnhc_t + \beta_5 Y_{t-1} + \epsilon$$

The ϵ_t is the error term. In the equation above, the coefficients of human capital, lagged level of GDP per capita, gross saving and growth of population are expected to be positive (Bassanini & Scarpetta 2003, 42). Nonetheless, the coefficients of four indicators measuring trade activeness are to be determined. We decided to take the subset of all countries by oil-producing country compared to all countries, the

regression model is used in evaluating the effect of trade activeness on oil-producing countries which have oil rents as a percentage of GDP greater than 0.1 percent.

Data Source

With the consideration of data availability and accuracy, the indicators required to measure the economic situation are from the World Bank database (The World Bank 2022) and Pen World Tables (Feenstra et al. 2015). The two datasets consist of the same country yet are referred to with different notation, modificationsion of the country

names is done to the World Bank dataset to match the country names in the Penn World Tables. Since the natural log of a negative number is undefined, the absolute value of net FDI outflow and gross savings is used to calculate the natural log and modified to be a negative value if the original data is negative. The overview of the variables is in Chart 2.

Chart 1. Description of individual variables

Indicator	Variable	Variable description
Trade openness	*tropen*	The ratio of exports plus imports over GDP (%) (The World Bank, 2022)
Net FDI outflow	*fdi*	Net outflows of foreign direct invest using a balance of payment in current US dollar (The World Bank, 2022)
Term of trade	*tot*	Net barter terms of trade index calculated as the percentage ratio of export unit value indexes to the import unit value indexes in 2000 =100 (The World Bank, 2022)
Tariff	*tariff*	The unweighted average of effectively applied rates for all products subject to tariff for all traded goods, as the simple mean applied tariff (%) (The World Bank, 2022)
Saving	*saving*	Gross national income less total consumption plus net transfer as a percentage of GDP (%) (The World Bank, 2022)

GDP	*cgdpe*	Expenditure side real GDP at current PPPs (in millions US$) 2005=1) (Feenstra et al., 2015)
GDP per capita	*Y*	Expenditure based GDP per capita (Feenstra et al., 2015)
Growth of population	*pop*	The year-on-year growth rate of population (%) (Feenstra et al., 2015)
Human capital	*hc*	The human capital index based on years of schooling and assumed returns (Feenstra et al., 2015)
Of Lagged GDP	Y_{t-1}	Lagged 1 of expenditure-based GDP per capita (Feenstra et al., 2015)
Oil rent	*oilprofit*	The oil rent calculated as the difference between the price of the crude oil and the average cost of producing the crude oil as a percentage of GDP (%) (The World Bank, 2022)

Chart 2. Summary of the dataset in year 2017

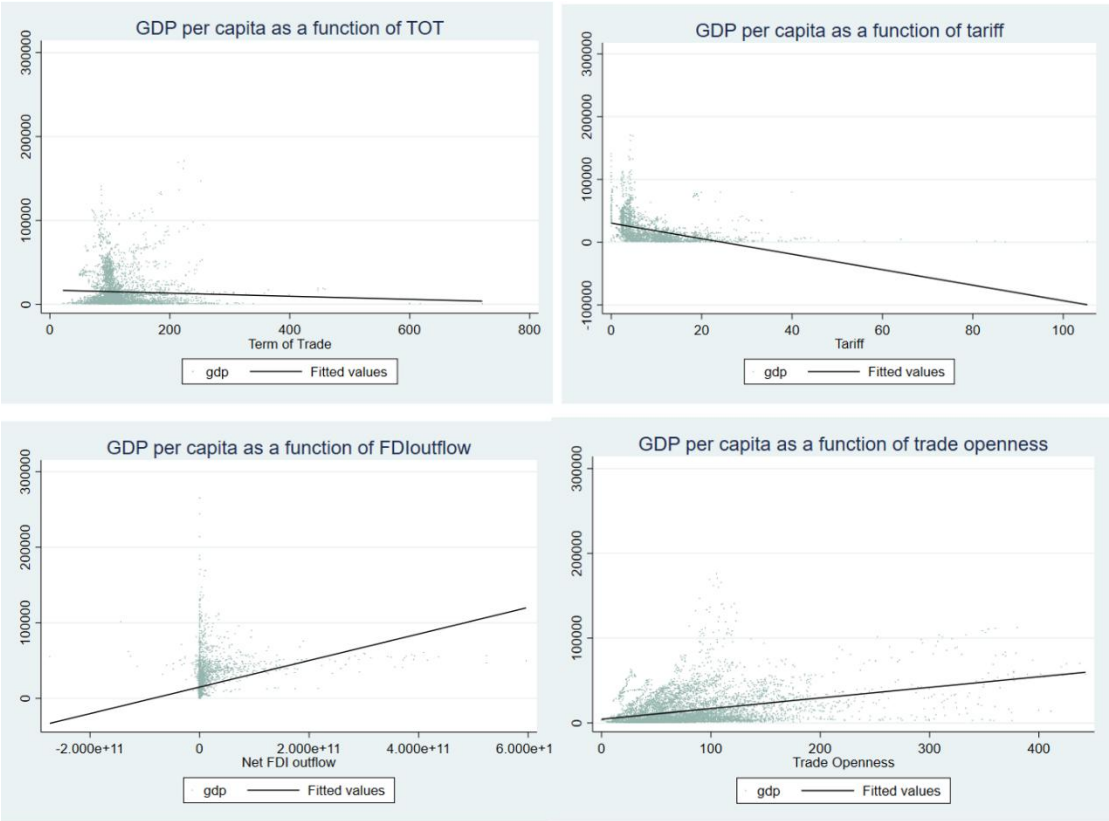
Variable name	Variable	Obs	Mean	Std. dev.	Min	Max
GDP	cgdpe	178	664433.8	2253405	794.7381	1.98E+07
Population	pop	178	41.52015	150.6975	0.029577	1421.022
GDP per capita	gdp	178	22113.07	22278.18	381.1562	110697.8
Growth of population	grpop	178	0.012814	0.011851	-0.0214061	0.046781
Term of trade	tot	176	117.7897	34.03321	50.72248	265.3916
Gross	saving	152	22.73048	9.498759	-1.7466	55.33646

