Acta Universitatis Danubius
ŒCONOMICA

A Panel Threshold Regression Approach to Establish The FDI-Exports Linkage in Emerging Markets

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Abstract: This paper explored the impact of foreign direct investment (FDI) on exports in emerging markets using panel data ranging from 2004 to 2019. More specifically, it studied the minimum threshold level of FDI that enhances a significant exports growth in emerging markets using the static Hansen (1999)'s panel threshold approach. Existing literature agrees that FDI forms an integral component of exports growth but recently, it is clearer that FDI does not only need to be available but must exceed a certain minimum threshold point before host countries can begin to experience significant exports growth. That is the reason the author carried out this study to determine the minimum threshold level of FDI that lead to significant exports growth in emerging markets. Results show that FDI significantly improved exports in emerging markets as expected. In addition, levels of FDI equal to and above a threshold level of 2.67% of GDP led to significant exports growth in emerging markets, in agreement with more recent available literature. Such results make it prudent for emerging markets to implement policies and mechanisms that enhances FDI inflow to expand the exports base of their respective countries.

Keywords: Foreign Direct Investment; Exports; Panel Data; Emerging Markets

JEL Classification: C33; F21; P2; P33

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1. Introduction

Theoretically, the impact of FDI on exports has been well and extensively argued (Makhoba, 2024). It is noted that FDI enhances exports of host nations by increasing the rate of productive capacity through technology transfer, capital stock, upgrading general skill levels of the local employees and managerial skills. FDI enhances the host country's level of exports through its ability to link domestic firms with new and large international markets. Sultan (2013) observed that the FDI-led exports hypothesis is quite a controversial one because it largely depends on the motive of foreign investment. If the motive of FDI is to enjoy comparative advantage and low production costs (vertical FDI), such foreign investments are more than likely to lead to increased exports. If the motive of FDI is to gain easily access large international markets, bypass barriers to trade and enjoy economies of scale (horizontal FDI), exports may not increase (Sultan, 2013, p. 1).

Several empirical researchers which examined the influence of FDI on exports produced quite divergent, mixed and conflicting findings. Some empirical researchers noted that FDI improved exports (Makhoba, 2024; Gladson, 1986; Mitic & Ivic, 2016; Acaravci & Ozturk, 2012; Mazurura et al., 2017; Kutan & Vuksic, 2007; Mukhtarov et al., 2019; Kastratovic, 2020), others observed that FDI negatively affected exports (Tessema, 2019) whilst another group found a negligible, insignificant or no relationship at all between these two variables (Sultan, 2013; Farid et al., 2023; Karimov, 2020; Diaz et al., 2023; Ahmed et al., 2023; Etale & Etale, 2016; Gebremariam & Ying, 2022). Others noted that certain absorption capacities must be present in the host country to facilitate FDI's positive impact on exports (Sahoo & Dash, 2022; Ezsoy, 2020). Others coalesced under the feedback effect view (Bouras & Raggad, 2015; Etale & Etale, 2016; Jana et al., 2020).

Majority of empirical researchers observed that FDI enhances exports. However, consistent with Sahoo and Dash (2022) and Ezsoy (2020), it is emerging in the literature that a certain minimum level of FDI is necessary to significantly enhance exports growth. So far, to the best of the author's knowledge, prior empirical research on FDI-exports nexus excluded the threshold regression analysis. This study departs from prior empirical studies on the subject matter (FDI-exports nexus) by focusing on estimating FDI threshold level that significantly enhance exports growth in emerging markets. That is what makes this study unique.

This study contributed to literature in four different ways. Firstly, to the author's best knowledge, this study is the first to explore FDI's threshold level necessary to enhance significant exports growth. Secondly, this study is unique because it used a static panel regression approach, a methodology which was never employed before by similar empirical research. Thirdly, this study used emerging markets as a focal point, a group of countries completely excluded by prior similar empirical studies.

Fourthly, this study used recent panel data (2004-2019), in contrast to the old data used by similar empirical studies.

Section 2 extensively discusses relevant literature, Section 3 describes and explains the research methodology used which Section 4 discusses and interprets main results of the study. Section 5 concludes the study.

