

## Export diversification and economic growth: A threshold regression approach for emerging markets and developing countries

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### Abstract

**Purpose** — This study investigates the nonlinear relationship between export diversification and economic growth in 44 emerging markets and developing countries.

**Methods** — The threshold regression methodology is employed to analyze data for the period between 1995 and 2015. Export diversifications in terms of both geography and product are measured by the Herfindahl-Hirschman market concentration index and overall Theil index, respectively.

**Findings** — The results demonstrate a nonlinear relationship between export diversification and economic growth. Above the threshold, diversified export markets and products boost economic growth. Below the threshold, the positive relationship between diversification in both markets and products and growth is insignificant.

**Implications** — The research implies that export diversification strategy in emerging markets and developing countries should be considered carefully when the level of export diversification is higher than the threshold, which usually occurs in the later stage of diversification.

**Originality** — The study investigates nonlinearity in terms of degrees of diversification instead of degrees of development. With this approach, the threshold is identified to show how economic growth is affected under different regimes.

**Keywords** — export diversification, economic growth, threshold regression, emerging markets, and developing countries

## Introduction

Export-led growth strategy has become dominant in many countries, especially emerging markets and developing countries (EMDCs). To follow this strategy, exports in EMDCs have gone through structural transformations in terms of products and markets. In other words, the process of export growth goes hand in hand with export diversification. Is there any causal relationship between export diversification and economic growth? Insights into this question will help EMDCs design better their export strategy. In general terms, export diversification refers to a diversified export structure (Al-Marhubi, 2000). Export diversification is discussed as product diversification from a product point of view and product diversification from a geographic perspective (Ali, Alwang, & Siegel, 1991). Similarly, Osakwe and Kilolo (2018) define export diversification as the spread of exports over various products and trading partners.

In the product space, export diversification refers to the change in export structures by widening the export basket; increasing export earnings by adding technology and innovation (Osakwe & Kilolo, 2018). Vertical product diversification involves a structural transformation from primary commodities to manufactured products due to technological innovations (Agosin, 2009; Chenery, 1979; Syrquin, 1989). Horizontal export diversification employs new areas of primary exports (Herzer & Nowak-Lehmann, 2006) to minimize the economic disadvantages and political risks. Amurgo-Pacheco & Pierola (2008) investigate product and geographic patterns of export diversification by disentangling trade with intensive and extensive margins. The intensive trade margin refers to the growth of exports in old goods, while trade in extensive margin involves an increasing number of varieties traded. Extensive margin diversification is essential if export diversification involves a shift in export composition from primary commodities to manufactured goods (Dennis & Shepherd, 2011). Geographic export diversification means widening the range of destinations for exports (Hill, Hitt, & Hoskisson, 1992).

Traditional literature identifies specialization according to comparative advantage and realization of economies of scale as sources of gains from trade, suggests only level effects of trade on income because open economy enjoys a high level of income than the closed economy, but no rate effects or open economy will not necessarily grow faster (Grossman & Helpman, 1990). However, some more research has shed more light on the channel through which export may cause effects on growth, focusing more on the growth effects of export diversification. A positive link between growth and export diversification relates to export earnings instability. Adding new products to the existing export basket can reduce revenue dependence on a limited number of commodity goods that are mostly exposed to price ups and downs. Shepherd (2009) also argues that high concentration in terms of products and markets creates high short-run volatility in national income; developing countries obtain more stable export revenue through a wide range of export products and export markets. Thus, countries with a high level of export diversification can compensate for income losses from high profitable or more stable sectors. Similarly, by adding a new market to the current portfolio, a country can decrease the reliance of export earnings on the conditions of a less diversified export market. Various studies indicate the positive association between the level of product concentration and the severity of trade collapse in the case of crisis (see Karahan, 2017; Romeu & Costa Neto, 2011). Observations from World Bank (1987) show that countries with high export concentration have a more volatile real exchange rate to the detriment of investment in production and services. To sum up, export diversification has a positive association with income growth.