saving						
Human capital	hc	144	2.658237	0.694527	1.211936	3.974208
Tariff	tariff	118	5.597627	4.311975	0	19.9
Net FDI outflow	fdiout	164	1.28E+10	4.66E+10	-1.45E+10	4.09E+11
Trade openness	tropen	164	89.8151	58.12199	1.462385	376.8278

Predictions

The hypothesis predicts trade activeness overall to have a positive relationship with the economic growth rate. As shown in Figure 1., an individual explanatory variable has a distinct relationship with the independent variable measuring economic growth. Our prediction of the performance of each variable in our regression is as follows:

Figure 1. Scatter plot of GDP as a function of four individual variables of interests



The variable term of trade represents the ability of one country to accumulate capital by trade, a country would accumulate more capital from exports than it is spending on imports with a term of trade greater than 100%. By the production function proposed, the accumulation of capital will result in an increase in total production. Therefore, a positive relationship between terms of trade and economic growth is proposed.

The variable net FDI outflow is somewhere crucial for developing countries (Jimborean and Kelber 2017), and trade agreements tend to encourage the country to execute more FDI the example of the North Atlantic Free Trade Agreement (NAFTA) (Villarreal & Fergusson 2017, 24), therefore, the lower net FDI outflow tends to help the country facilitated economic growth.

The variable tariff represents the protectionism of the product of a country against international competition, high tariff creates trade barriers that tend to raise the price and reduce the availability of goods and services, thus negatively impacting economic growth (Roy, 2013).

The variable trade openness measures direction of the economy of one country in the context of trade. The previous discussion argues trade growth is the main driver force of economic growth (Hye et al. 2013, 654). Moreover, higher trade openness stimulates allocation of resources and factor accumulation (Wei 2016, 16), by the production function proposed, higher factor trade openness tends to bring a higher economic growth rate.

The general relationship of the four indicators and economic growth remains the same for oil-producing countries, yet they tend to amplify the effect of some indicators. The variable term of trade will be amplified positively since the unit value of oil is relatively high, it tends to bring up the value for terms of trade. The effect of the other three variables tends to stay the same.

Weakness

There is a deficiency in the data used in the regression. Firstly, the individual variable may have an effect on economic growth, there is rarely discussion about the joint effect of many trade indicators on economic growth. Secondly, there is the

possibility that variable A in the production function is endogenous, and the error term ϵ_t contains other possible factors that could influence the regression result. Lastly, the selection of an oil-producing country is based on the oil rent one country make based on crude oil production as a percentage of GDP, yet if the country is a large economy and the percentage will be relatively small or the country produces oil but is not making a profit, then make the subset of country list exclusive.

Results and Analysis

Our hypothesis is that countries with high trade activeness will have better growth than those with low trade activeness. To test this hypothesis, four variables, including TOT, net FDI outflow, tariff, and trade openness, will be regressed independently, and then the four variables will be combined to test the variables of interest, trade activeness. For each model, the feasibility of the model will be tested, and corrections will be made.

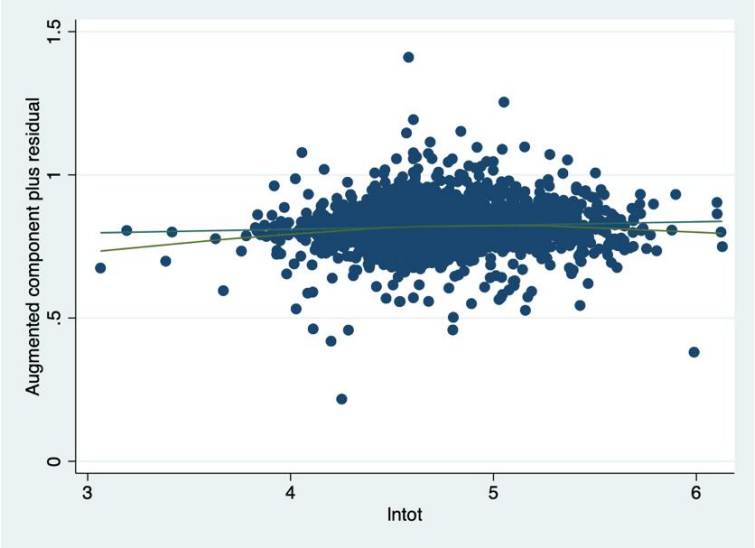
For the regression models, several tests and corrections will be performed to improve the model's construction, including non-linearity, heteroskedasticity, outliers, multicollinearity, and serial correlation.