2. Literature Review

Mundell (1957) argued that FDI and exports are substitutes. According to this hypothesis, trade occurs between dissimilar nations because of the existence of comparative advantages. With the introduction of international capital mobility, the hypothesis argues that foreign capital moves from a capital abundant nation to a more capital deficient nation, and it continues to happen until that comparative advantage difference is eliminated hence forming the basis of trade between those two countries. It is for this reason according to the substitution hypothesis that exports decline as FDI inflow increases.

The complementarity hypothesis fronted by Markusen (1984), Ekholm et al. (2007) and Helpman (1984) argued that FDI can be used effectively to build export platforms hence promoting exports-oriented businesses. Helpman and Krugman (1985) noted that under vertical FDI integration, parent countries can export inputs and intermediate goods to the host country whilst finished products can be exported back to the parent country. According to Helpman and Krugman (1985), under horizontal FDI, parent countries builds production plants in the host countries to be closer to the market. In this scenario, production is done in the host country and finished products are sold domestically in a bid to reduce tariffs and transportation expenses. It is for these reasons that Markusen (1984) argued that horizontal FDI substitutes exports whilst vertical FDI complements exports.

Moran (2011) argued that the purpose of FDI determines whether it results in increased or diminished exports. For example, market seeking FDI is more likely not to increase exports because the finished products are sold locally. Efficiency seeking FDI tends to build production plants in countries characterised by low cost of production and then export back the finished products, hence boosting exports from the host country point of view.

Zhang and Song (2001) noted that FDI increases exports either directly or indirectly. FDI directly increases exports when foreign subsidiaries in host countries take advantage of multinational firms' global distribution networks to exports more of its finished goods. FDI indirectly enhances exports through positive spill-over influence of foreign subsidiaries in the host countries. Example include local firms boosting their exports level by benefiting from technology transfers, skills development,

global networking, capital augmentation, increased competitiveness, superior managerial skills and transportation infrastructure. The variables enhance domestic firms' productivity, output and exports, argued Zhang (2006).

On the empirical side, several studies investigated the influence of FDI on exports. Their findings are diverse, mixed, not congruent, divergent and far from reaching a consensus. Makhoba (2024) examined the relationship between FDI and exports in South Africa using the vector autoregressive approach and dynamic ordinary least squares with time series data set (1960-2021). Exports growth in South Africa was found to be positively associated with FDI both in the short and long run. Using panel data (1963-1983) analysis, Gladson (1986) examined the link between exports and FDI in twenty-three least developed countries. The positive influence of FDI on exports was confirmed for these least developed countries.

Sahoo and Dash (2022) studied FDI's influence on exports in developing countries using panel data analysis with data ranging from 2000 to 2017. FDI enhanced exports depending on the host country's level of development. FDI was found to have a more significant positive influence on exports in upper middle-income countries than in lower middle-income countries. Using correlation analysis approach with data spanning from 1993 to 2013, Mitic and Ivic (2016) studied FDI's impact on export performance in European transition economies. Their study noted FDI inflow into European transitional economies significantly led to an increase in high technology related exports.

The Autoregressive Distributive Lag (ARDL) approach was employed by Acaravci and Ozturk (2012) to examine the interrelationship among FDI, economic growth and exports in new European Union (EU) countries, which include Bulgaria, Estonia, Latvia, Poland, Slovakia, Czech Republic, Hungary, Lithuania, Romania, and Slovenia. The study revealed that in forty percent of the countries' studies, FDI granger caused exports in the long and short run. A study by Mazurura et al. (2017) using multiple regression analysis with time series data (1980-2011), investigated the exports growth influence of FDI in Zimbabwe. The results of their study indicated that exports growth was enhanced by both lag of FDI and current FDI in the context of Zimbabwe.

Using the vector error correction model (VECM), Sultan (2013) explored the link between FDI and exports in India with time series data spanning from 1980 to 2010. No relationship in either direction between exports and FDI was found in the short run. In the long run, exports Granger caused FDI whilst the null hypothesis that FDI influences exports was rejected. Investigating the relationship between export performance and FDI in Central and Eastern Europe, Kutan and Vuksic (2007) used general least squares with panel data spanning from 1996 to 2004. For all countries under study, the domestic supply capacity and exports were both enhanced by FDI

inflow whilst European Union new member states experienced an increase in exports directly related to FDI inflow.