Immisserizing growth theory indicates that economic growth offset with deteriorating trade terms could worsen a country. Developing countries get stuck in this situation if they concentrate on exporting primary commodities at a price disadvantage compared to manufactured goods. Sustained growth entails export diversification in developing countries to shift exports from primary goods to manufactured goods, as indicated by “vertical diversification”. Similarly, the “natural resource curse” hypothesis also implies that a large share of natural resource exports in GDP could deteriorate terms of trade, excess volatility, and low productivity growth (Prebisch, 1950; Sachs & Waner, 1995). Cadot, Carrère, and Strauss-Kahn (2013) summarize three supportive arguments for the notion of this hypothesis. First, as the relative price of primary products has a downward trend, countries with high dependency on commodity goods suffer from decreased exports. Second, the dominance of primary products in the export basket is a factor of growth-inhibiting volatility because of the volatility of the terms of trade. Finally, concentration on primary commodities hampers productivity as primary products are typical laggards.

The comparison between specialization and export diversification attracts much attention in the literature. Chenery (1979) discussed the conflicts between trade theory focusing on the comparative advantage and growth theory ignoring comparative advantage. Grossman and Helpman (1990), also looking into the comparative advantage and long-run growth, emphasize acquiring comparative advantage. Agosin (2009) considered widening comparative advantage as the main force behind economic growth.

Endogenous growth theory refers to the product variety for export as one of the sources of growth. Diversification contributes to sustained growth by knowledge spillover effects like “learning by doing” and “learning by exporting”. Export diversification entails using new technology. “Learning by doing” relates to the spillover from the export sectors to other sectors in the economy. Business skills acquiring by diversified exports will spread to other areas. All of these contribute to capital accumulating and become sources of growth. “Learning by exporting” means that the export sector is acquiring knowledge from abroad while foreign importers transfer their technological information for higher productivity Herzer and Nowak-Lehmann (2006). Product cycle theory explains the spillover as mentioned above effects (Vernon, 1966). A product in its life cycle brings opportunities for an importing country to become an exporter of this product. This product would not be new to the world, but it could get knowledgeable spillover effects described above for this country.

To sum up, the literature mentioned earlier implies the positive effects of export diversification on growth. From our perspective, benefits from diversification cannot be obtained without considering comparative advantage (Cadot et al., 2013). Early stages of diversification need to be associated with the most effective products, leading to economic growth. A greater degree of diversification, to some extent, will involve less effective products which have no comparative advantage or new markets where existing products have no competitive advantage. Different from the early stages, export diversification at this stage brings no source for economic growth.

Several empirical investigations into the link between export diversification and growth have shown a linear relationship, implying greater export diversification associated with faster growth (Agosin, 2009; Al-Marhubi, 2000; Hodey, Oduro, & Senadza, 2015). Al-Marhubi (2000) uses three indicators (number of products exported, diversification index, and concentration index) measuring export diversification to estimate the growth effects of 91 economies for the period from 1961 to 1988. Employing ordinary least square (OLS) estimation, the research proves that export diversification is associated with higher economic growth. Agosin (2009) investigates the growth effects of export diversification from the data of 27 emerging economies in Latin America and Asia for the period 1980-2003. Estimation results derived by OLS methodology also show that export diversification is a source for economic growth. More importantly, the research indicates spillover effects of export sectors to other economic areas. It is also evidenced that an economy will obtain more significant economic growth when exporting to higher-income markets. Hodey et al. (2015) analyze the effects of export diversification on growth by employing the system GMM estimation techniques. The findings show a positive monotonic relationship between export diversification and growth in 42 Sub-Saharan African economies.