For the non-linearity problem, the augmented component-plus-residual plot will be drawn to determine whether this issue exists. If the two green lines diverge as the variable increase, we should be concerned about non-linearity. The solution is to add a polynomial term; we tend to add a squared term to regression and keep the term if the coefficient on this term is statistically significant. When we detect the problem of heteroskedasticity, which indicates the variance of the error terms is not constant, we will correct our regression with consideration of heteroskedasticity. For the outlier problems, the observations with an absolute vale of residual score greater than 3 standard deviation away form the fitted model is considered an outliers and will be dropped. For the regression model containing all four variables, we take into account the greater variability in the regression process. Therefore, we consider observations with residual term's value greater than four standard deviations from our fitted model

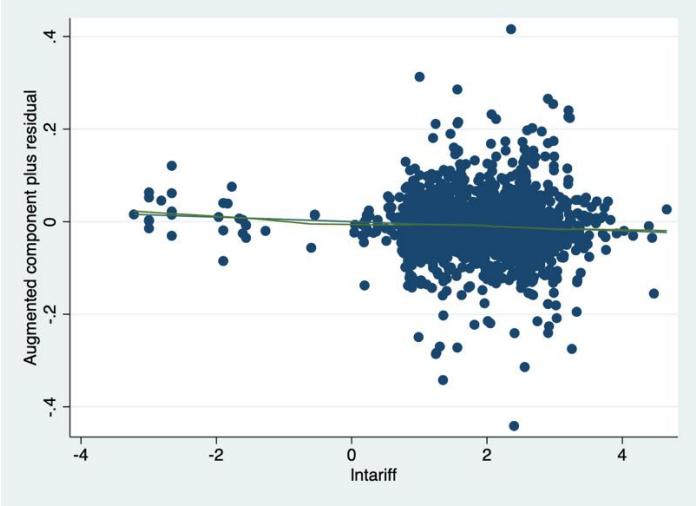
to be outliers, and the outliers will be dropped. Since the outliers may be caused by non-linearity, we choose to adjust the non-linearity first and use the corrected model to deal with the outliers. Finally, we test for multicollinearity and serial correlation problems and make appropriate corrections if they exist. If the VIF is less than 10, we do not need to worry about multicollinearity.

Among the 4 variables, only the graph for variable TOT indicates non-linearity. To correct this problem, the term lntot2, which is the square of the natural log of TOT, was added to the model. The graphs for the remaining 3 variables do not indicate issues with non-linearity. After controlling the non-linearity, the outliers will be dropped in the way we stated above. Heteroskedasticity and serial correlation were found in all our 5 models and the corresponding corrections was made to the regression model. Also, there is no evidence of multicollinearity since the VIF is less than 10 for all the 5 regressions.

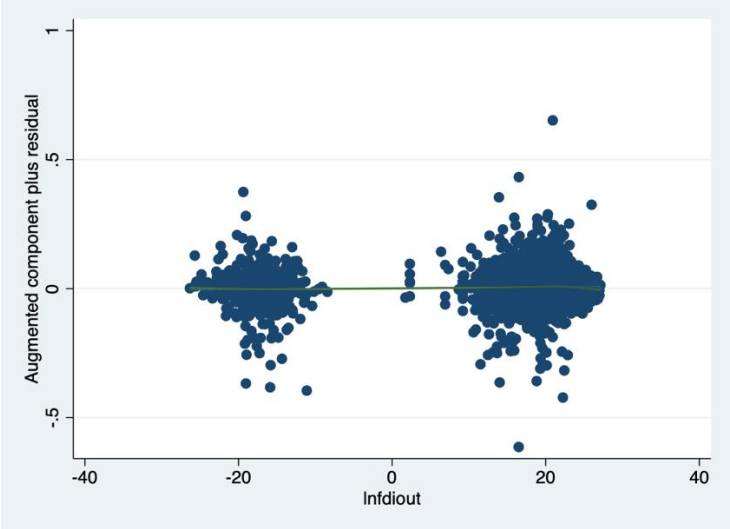
Graph 1. Augmented component-plus-residual plot of variable terms of trade