Tessema (2019) examined the relationship between export performance and FDI in Ethiopia using VECM and vector autoregressive method with time series data (1990-2017). FDI was found to have a deleterious influence on exports in both short and long run. The study also noted that Ethiopia was not yet reaping the FDI inflow benefits, specially focusing on the export sector. Using the ARDL method with time series data (1980-2018), Mukhtarov et al. (2019) examined the exports influence of FDI in Jordan. Their study observed that exports were significantly improved by FDI only in the long run. Employing random effects, fixed effects and pooled ordinary least squares with panel data (1988-2012), Bouras and Raggad (2015) investigated whether the relationship between FDI and exports was complementary or that of substitutes in ten countries which included Tunisia, Egypt, Hungary, Portugal, Slovenia, Morocco, Finland, Poland, and Czech Republic. For both manufacturing and non-manufacturing sectors, exports and FDI were found to have complemented each other.

Using Pakistan as a focal point, Farid et al. (2023) examined the relationship between exports of five economic sectors (major) and the inflow of FDI. VECM with time series data ranging from 2000 to 2020 were used in the study. In the short run, the influence of FDI on exports was not observed. On the contrary, a statistically positive influence of FDI on exports in the long run was noted. Kastratovic (2020) examined the FDI-exports nexus in developing countries using the meta-regression approach. The study observed that exports were significantly enhanced by FDI inflow especially for developing nations.

Karimov (2020) used vector autoregression method with time series data (1974-2017) to examine the linkages between trade (imports and exports) and FDI in Turkey. The study only observed a uni-directional causality running from imports and exports towards FDI, both in the long and short run. The ARDL approach with quarterly time series data (2005-2018) was employed by Basilgan and Akman (2019) to study if there is an influence of FDI on export performance in Turkey. FDI-led exports growth hypothesis was confirmed in the context of Turkey, both in the long and short run. Diaz et al. (2023) also examined the exports-FDI link in Mexico using panel data analysis with sectoral data spanning from 1990 to 2019. Their study failed to find a statistically significant relationship between FDI and exports. Matlasedi and Ncanywa (2017) used the VECM (with annual time series secondary data, 1980 to 2015) to also pursue a study on the inward FDI's influence on exports in South Africa. In the short run, exports influenced FDI whilst in the long run, FDI inflows had an enhancing effect on exports in South Africa.

A study carried out by Pelinescu and Radulescu (2009) used multi-regression model to examine the linkage between exports and FDI in developing countries. Their study

confirmed that FDI has a positive role to play in influencing exports in developing nations. Ahmed et al (2023) used the VECM approach with annual time series data (1972-2019) to explore the FDI-exports performance nexus in Bangladesh. In both short and long run, the study noted the existence of a uni-directional causality relationship running from export performance towards FDI inflows in Bangladesh. Using Ethiopia as a unit of analysis, Mekuriaw (2021) examined the FDI-exports linkages with annual time series data spanning from 1991 to 2016. The VECM approach produced results which show that FDI significantly promoted exports in the long run. A non-significant export enhancing effect of FDI was also observed in the short run.

Kastratovic (2023) examined the influence of FDI inflows on agricultural exports in developing countries using a system generalized methods of moments (GMM) with panel data (2005-2017). The variables used were found to be co-integrated hence allowing main data analysis to happen. Both long and short run results indicate that agricultural related exports were enhanced by FDI inflows in developing nations. In the context of India, a study done by Prasanna (2010) using multiple-regression model (1991-2007) noted that FDI significantly improved the exports quantity both the short and long run. Using VECM approach with annual time series data (1980-2013), Etale and Etale (2016) studied the linkage between exports economic growth and FDI in Malaysia. A uni-directional causality relationship running from exports towards FDI was noted in the long run, not the other way around. Also, in the long run, a feedback effect between economic growth and FDI was observed.

Employing the ARDL approach with secondary annual time series data (1992-2018), Gebremariam and Ying (2022) studied the nexus between export performance and FDI in Ethiopia. The relationship between export performance and FDI inflows was found to be insignificant in the long run whilst it was non-existent in the short run. Jana et al. (2020) used the VECM approach to examine the linkage between foreign trade growth and FDI in India. They noted that foreign trade enhanced FDI in the long run whilst these two variables affected one another (bi-directional relationship) in the short run. The positive effect of FDI on foreign trade growth was not found in the long run in India.