By contraries, findings from Ferreira and Harrison (2012) using the autoregressive distributed lags (ARDL) model and dynamic OLS for the period 1965-2006 indicate that horizontally and vertically diversified exports are not positively associated with growth in Costa Rica. The study implies that export diversification cannot lead to growth without spillover effects like “learning by doing” and “learning by exporting” from the export sectors to other economic sectors. Hinlo and Arranguéz (2017) analyze data from ASEAN countries for the period 1980-2014 but focus on geographically diversified exports. They find no causal relationship between geographical diversification and growth in Indonesia, Singapore, and Thailand. Nevertheless, the research has found bidirectional causality in Malaysia and uni-directional causality in the Philippines.

Some studies employing nonlinear estimation methods have recently challenged the linear positive effect of export diversification on growth. Cadot et al. (2011) analyze HS6 classification data from 159 economies for the period 1988-2006 and obtain a conclusion of a hump-shaped relation with a turning point around \$25,000 per-capita income at PPP. Diversification is found at an income level below \$25,000, and re-concentration tends to happen with per capita income over the turning point. It is inferred that export diversification should be a key element of the development process. Munir and Javed (2018) analyze the impacts of horizontal and vertical export diversification on the economic growth of 4 South Asian countries for the period 1990-2013. Using regression analysis of panel data with a squared term of export diversification as a regressor

represents a reversed U-shaped (hump-shaped) relationship between vertical diversification and growth and a U-shaped relationship for horizontal diversification. Vertical diversification is insignificantly positively associated with growth because early stages of diversification lead to higher growth, but after some critical points, specialization drives economic growth. On the contrary, horizontal diversification is negatively related to growth in that initial degrees of diversification give no benefits for growth up to a threshold after which diversification may become a driver for growth. However, the thresholds mentioned have not been defined in detail in the study.

Aditya and Acharyya (2013) findings are in parallel with Munir and Javed (2018). Using non-linear estimation techniques with a dynamic panel model – GMM for 65 countries in the period between 1965 and 2005, the study indicates the U-shaped relationship between export concentration and economic growth that implies a reversed U-shaped relationship between export diversification and growth. Export diversification fosters economic growth until it reaches a critical value of diversification. After this threshold, re-concentration with existing products takes place. The thresholds (degrees of concentration derived by the first-order condition of optimization for the logarithm of GDP) are found to vary from one group of countries to another. Hesse (2009) also examines the dataset of 99 countries in the period between 1965 and 2000 by GMM methodology. The study finds a nonlinear relationship but in a manner that developing countries obtain higher income with more significant diversified export while developed countries benefit from specialization.

This paper follows the strand of the nonlinear relationship between export diversification and growth with some modifications. We investigate nonlinearity in terms of degrees of diversification instead of degrees of development, as indicated in Cadot et al. (2011). Unlike Aditya and Acharyya (2011), Hesse (2009), and Munir and Javed (2018), referring to nonlinearity by using a squared term of diversification, we analyze nonlinearity via threshold regression methodology for panel data. With this approach, the threshold is identified in an attempt to show how economic growth is affected under different regimes, and there are before and after the threshold. Besides, both geography and product areas of export diversification are involved in this study, while previous studies focus on either of them.

The rest of the paper is organized as follows. Section 2 discusses the application of threshold regression methodology to the research model constructed based on endogenous growth theory. Data for estimation and robustness tests are also elaborated in this section. The last two sections analyze results and conclude the main findings, respectively.

## Methods

We use a panel dataset of 44 EMDCs in the period between 1995 and 2015. While the selection of EMDCs involved in the study relies mainly on the availability of macroeconomic data in EMDCs, the selection of the research period depends on the availability of export diversification data. We use two measures of export diversification, including the Herfindahl-Hirschman market concentration index (HHI) and the overall Theil Index (THE). HHI can reflect export diversification relative to geography as it measures the dispersion of trade value across an exporter's partners. Meanwhile, THE developed by Theil (1976) reflects export diversification in terms of products. The overall Theil index is the sum of two components: intensive margin refers to the diversification of export values among active product lines, and extensive margin shows diversification by adding new products (Cadot et al., 2011). As both indices measure export concentration, an increase in the index implies higher export concentration or lower export diversification, and a decrease in the index indicates lower export concentration or higher export diversification. Although the two measures are popularly used in previous studies, no study uses both of them to reflect different aspects of export diversification. The estimation using HHI as export diversification variable is conducted in the period between 1995 and 2015; the other using THE as export diversification variable is conducted from 1995 to 2014.