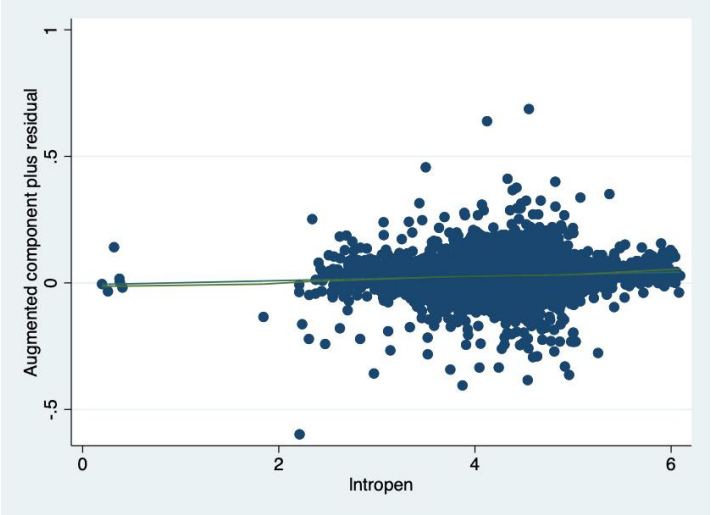
Graph 2. Augmented component-plus-residual plot of variable tariff



Graph 3. Augmented component-plus-residual plot of variable FDI outflow



Graph 4. Augmented component-plus-residual plot of variable trade openness



Among the 4 variables, only the graph for the terms of trade (TOT) indicates the presence of non-linearity. To correct this problem, the square of the natural logarithm of TOT was added to the model. Graphs for the other 3 variables do not indicate an issue with non-linearity. After controlling the non-linearity, the outliers will be dropped in the way we stated above. Heteroskedasticity and serial correlation were found in all our 5 models, and the corresponding corrections were made to the regression model. Also, there is no evidence of multicollinearity, since the VIF is less than 10 for all the 5 regressions.

1. Variable TOT

Chart 3. Estimated regression model for terms of trade; Factors that affect economic growth

	Regression1	Regression2	Regression3	Regression4	Regression5	
	lngdp	lngdp	lngdp	lngdp	lngdp	
lntot	0.122***	-0.0472	0.163	-0.148	0.180**	Coefficient
	(0.0186)	(0.230)	(0.308)	(0.175)	(0.0780)	SE

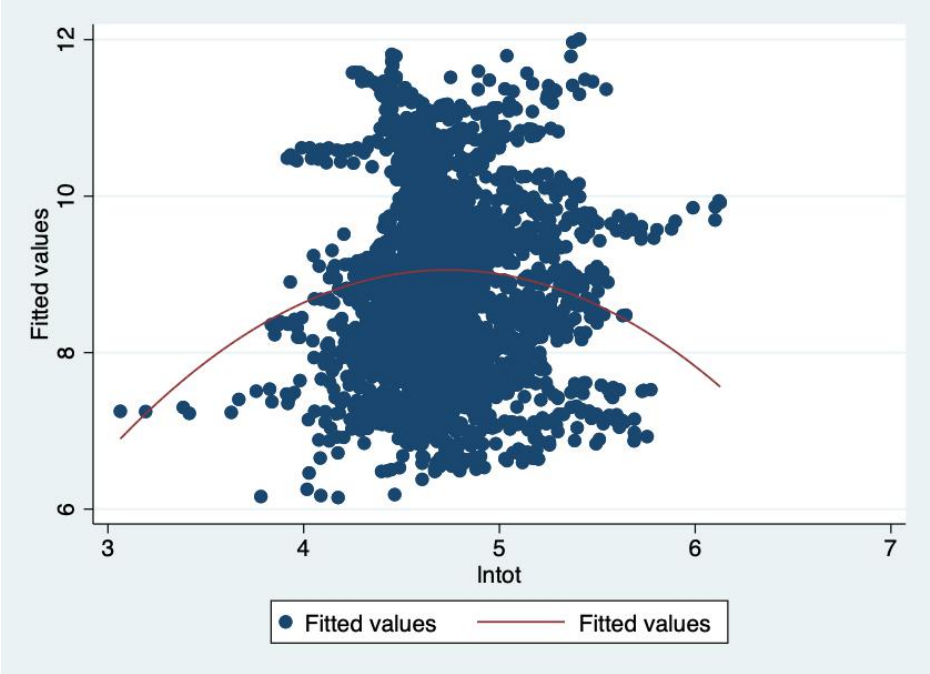
lntot2		0.0177	-0.00656	0.0300	-0.0168**	Coefficient
		(0.0242)	(0.0325)	(0.0185)	(0.00820)	SE
lnsaving			0.0427***	0.0193***	0.0124***	Coefficient
			(0.00803)	(0.00391)	(0.00198)	SE
grpop			-10.66***	5.020***	-0.709***	Coefficient
			(1.907)	(1.409)	(0.152)	SE
lnhc				3.065***	0.0443***	Coefficient
				(0.0687)	(0.00823)	SE
L.lngdp					0.979***	Coefficient
					(0.00201)	SE
_cons	7.621***	8.015***	7.680***	6.678***	-0.314*	Coefficient
	(0.0987)	(0.546)	(0.731)	(0.416)	(0.185)	SE
Year Dummies	Yes	Yes	Yes	Yes	Yes	
Number	3576	3576	3576	3576	3576	
r2	0.954	0.954	0.951	0.974	0.998	
Standard errors in parentheses (Significant level)						
="* p<.10	** p<.05	*** p<.01"				

(Number is the number of observations, SE is the Standard errors)

According to Chart 3, as more variables are added, we see a general trend of R-squared statistics improving. The final regression model taking account of variables for term of trade and the other three general variables have the greatest R-squared statistics. Therefore, the model fitted is appropriate for this regression.