A study done by Ezsoy (2020) on the influence of FDI on the exports of high technology related products in seventy developing countries used the GMM approach with data ranging from 2002 to 2015. The main advantage of the GMM is that it allowed controlling of the endogeneity influence on the results. The study observed that financial development and quality of regulation influenced the impact of FDI on exports of the high technology products. In other words, countries characterised by higher levels of regulatory quality and financial development saw FDI having a significant enhancing influence on exports of the high technology

products. Vice-versa was also to be true for countries with low financial development and regulatory index.

A multi-regression analysis was employed by Abamu and Pietrzak (2019) to examine if there is a relationship between international trade and FDI in Nigeria. Their study used time series data (1995-2017). The study noted the existence of a statistically significant influence of FDI on exports in Nigeria. Silva and Forte (2018) studied the exports-FDI nexus for Portuguese companies (services and manufacturing sectors) using fixed effects model with panel data (2006-2012). FDI's positive influence on exports was observed in this study. Using India, China and Malaysia as a focus area, Das (2007) examined the linkage between export performance and FDI. The study employed the multiple-regression analysis with annual time series data (1991-1999). The finding is that FDI did not influence exports but imports and economic growth improved exports in China, India, and Malaysia.

Okechukwu (2016) examined the impact of FDI on exports in Nigeria using ARDL method with annual time series data (1980-2015). Exports were enhanced by FDI inflow in Nigeria both the short and long run. Using disaggregated data set, FDI enhanced oil exports whilst the relationship between non-oil exports and FDI was not only negligible but also statistically non-significant. Employing panel methods of data analysis, Illa (2022) explored FDI-international trade nexus in Western African Economic and Monetary Union (WAEMU) nations. The study noted FDI enhanced international trade in these WAEMU group of nations.

Bhatt (2013) examined the FDI-income-exports nexus in Vietnam using the vector autoregressive (VAR) approach. 1990 to 2008 is the timeframe of the annual time series data used. The study observed that exports were enhanced by FDI in a significant way in Vietnam. The ARDL approach was employed by Okechukwu et al. (2018) to study the export performance and FDI nexus in Nigeria. The sectoral data set used ranged from 1980 to 2015. FDI enhanced exports in Nigeria in the long run. Using disaggregated data, FDI improved oil exports only in the long run. Disaggregation of FDI data (using primary, secondary and tertiary criteria), show that FDI enhanced both oil exports and total exports whilst service sector FDI did not have significant relationship with Nigeria's exports at all.

3. Research Methodology

Data, variables and source of data: This study used exports as a dependent variable, FDI as an independent variable whilst financial development, economic growth, human capital development, tax revenue and urbanization are control variables used. Panel data ranging from 2004 to 2019 were used and this data was obtained from World Development Indicators

According to Makhoba (2024), Sahoo and Dash (2022), Mitic and Ivic (2016), Mazurura et al. (2017), Tessema (2019), Basilgan and Akman (2019), and Mekuriaw (2021), financial development, human capital development, economic growth, urbanization and tax revenue are expected to increase exports.

Estimation approach: Equation 1 is a static panel threshold model developed by Hansen (1999) whose main weakness is that it could not address the influence of the regime intercepts on the findings of the study. When the regime intercepts are excluded from the model, variable omitting bias occurs in estimating both threshold co-efficiency and regression slope (Bick, 2010). Despite its weakness, this study employed the Hansen (1999)'s static panel threshold model.

$$y_{it} = \mu_i + \beta_1{}^1 x_{it} I(q_{it} \leq \gamma) + \beta_2{}^1 x_{it} I(q_{it} > \gamma) + \varepsilon it \quad [1]$$

Theoretical base of Hansen (1999) model is that investments starts to be negatively affected beyond a certain maximum threshold level of financial constraints. Regarding this study, a certain minimum level of FDI exists above which significant exports start to be realised. Hence, equation 2 is modified to correctly capture the link between FDI and exports, in line with the Hansen (1999) method.

$$EXP_{it} = \mu_i + \beta_1 \, fdi_{it} I(fdi_{it} \geq \gamma) + \beta_2 \, fdi_{it} I(fdi_{it} < \gamma) + \varphi z_{it} + \varepsilon it \quad [2]$$