**Table 1.** EMDCs in The Study

ID	Country	ID	Country	ID	Country	ID	Country
1	Algeria	12	Croatia	23	Lithuania	34	Poland
2	Argentina	13	Ecuador	24	Malaysia	35	Romania
3	Bolivia	14	Egypt	25	Mauritius	36	Russian Federation
4	Brazil	15	El Salvador	26	Mexico	37	Senegal
5	Bulgaria	16	Georgia	27	Moldova	38	Tanzania
6	Burkina Faso	17	Guatemala	28	Morocco	39	Thailand
7	Cameroon	18	Guyana	29	Mozambique	40	Tunisia
8	Chile	19	Hungary	30	Panama	41	Turkey
9	China	20	India	31	Paraguay	42	Uganda
10	Colombia	21	Indonesia	32	Peru	43	Uruguay
11	Costa Rica	22	Jamaica	33	Philippines	44	Vietnam

Source: Authors.

The research model to examine the impact of export diversification on economic growth in EMDCs is constructed based on the endogenous growth theory as follows:

$$GDPG_{i,t} = \alpha_i + \beta_1 EDI_{i,t} + \beta_2 CAP_{i,t} + \beta_3 FDI_{i,t} + \beta_4 GOV + \beta_5 LAB_{i,t} + \beta_6 AFC_{i,t} + \beta_7 GFC_{i,t} + u_{i,t} \quad (1)$$

Where the subscript  $i$  indexes the individual (country) and the subscript  $t$  indexes time, error  $u_{i,t}$  is assumed to be independent and identically distributed with mean zero and finite variance.

In model (1), the dependent variable on the left-hand side is real economic growth (GDPG) measured by the annual growth of GDP per capita. Independent variables on the right-hand side involve export diversification (EDI) measured by the HHI and THE as mentioned above, physical capital (CAP) measured by the ratio of gross capital formation to GDP, foreign direct investment (FDI) measured as the ratio of net foreign direct investment inflow to GDP, the labor force (LAB) measured by the growth of total labor and government expenditure (GOV) is measured by the ratio of government consumption to GDP. The growth model also captures structural breaks in the economic growth series of EMDCs generated by two financial crises involving dummy variables of AFC (Asian Financial Crisis 1997) and GFC (Global Financial Crisis 2008). All variables data are taken from World Bank Open Data, except for the Theil index from International Monetary Fund (2020).

To examine the non-linear relationship between export diversification and economic growth in EMDCs, we employ the methodology of the threshold autoregressive model (TAR) introduced by Tong (1978) and Hansen (1999). TAR model specifies that individual observations can fall into discrete classes based on the value of an observed variable (threshold variable). In other words, TAR methodology classifies the influence of regressors on dependent variables into different regimes relative to varying levels of threshold variables. In this study, the threshold variable is export diversification (EDI) to investigate its various impact on economic growth relative to the level of export diversification. As indicated in Hansen (1999), model (1) in the form of two-regime could be written as follows:

$$GDPG_{i,t} = \alpha_1 + \beta'_1 X_{i,t} I[EDI_{i,t} \leq \gamma] + \beta'_2 X_{i,t} I[EDI_{i,t} > \gamma] + \beta_3 Z_{i,t} + u_{i,t} \quad (2)$$

In model (2)  $\gamma$  is the threshold value,  $X_{i,t}$  includes EDI, CAP, FDI, GOV, and LAB, which cause various impacts on economic growth under different regimes of the threshold variable (export diversification);  $Z_{i,t}$  includes AFC and GFC having unchanged influences on economic growth regardless of different regimes. Export diversification is expected to significantly foster economic growth in the early stages when the export diversification level is above the threshold level. The positive influence will diminish when the export diversification process reaches a greater degree, which means that the export diversification level is lower than the threshold level. The number of threshold values and tests are identified using the Threshold Test methodology developed by (Bai & Perron, 1998, 2003).