According to the coefficient, 1 percent increase in TOT leads to 0.180 percent increase in GDP per capita taking into account of non-linearity of this variable.

Graph 5. Predicted value of natural log of GDP per capita against terms of trade



According to Graph 5, there is a quadratic relationship between GDP per capita and terms of trade, with an inverted U-shape as the graph above. The coefficient on terms of trade referring to the 1st order, and the squared term referring to the 2nd order. The terms of trade are defined as the ratio between the index of export prices and the index of import prices; considering the graph, the effect of export and import prices on economic growth is uncertain, and it would have a negative influence if the terms of trade are too high. Since GDP is defined as: GDP = Consumption + Investment + Government Spending + (Exports – Imports), either the increase in exports or the decrease in imports can facilitate GDP growth. According to the demand and supply theory, the change in prices will also change the quantity, but the effect on total revenue is uncertain. When the demand is inelastic, an increase in export price tends to increase the total revenue of export; however, when the demand is elastic, total revenue tends to decrease. Therefore, the graph shows an inverted U-shape with the GDP per capita increase first and then decrease.

2. Variable Tariff

In terms of the coefficient of variable tariff, a 1 percent increase in tariffs leads to a 0.00628 percent decrease in GDP per capita.

The tariff leads to a barrier to trade, which reduces the export and import; in this way, the countries with trade barriers tend to have less chances to access the global technology pool and have negative effects on domestic productivity, and therefore impede economic growth (Lampe and Sharp 2012). Foreman-Peck (1995)'s model indicates that the average tariff is negatively related to output per capita; according to structural equations, the reason behind it is the negative relationship between output per capita and agriculture's share of employment, while agriculture's share of employment is positively related to tariff (Rourke 2000). As expected in the data section, high tariff creates trade barrier that tend to raise the price and reduce the availability of good and services, thus negatively impacting economic growth. Therefore, the negative relationship in the result is consistent with the expectation.

Chart 4. Estimated regression model for tariff; Factors that affect economic growth

	(1)	(2)	(3)	(4)	(5)	
	lngdp	lngdp	lngdp	lngdp	lngdp	
lntariff	-0.307***	-0.315***	-0.244***	-0.0817***	-0.00628***	coefficient
	(0.0208)	(0.0209)	(0.0202)	(0.0136)	(0.00194)	SE
lnsaving		0.174***	0.159***	0.0860***	0.0142***	coefficient
		(0.0321)	(0.0280)	(0.0171)	(0.00272)	SE
grpop			-22.00***	7.860***	-0.289**	coefficient
			(2.881)	(2.345)	(0.146)	SE
lnhc				3.058***	0.0456***	coefficient
				(0.0898)	(0.00918)	SE
L.lngdp					0.974***	coefficient
					(0.00225)	SE
_cons	9.798***	9.270***	9.431***	6.399***	0.223***	coefficient

	(0.0811)	(0.132)	(0.120)	(0.121)	(0.0208)	SE
Year Dummies	Yes	Yes	Yes	Yes	Yes	
N	2554	2554	2554	2554	2554	
r2	0.957	0.957	0.963	0.982	0.999	
Standard errors in parentheses						
="* p<.10	** p<.05	*** p<.01"				

(Number is the number of observations, SE is the Standard errors)

3. Variable FDI outflow

According to Chart 5, 1 percent increase in FDI outflow leads to 0.000136 percent increase in GDP per capita.

Chart 5. Estimated regression model for FDI outflow; Factors that affect economic growth

	(1)	(2)	(3)	(4)	(5)	
	lngdp	lngdp	lngdp	lngdp	lngdp	
lnfdiout	0.00112***	0.000908***	0.000899***	0.000150	0.000136**	coefficient
	(0.000296)	(0.000265)	(0.000267)	(0.000124)	(0.0000645)	SE
lnsaving		0.165***	0.170***	0.0492***	0.0214***	coefficient
		(0.0190)	(0.0185)	(0.00803)	(0.00231)	SE
grpop			-17.71***	5.721***	-0.771***	coefficient
			(2.255)	(1.878)	(0.139)	SE

lnhc				2.976***	0.0245***	coefficient
				(0.0696)	(0.00787)	SE
L.lngdp					0.981***	coefficient
					(0.00194)	SE
_cons	9.086***	8.521***	8.849***	6.729***	0.146***	coefficient
	(0.121)	(0.126)	(0.123)	(0.0863)	(0.0174)	SE
Year Dummies	Yes	Yes	Yes	Yes	Yes	
N	3787	3787	3787	3787	3787	
r2	0.920	0.931	0.933	0.976	0.998	
Standard errors in parentheses						
="* p<.10	** p<.05	*** p<.01"				

(N is the number of observations, SE is the Standard errors.)