Where β_1 and β_2 stands for coefficients of the regression slope, φz_{it} represents control variables, I is the indicator function, γ is the threshold level, μ_i stands for country specific fixed effect, z_{it} is a vector of conditional information set of explanatory regressors (including exogenous variables) and EXP_{it} is total exports as a ratio of GDP for country i at time t. Error term (εit) is identically and independently distributed, characterised by constant variance and zero mean. fdi_{it} stands for foreign direct investment for country i at time t. Country specific effects (μ_i) elimination using the standard within transformation is the first step in the approximation of threshold levels, consistent with Hansen (1999). Ordinary least square was then employed to estimate both slope co-efficients and threshold level.

4. Results Discussion

Table 1 presents mean of the main variables involved in the study, where EXP stands for total exports as a ratio of GDP, FDI is the net foreign direct investment inflows as a ratio of GDP, HCD represents human capital development index whilst FIN stands for domestic credit to private sector as a ratio of GDP. TR is the total tax

revenue as a ratio of GDP, GROWTH stands for gross domestic product per capita whilst URBAN is urban population as a ratio of total population in the country.

Table 1. Mean of main variables by Country (2004 to 2019)

	EXP	FDI	HCD	FIN	TR	GROWTH	URBAN
Argentina	33.27	2.00	0.82	13.62	12.29	10 837.01	91.00
Brazil	25.81	3.19	0.76	52.85	13.79	9 011.37	84.74
China	48.75	2.97	0.73	131.99	9.53	5 696.75	50.97
Colombia	37.27	4.13	0.74	37.25	13.81	5 872.81	78.46
Czech Republic	136.91	4.45	0.88	44.56	14.55	19 082.84	73.48
Indonesia	48.86	1.89	0.69	32.20	11.29	2 915.32	50.78
India	46.23	1.82	0.60	48.22	10.83	1 384.11	31.55
Mexico	64.72	2.73	0.77	26.20	10.89	9 136.01	78.25
Malaysia	158.44	3.33	0.79	112.84	14.18	9 073.76	71.62
Peru	49.61	4.26	0.75	33.44	15.16	5 236.84	76.61
Philippines	67.64	1.67	0.69	34.77	12.74	2 364.58	45.97
Republic of Korea	83.76	0.89	0.90	131.05	13.97	24 821.17	81.62
Thailand	128.36	2.62	0.74	127.13	15.42	5 235.29	44.32
Turkey	51.77	1.81	0.77	50.36	17.68	9 557.13	71.59
Singapore	367.50	21.10	0.91	107.46	12.97	48 806.28	100.00
South Africa	54.58	1.31	0.67	124.79	23.71	6 415.49	62.98
Overall Mean	**87.72**	**3.76**	**0.76**	**69.30**	**13.93**	**10 965.42**	**68.37**

Czech Republic, Malaysia, Thailand, and Singapore are the countries whose mean exports figures exceeded the overall mean export figure of 87.72% of GDP whilst the remainder of the countries had their mean exports below the overall mean exports value. Thailand, Singapore, Malaysia, Czech Republic, Brazil, and Argentina are outliers because their mean exports deviated from the overall mean exports by a wider margin. Colombia, Czech Republic, Peru and Singapore attracted highest FDI inflows than their peers whilst Indonesia, India, Philippines, Turkey, and South Africa attracted the least. Regarding human capital development, Argentina, Czech Republic, Mexico, Malaysia, Republic of Korea, Turkey, and Singapore fared much better than their peers.

China, Malaysia, Republic of Korea, Thailand, Singapore, and South Africa had their mean domestic credit to private sector ratio of GDP higher than the overall mean domestic credit to private sector (69.30% of GDP). Argentina, China, Mexico, Malaysia, Republic of Korea, Thailand, Singapore, South Africa, Colombia, Indonesia, Peru, and Philippines are extreme values because their mean domestic

credit to private sector ratios far much deviated from the overall mean domestic credit to private sector ratio of 69.30% of GDP.