The robustness test and comparison with previous studies (Aditya & Acharyya, 2013; Hesse, 2009; Munir & Javed, 2018) use the methodology employed in previous studies. The non-linear relationship between export diversification and economic growth is examined by adding the squared term of export diversification into the model (1).

$$GDPG_{i,t} = \alpha_i + \beta_1 EDI_{i,t} + \beta_2 EDI_{i,t}^2 + \beta_3 CAP_{i,t} + \beta_4 FDI_{i,t} + \beta_5 GOV + \beta_6 LAB_{i,t} + \beta_7 AFC + \beta_8 GFC + u_{i,t} \quad (3)$$

In model (3), we expect  $\beta_1$  is positive ( $>0$ ) and  $\beta_2$  is negative ( $<0$ ) simultaneously, reflecting an inverted U-shape relationship between export diversification and economic growth as in previous studies. This expectation implies that higher economic growth is driven by greater export diversification when export diversification is lower at a certain level. However, when export diversification is greater than that specific level, it is no longer significantly associated with higher economic growth. Adversely, when  $\beta_1$  is negative and  $\beta_2$  is positive simultaneously, export diversification and economic growth have a U-shaped relationship. Estimation of the model (3) is generated by panel model methodology, including pooled OLS, fixed effect model (FEM), and random effect model (REM).

## Results and Discussion

Descriptive statistics of the variables are presented in Table 2. The diversity of data reflects different levels of growth as well as export diversification across EMDCs. The GDP growth rate of all countries ranges from -14.351% to 23.053% with a sample mean of 3.050% and a high standard deviation of 3.517. The average export diversification measured by HHI is about 0.125, with the minimum and maximum values at 0 and 0.710, respectively. This figure indicates that most EMDCs keep low diversification in terms of the export market. The export diversification measured THE ranges from 1.597 to 5.592 with a sample mean of 2.938. Diversity in the level of export diversification predicts different effects on economic growth in EMDCs. Descriptive statistics of other dependent variables also show the diversity of the sample in terms of the ratio of capital formation to GDP, the ratio of net FDI inflow to GDP, the ratio of government consumption to GDP, and the growth of the labor force.

**Table 2.** Descriptive Statistics

	GDPG	HHI	THE	CAP	FDI	GOV	LAB
Mean	3.050	0.124	2.938	22.737	3.742	14.368	1.527
Median	3.240	0.090	2.847	21.836	2.812	13.813	1.778
Maximum	23.053	0.710	5.592	45.690	50.505	28.806	11.261
Minimum	-14.351	0.000	1.597	4.493	-15.989	4.997	-9.900
Standard deviation	3.517	0.103	0.853	5.779	4.365	4.196	1.837
Skewness	-0.376	3.140	0.699	1.162	4.735	0.465	-0.414
Kurtosis	6.146	14.980	3.075	5.234	41.951	3.082	6.177

Source: Authors.

## Threshold Test

Threshold test using Bai-Perron test used to identify the threshold and number of regimes. Table 3 shows the results of the test for the model using HHI and THE. The hypothesis of no threshold is rejected in both models, while the hypothesis of 1 threshold could not be rejected. These results imply a non-linear relationship between economic growth and export diversification in the form of two regimes. The threshold values of export diversification measured by HHI and THE are 0.060 and 2.069, respectively. As these thresholds are below average HHI and THE of EMDCs, most EMDCs belong to the first export diversification regime in terms of geography and product.