From previous research from Aizenman and Noy(2006), there is strong evidence that FDI promotes growth in developing country. FDI has long been acknowledged as a significant source of technology and know-how for developing countries. It accelerates the growth by creating more employment and satisfying the investment demand and saving gap for host countries. Besides, the knowledge and management skills can be shared through FDI process (Frenkel et al., 2004).

The research by Ram and Zhang (2002) also supports that FDI can promotes growth by increasing the domestic saving, investment and export, facilitating domestic competitions, accelerating the technology transfer. Overall, FDI offers the financial resources and technology, and increase the amount of foreign exchange reserves through increased export. The previous studies that investigate developing countries found a significant and positive effect of FDI on economic growth (Agrawal and Khan 2011).

The data section predicts a positive relationship between net FDI outflow and economic growth. Therefore, the positive relationship in the result is consistent with the expectation.

4. Variable trade openness

As shown in the chart 6, 1 percent increase in trade openness corresponds to 0.00888 percent increase in GDP per capita. The data section gives the expectation that higher trade openness stimulates allocation of resources and factor accumulation (Wei 2016, 16).

Chart 6. Estimated regression model for trade openness; Factors that affect economic growth

	(1)	(2)	(3)	(4)	(5)	
	lngdp	lngdp	lngdp	lngdp	lngdp	
lntropen	0.0387***	0.134***	0.140***	0.0197*	0.00888***	coefficient
	(0.0126)	(0.0172)	(0.0174)	(0.0112)	(0.00180)	SE
lnsaving		0.0371***	0.0396***	0.0218***	0.0168***	coefficient
		(0.00579)	(0.00587)	(0.00331)	(0.00173)	SE
grpop			-5.850***	4.753***	-0.726***	coefficient
			(1.543)	(1.394)	(0.134)	SE
lnhc				2.773***	0.0283***	coefficient
				(0.0616)	(0.00745)	SE
L.lngdp					0.981***	coefficient
					(0.00185)	SE
_cons	8.032***	7.824***	7.949***	6.731***	0.0940***	coefficient
	(0.109)	(0.128)	(0.136)	(0.121)	(0.0290)	SE
Year Dummies	Yes	Yes	Yes	Yes	Yes	
N	4634	4634	4634	4634	4634	
r2	0.950	0.946	0.946	0.969	0.997	

Standard errors in parentheses						
="* p<.10	** p<.05	*** p<.01"				

(Number denotes the number of observations, SE denotes the Standard errors.)

According to the production function, higher factor trade openness tends to produce a higher economic growth rate. Trade shares, which are exports plus imports divided by GDP, are the simplest fundamental approach to gauge trade openness. Harrison (1996) conducted many studies and discovered a positive and robust relationship between trade shares and economic growth. Trade helps a country to get access to technical developments; it allows domestic producers to access larger markets, intermediate goods, new products, and inputs, and increases investment opportunities. In general, trade simulates the economy growth, with developing countries benefits more through the trade (Yanikkaya 2003). Therefore, the positive relationship here is consistent with the underlying economic theory.

5. **All 4 Variables**

Chart 7. Estimated regression model of all variables; Factors that affect economic growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	lngdp	lngdp	lngdp	lngdp	lngdp	lngdp	lngdp	lngdp	lngdp
lntot	0.168***	0.850	0.928	1.303	1.252	1.525*	0.853	0.335	0.0941
	(0.0584)	(0.707)	(0.772)	(0.896)	(0.920)	(0.893)	(0.740)	(0.518)	(0.0953)
lntot2		-0.0711	-0.0777	-0.118	-0.112	-0.149	-0.0636	-0.0183	-0.00574
		(0.0722)	(0.0792)	(0.0923)	(0.0948)	(0.0921)	(0.0767)	(0.0541)	(0.0103)
lntariff			-0.403***	-0.525***	-0.485***	-0.471***	-0.371***	-0.167***	-0.00711***
			(0.0216)	(0.0239)	(0.0235)	(0.0231)	(0.0216)	(0.0159)	(0.00215)
lnfdiout				0.00141***	0.00139***	0.00131***	0.000971**	0.000392*	0.000102
				(0.000405)	(0.000403)	(0.000398)	(0.000353)	(0.000236)	(0.0000736)
lntropen					0.297***	0.252***	0.249***	0.0997***	0.00907***
					(0.0441)	(0.0430)	(0.0399)	(0.0280)	(0.00252)
lnsaving						0.211***	0.183***	0.0996***	0.0136***
						(0.0357)	(0.0315)	(0.0225)	(0.00294)
grpop							-23.75***	5.234**	-0.648***
							(2.623)	(2.302)	(0.181)
lnhc								2.836***	0.0293***
								(0.0869)	(0.0101)
L.lngdp									0.975***
									(0.00263)
_cons	7.971***	6.344***	7.382***	6.881***	5.665**	4.620**	6.198***	5.242***	-0.0995
	(0.293)	(1.737)	(1.893)	(2.190)	(2.243)	(2.182)	(1.809)	(1.259)	(0.223)
Year Dumn	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2134	2134	2134	2134	2134	2134	2134	2134	2134
r2	0.961	0.961	0.961	0.952	0.953	0.955	0.962	0.980	0.998
Standard errors in parentheses									
="* p<.10	** p<.05	*** p<.01"							

(N is the number of observations, SE is the Standard errors.)