Regarding tax revenue, Argentina, Brazil, China, Colombia, Indonesia, India, Mexico, Philippines, and Singapore performed below their peers whilst South Africa was the highest in terms of tax revenue as a ratio of GDP collected. Czech Republic, Republic of Korea, and Singapore performed well above their peers when it comes to GDP per capita whilst India had the lowest mean GDP per capita during the period under study. Countries which are on the extreme include India, China, Colombia, Indonesia, Peru, Philippines, Thailand, Singapore, Republic of Korea, and Czech Republic because their mean GDP per capita values deviated from the overall mean GDP per capita value of US$10 965.42 by a wider margin.

Only six countries (China, Indonesia, India, Philippines, Thailand, and South Africa) had their mean urbanization values below the overall mean urbanization value of 68.37% of total population. Countries which were on the extreme regarding urbanization include Argentina, Brazil, India, Philippines, Thailand, and Singapore for the same reason alluded to earlier on in this section. To manage the effects of abnormally distributed data, multi-collinearity and extreme values, the data was converted into natural logarithms, consistent with Hair et al. (2014).

The main results of the study are presented in Table 2.

Table 2. Panel threshold regression results - Hansen (1999) model

	EXP= f(foreign direct investment, initial, controls)		
Threshold estimate	2.67 Confidence level [2.03-2.99]		
	Coefficient	Std. error	T statistic
β_1	0.3618***	0.1016	3.5610
β_2	0.3004	0.2710	1.1085
Human capital development	0.4482*	0.2671	1.6780
Financial development	0.1065**	0.0433	2.4596
Tax revenue	0.2189	0.1598	1.3698
Economic growth	0.0065***	0.0017	3.8235
Urbanization	0.3338	0.3367	0.9914

/**/** indicate 10%/5%/1% respectively

The co-efficient β_1 is 0.3618 which is significant at 1% in the first regime in which foreign direct investment ratio is greater or equal to a threshold level of 2.67% of GDP. This means that exports go up by 36.18% in response to a 1% increase in foreign direct investment. A non-significant co-efficient (β_2) of 0.3004 which is associated with the second regime in which foreign direct investment ratio is below the threshold level of 2.67% of GDP. Such a result means that a 1% increase in foreign direct investment ratio led to a 30.04% rise in exports in emerging markets.

Estimated co-efficient of foreign direct investment ratio in the first regime is greater than in the second regime. This provides evidence of the existence of an optimal level of foreign direct investment (2.67% of GDP) beyond which point any additional increase in foreign direct investment more significantly increases exports for emerging markets. The results agree with Zhang and Song (2001) noted that FDI directly increases exports when foreign subsidiaries in host countries take advantage of multinational firms' global distribution networks to exports more of its finished goods and indirectly through positive spill-over influence of foreign subsidiaries in the host countries.

They also concur with empirical literature done by Ezsoy (2020), Mukhtarov et al. (2019), Bouras and Raggad (2015), Farid et al. (2023), Karimov (2020), Diaz et al. (2023), Matlasedi and Ncanywa (2017), and Diaz et al. (2023) whose studies noted that significant exports are more likely to be associated with higher levels of foreign direct investment. The influence of each control variable on exports is according to literature's prediction. Human capital development, financial development, tax revenue, economic growth and urbanization according to literature (Mekuriaw, 2021; Sahoo & Dash, 2022; Makhoba, 2024; Mazurura et al., 2017; Mitic & Ivic, 2016; Basilgan & Akman, 2019; Tessema, 2019) are expected to have a positive influence on exports as already has been alluded to earlier on under the research methodology section.

5. Conclusion

This paper explored the impact of FDI on exports in emerging markets using panel data ranging from 2004 to 2019. More specifically, it studied the minimum threshold level of FDI that enhances a significant exports growth in emerging markets using the static Hansen (1999)'s panel threshold approach. Existing literature agrees that FDI forms an integral component of exports growth but recently, it is clearer that FDI does not only need to be available but must exceed a certain minimum threshold point before host countries can begin to experience significant exports growth. That is the reason the author carried out this study in order to determine the minimum threshold level of FDI that lead to significant exports growth in emerging markets. Results show that FDI significantly improved exports in emerging markets as expected. In addition, levels of FDI equal to and above a threshold level of 2.67% of GDP led to significant exports growth in emerging markets, in agreement with more recent available literature. Such results make it prudent for emerging markets to implement policies and mechanisms that enhances FDI inflow in order to expand the exports base of their respective countries.

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