Table 4 summarizes the main estimation results of the threshold model in the model (2) using HHI and THE as highly consistent threshold variables. The result shows estimated coefficients of independent variables at the top panel in the first regime and the second regime of

the HHI and THE variables. The middle panel of the result represents estimated coefficients of constant and two dummy variables of crises which are unchanged in two regimes. The bottom panel is some statistics that indicate both estimated models are well-behaved.

**Table 3.** Threshold Test Results

Hypothesis	HHI	THE
0 vs 1 (F-stat)	6.471***	4.782**
1 vs 2 (F-stat)	2.422	2.592
Threshold value	0.060	2.069

Source: Authors' estimation

**Table 4.** Threshold Regression Estimation Results

Variables	Dependent Variable: GDPG			
	First Regime		Second Regime	
	HHI < 0.060	HHI ≥ 0.060	THE < 2.069	THE ≥ 2.069
HHI	-4.642	-5.273**		
THE			-1.339	-1.585***
CAP	0.106***	0.108***	0.185***	0.160***
FDI	0.199***	0.031	0.211**	0.094**
GOV	-0.465***	-0.337***	-0.166	-0.372***
LAB	0.463**	0.172***	0.065***	0.051*
C		4.222***		-2.123
C97		-0.786**		-0.845***
C08		-2.290***		-2.372***
R <sup>2</sup>		0.332		0.371
Adj. R <sup>2</sup>		0.288		0.316
F-stat (Prob)		7.525 (0.000)		6.766 (0.000)
DW		1.947		1.896
LM(2)		1.208 (0.211)		1.852 (0.131)
LM(4)		1.659 (0.157)		1.475 (0.158)

Notes: \*\*\*, \*\*, \* indicate significant level at 1%, 5%, and 10%, respectively.

Source: Authors' estimation.

Regarding estimation with export diversification measured by HHI, the estimated coefficient of HHI is insignificantly negative in the first regime when HHI is below the threshold value. However, the negative influence of HHI on economic growth is significant at a 5 percent level in the second regime when HHI is higher than the threshold value. This result implies a more diversified portfolio of the export market leads to an increase in economic growth when the degree of diversification is lower than a certain degree (i.e., the threshold), reflecting more benefits associated with comparative advantages as well as earning stability of existing products on the entrance to new markets. However, when market diversification reaches a certain degree (i.e., the threshold), existing products could not maintain comparative advantages in additional markets. As a result, greater export diversification would no longer be a positive driver for economic growth. Besides, adding a new market to the current portfolio would fail to obtain more stable earnings when macroeconomic conditions of the new market are correlated with other markets in the portfolio.

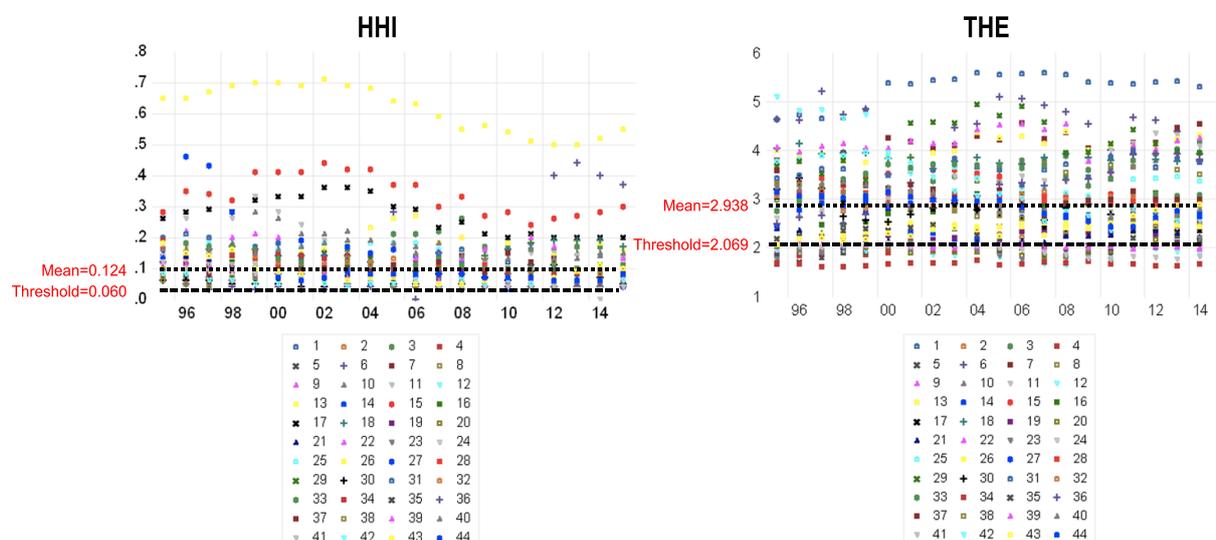
Regarding estimation results of the model in equation 2 with THE as the measure of export diversification, the coefficient of THE is also insignificantly negative in the first regime but significantly negative in the second regime. This result also indicates a nonlinear relationship between economic growth and export diversification in terms of product. Adding a new product to current export baskets can promote economic growth when the degree of product diversification is below the threshold. In the early stages, exports relied heavily on commodity goods. Thus, in terms of the horizontal aspect, a more diversified product portfolio can reduce the reliance on a