For the final model, all variables are taken into account. The statistical significance can be observed in terms of tariff, trade openness, saving, growth rate, human capital, and lagged GDP for the full regression. However, the intercept, TOT, squared TOT and FDI outflow are insignificant, but it has an appropriate sign with

reference to the model. The model with all 4 variables added cannot illustrate the relationship between all explanatory variables and dependent variables well or provide a powerful statistical significance of all variables. The results here show a strong relationship between tariffs and trade openness to log GDP.

Chart 8. Factors that affect economic growth; 5 Estimated regression models

(1) Terms of trade		(2) Tariff		(3) FDI outflow		(4) Trade openness		(5) All variables	
	lngdp		lngdp		lngdp		lngdp		lngdp
lntot	0.180**	lntariff	-0.00628***	lnfdiout	0.000136**	lntropen	0.00888***	lntot	0.0941
	(0.0780)		(0.00194)		(0.0000645)		(0.00180)		(0.0953)
lntot2	-0.0168**	lnsaving	0.0142***	lnsaving	0.0214***	lnsaving	0.0168***	lntot2	-0.00574
	(0.00820)		(0.00272)		(0.00231)		(0.00173)		(0.0103)
lnsaving	0.0124***	grpop	-0.289**	grpop	-0.771***	grpop	-0.726***	lntariff	-0.00711***
	(0.00198)		(0.146)		(0.139)		(0.134)		(0.00215)
grpop	-0.709***	lnhc	0.0456***	lnhc	0.0245***	lnhc	0.0283***	lnfdiout	0.000102
	(0.152)		(0.00918)		(0.00787)		(0.00745)		(0.0000736)
lnhc	0.0443***	L.lngdp	0.974***	L.lngdp	0.981***	L.lngdp	0.981***	lntropen	0.00907***
	(0.00823)		(0.00225)		(0.00194)		(0.00185)		(0.00252)
L.lngdp	0.979***	_cons	0.223***	_cons	0.146***	_cons	0.0940***	lnsaving	0.0136***
	(0.00201)		(0.0208)		(0.0174)		(0.0290)		(0.00294)
_cons	-0.314*	Year Dummies	Yes	Year Dummies	Yes	Year Dummies	Yes	grpop	-0.648***
	(0.185)								(0.181)
		N	2554	N	3787	N	4634		
Year Dummies	Yes	r2	0.999	r2	0.998	r2	0.997	lnhc	0.0293***
									(0.0101)
N	3576								
r2	0.998							L.lngdp	0.975***
									(0.00263)
Standard errors in parentheses									
="* p<.10	** p<.05	*** p<.01"						_cons	-0.0995
									(0.223)
								Year Dummies	Yes
								N	2134
								r2	0.998

According to Chart 8, for each independent part, the coefficients of terms of trade, tariffs, FDI outflows, and trade openness are statistically significant, but when all 4 variables are combined, the terms of trade, squared terms of trade and FDI outflow become insignificant. According to the multicollinearity test, there is no evidence of multicollinearity in the regression model. However, the insignificance still appears. Mohamed suggests that although almost all studies find positive effects for FDI, in

some circumstances, periods, and countries, he relationship between FDI and output growth may not be significant (Masry, Mohamed, 2015).

$$lnY_t = \beta_0 + \beta_1 lntot_t + \beta_2 lntot_t^2 + \beta_3 lntariff_t + \beta_4 lnfdi_t + \beta_5 lntropen_t + \beta_6 lnsaving_t + \beta_7 grpop_t + \beta_8 lnhc_t + \beta_9 Y_{t-1} + \epsilon$$

From the data section, the coefficients of human capital, lagged level of GDP per capita, gross saving, and population growth are expected to be positive.

$$Y = AL^{\beta}K^{\alpha}$$

For our model with all 4 variables, terms of trade, tariff, net FDI outflow and trade openness, for each section with one variable only, there is a strong relationship between explanatory variables and dependent variables. However, after we combine all variables, the statistical significance becomes weaker in variables terms of trade, terms of trade squared and FDI outflow. According to the formula here, these four variables are connected to A first and then to GDP, and it will also be affected by the terms L, β, α and K. Therefore, the relationship between terms of trade, tariff, FDI outflow and trade openness to GDP can be further discussed by adding more terms related to labor and capital, rather than just considering the linear relationship.

Furthermore, for different factors and situations between each country, the subsets of countries are separated by oil-producing countries to compare the regressions. By separating countries into 2 groups, the variables are controlled better so that the study can focus only on the variables we are interested in, which is the relationship between trade activeness and GDP growth. Chart 9 shows the results of models fitted in oil-producing countries.