limited number of commodity goods whose prices are highly volatile. In terms of the vertical aspect, the addition of higher value-added products can increase productivity and output growth through knowledge spillover effects. These positive influences of more diversification in terms of horizontal and vertical aspects occur because product diversification at early stages usually concentrates on the most effective products with a strong comparative advantage. When the export basket becomes diversified at a certain high level, a new export product is hardly the particularly effective one, thus benefits to economic growth are hardly obtained.

The estimation results in this study partly support the findings by Aditya and Acharyya (2013) and Munir and Javed (2018), confirming the contribution of export diversification in terms of both geography and product to economic growth in the early stages. However, while previous studies indicate the negative influence of export diversification on economic growth when export diversification is at a high level, this study shows other evidence. Keeping diversifying export markets or products could not promote economic growth when the degree of diversification meets its threshold. This result is consistent with theoretical arguments. As macroeconomic conditions of markets are correlated regionally or globally, benefits of export earning stability indicated in portfolio investment theory could not grow unlimitedly. Romeu & Costa Neto (2011) and Karahan (2017) also indicate that more market diversification does not guarantee a more stable export revenue in crisis when countries' macroeconomic conditions are highly positively correlated.

Similarly, spillovers from export sectors to other sectors in the economy following endogenous growth theory would gradually diminish. Bao, Ye, and Song (2016) indicate a negative spillover of export production among Chinese firms in the later stage of export growth. The entry of more exporters will increase export crowding, as a result, raising the costs for exporting and depressing the export prices due to more competitive pressure. Moreover, an over-diversified export portfolio in terms of products will involve products with a less comparative advantage, while an over-diversified export portfolio in terms of the market will involve markets where existing products have a less competitive advantage. Cadot et al. (2011) also document a hump-shape relationship between export diversification and the level of income and find that “countries on the right of the turning point close lines that are typical, in terms of factor intensities, far from their endowments-outliers in their export portfolios”.

Figure 1 indicates that most EMDCs experience export diversification in terms of geography lower than the threshold value. Thus, EMDCs significantly growth benefit from diversification during the study period. The export diversification in terms of products on average is much lower than the threshold, while the export diversification in terms of geography on average is relatively close to the threshold. This implies a great room for the addition of more products and more narrow room for increasing export markets.



Source: WB (2020), IMF (2020) and authors' calculation.

**Figure 1.** HHI and THE of EMDCs compared to threshold values

According to estimation results, other variables also cause consistent influences on economic growth in both models using HHI and THE as measures of export diversification. Economic growth is significantly driven by capital formation, FDI, and the labor force. Contrarily, an increase in government consumption is detrimental for growth which can be explained by higher external debt to finance public consumption in EMDCs. External debt burden leads to more deficit fiscal balance, worsens the balance of payment, lowers sovereign credit rating, and undeniably damages economic growth.

### Robustness Test

Table 5 summarizes estimation results of model (3) by FEM based on the results of likelihood ratio and Hausman tests which are also presented at the bottom of the table. The coefficients of export diversification and its squared terms are consistently and significantly negative in both HHI and THE models. This result supports Aditya and Acharyya (2013) and Munir and Javed (2018), indicating a U-shape relationship between export concentration and economic growth or an inverted U-shape relationship between export diversification economic growth. Thus, benefits to economic growth could be obtained in the early stages of export diversification, while disadvantages to economic growth are the influence of export diversification at a high level. Besides, the effects of capital formation, FDI, and government consumption on economic growth are consistent with threshold estimation results. These consistencies confirm the robustness of our estimation results.

**Table 5.** Robustness Estimation Results by Fixed Effect Model

Variables	Dependent Variable: GDPG	
	HHI	THE
(1)	(2)	(3)
THE		-6.334***
THE <sup>2</sup>		-0.690**
HHI	-5.010*	
HHI <sup>2</sup>	-1.524**	
CAP	0.141***	0.223***
FDI	0.065**	0.111***
GOV	-0.349***	-0.381**
LAB	-0.079	-0.100
C97	-0.612*	-0.846**
C08	-2.066***	-2.215***
C	5.595***	-8.497**
R <sup>2</sup>	0.297	0.344
Adj. R <sup>2</sup>	0.255	0.292
F-stat (Prob)	7.075 (0.000)	6.655 (0.000)
DW stat	1.629	1.694
Poolability test (F-stat)	3.785 (0.000)	4.294 (0.000)
Hausman test (Chi-sq stat)	33.541 (0.000)	15.102 (0.019)

Notes: \*\*\*, \*\*, \* indicate significant level at 1%, 5%, and 10%, respectively.

### Conclusion

There has been growing consensus that export diversification can solve the weakness of the high dependence of exports on commodity goods in EMDCs. However, whether this strategy associated with general economic growth? This study investigates the nonlinear relationship between export diversification and economic growth by employing the threshold regression methodology introduced by Tong (1978) and Hansen (1999). The Herfindahl-Hirschman market concentration index measures geographical and product diversification, and the overall Theil index is involved. The following result of this study uses data from 44 EMDCs in the period between 1995 and 2015. First, the threshold values of export diversification measured by HHI and THE are found to be significant, implying the nonlinear relationship between export diversification and economic

growth across EMDCs. Second, below the threshold, export diversification in terms of geography and products is associated with economic growth. This result implies the role of an export diversification strategy in growth. However, when the level of export diversification is higher than the threshold, economic growth fails to get benefits from an increase in export diversification in either geography or product aspects.

Our results support previous studies that document the positive influence of export diversification on economic growth in the early stage. However, different from previous studies which conclude the negative effect of export diversification above the threshold on economic growth, we indicate no benefit for economic growth following an increase in export diversification.

The results evidence of this study is the appropriation of export diversification to stimulate growth in EMDCs. As the degree of export diversification of most EMDCs is currently lower than the threshold values, it seems that these countries would keep increasing the level of export diversification in terms of the geography or product aspect. Since the effects of export diversification on growth are sensitive to its levels, EMDCs need to track the degree of export diversification of the economy to have an appropriate assessment. When the level of export diversification is greater, EMDCs should revise their export diversification strategy because an expansion of markets or the addition of export products would not be beneficial to growth. In essence, the positive effect of export diversification on economic growth occurs only when adding a new product or market to the existing portfolio is accompanied by the benefit of stabilizing export revenue or the spillover effects of export activities, most importantly, the comparative advantage. Therefore, the assessment of export diversification of each economy should be considered in these aspects.

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