Chart 9. The 5 Estimated regression models for oil-producing countries

	(2) lngdp		(2) lngdp		(2) lngdp		(2) lngdp		(2) lngdp
lntot	0.282** (0.126)	lntariff	-0.00674* (0.00370)	lnfdiout	0.000166 (0.000119)	lntropen	0.00507 (0.00311)	lntot	0.176 (0.161)
lntot2	-0.0251* (0.0131)	lnsaving	0.0198*** (0.00382)	lnsaving	0.0197*** (0.00359)	lnsaving	0.0192*** (0.00319)	lntot2	-0.0125 (0.0168)
lnsaving	0.0164*** (0.00341)	grpop	-0.321 (0.246)	grpop	-0.855*** (0.252)	grpop	-0.766*** (0.232)	lntariff	-0.0147*** (0.00398)
grpop	-0.924*** (0.266)	lnhc	0.0305** (0.0147)	lnhc	0.0189 (0.0141)	lnhc	0.0253** (0.0124)	lnfdiout	0.000101 (0.000130)
lnhc	0.0369*** (0.0130)	L.lngdp	0.974*** (0.00340)	L.lngdp	0.978*** (0.00340)	L.lngdp	0.977*** (0.00300)	lntropen	0.00168 (0.00411)
L.lngdp	0.971*** (0.00319)	_cons	0.195*** (0.0350)	_cons	0.170*** (0.0278)	_cons	0.135*** (0.0308)	lnsaving	0.0162*** (0.00399)
_cons	-0.529* (0.305)	Year Dumr	Yes	Year Dumr	Yes	Year Dumr	Yes	grpop	-0.914*** (0.285)
		N	1093	N	1695	N	2009		
Year Dumr	Yes	r2	0.998	r2	0.997	r2	0.997	lnhc	0.000545 (0.0172)
N	1563								
r2	0.997							L.lngdp	0.971*** (0.00404)
Standard errors in parentheses ="* p<.10 ** p<.05 *** p<.01"								_cons	-0.244 (0.385)
								Year Dumr	Yes
								N	942
								r2	0.998

Compared with all countries, the oil-producing countries have similar distribution for variable terms of trade, tariff, FDI outflow and trade openness. However, for variable FDI outflow and trade openness, the coefficients of independent regressions become insignificant for oil-producing countries. After we combine 4 variables together, only tariff is found to be significant for oil-producing countries. By contrast, variable trade openness was found to be significant for regression of all countries but becomes insignificant when we focus on oil-producing countries; only the tariff is significant in both cases. Therefore, for oil-producing countries, the relationship between tariff and GDP per capita seems to be strong, while for all countries, we see a strong relationship between tariff and trade openness to GDP per capita.

In general, there is a strong relationship between these 4 variables to GDP per capita independently. Therefore, our result supports the hypothesis that countries with high trade activeness will have better growth than those with low trade activeness.

Conclusion

In conclusion, the hypothesis of this paper aims to figure out whether there is a long-term economic influence by trade activeness, a comprehensive variable including terms of trade, tariffs, net FDI outflow and trade openness. By adopting the Solow model and Cobb Douglas production function, this paper draws the following conclusions from four independent regressions of the factors in trade activeness and analyzes the specificity of oil-producing countries.

1. Terms of trade, as a key indicator of trade activeness, reveals the famous Kuznets inverted U-shaped relationship with economic growth, and the writers of the paper speculate that this Kuznets inverted U-shaped is due to middle-income countries' increased reliance on exports to boost their economic growth. On the other hand, low-income countries require relatively more imports to invest in future growth due to their low productivity and technology. The relatively low imports of high-income countries may be attributed to the fact that they import a lot of primary products from middle-income countries because of the comparative advantage and opportunity cost. If the Kuznets inverted U-shaped applies to the terms of trade regression, the puzzle of why China persists high economic growth could be solved because China, as a middle-income country, performs a high level of TOT.

2. Since this research indicates a negative relationship between tariffs and GDP growth, the authors of this article believe that a fair tariff decrease that assures normal national tax revenues would be beneficial to economic growth, since tariff acts as a trade barrier in the international trade market.

3. This study also discovers a positive relationship between net FDI outflow and GDP growth, implying that encouraging citizens to invest in overseas assets will benefit the domestic economy.

4. Similar to Bassani and Scarpetta (2001) and Nasreen and Anwar (2014) and Ramazan, Sheng, Shahbaz, Song, and Jiao (2019), this research showed a positive relationship between trade openness and GDP development, thus nations are once again encouraged to open their borders and trade actively. In economic terms, the research proposes that nations use their comparative advantage by increasing the share of export and import to domestic GDP, which is referred to as trade openness, to achieve benefit optimization.

5. For the integrated variable, trade activeness, we conclude that each variable performs as expected when looking at each regression separately, indicating that trade activeness can positively impact economic growth.

Because there might be correlation among the four variables, this paper does not end up with an integrated model to reflect the importance of trade activeness on the country's economic development. Also, the four trade-related variables may not be comprehensive enough. Our study also considered the possible effect of current account and net international investment position (NIIP) during our research. However, since the current account and FDI out have a strong correlation, we decided to exclude this variable. In addition, the lack of logistic data also prevented us from covering our trade model more comprehensively. Thus, future research could put efforts in developing integrated trade models that include more indicators and exclude the correlation among the variables. Nonetheless, this research helped improving the prior model based on a single variable by providing guidance to government agencies on managing multiple factors to achieve maximum social efficiency.

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