Export Diversification and Free Trade Agreements: The case of Peru*

Diversificación de exportaciones y tratados de libre comercio: el caso del Perú

Eduardo Vera**

Resumen

Este artículo de investigación examina el efecto de los Tratados de Libre Comercio (TLCs) en la diversificación de las exportaciones, centrándose en las exportaciones peruanas a cinco países de la región de Asia Pacífico: China, Japón, Corea del Sur, Tailandia y Singapur. Al emplear modelos de regresión con variables de control, el estudio investiga los resultados de los TLCs en los patrones de exportación. Los hallazgos revelan que el TLC produjo dos efectos principales: general y rezagado. El efecto general del TLC se observó en el caso de las exportaciones peruanas a China y Corea, donde una mayor variedad de productos exportados estuvo disponible. Por otro lado, el TLC firmado con Japón, Tailandia y Singapur resultó en una reducción gradual de la concentración de artículos exportados con el tiempo.

* The views expressed in this paper are solely those of the author and do not necessarily reflect those of the Central Reserve Bank of Peru.

** Specialist, Monetary Statistics Department, Central Bank of Peru; Researcher, National University of San Marcos (Perú). ORCID: https://orcid.org/0000-0002-0933-4125. Correo electrónico: eduardo.nina@bcrp.gob.pe. Recibido: 17 de noviembre de 2023, Aceptado: 26 de diciembre de 2023

Estos hallazgos subrayan la importancia de comprender los impactos multifacéticos de los TLCs en la diversificación de las exportaciones y destacan la necesidad de una comprensión matizada de cómo los tratados comerciales influyen en la dinámica de exportación en mercados diversos.

Palabras clave: Diversificación de las exportaciones – Tratados de Libre Comercio – Perú – Asia Pacífico.

Abstract

This research paper examines the effect of Free Trade Agreements (FTAs) on export diversification, focusing on Peruvian exports to five countries in the Asia Pacific region: China, Japan, South Korea, Thailand, and Singapore. By employing regression models with control variables, the study investigates the outcomes of FTAs on export patterns. The findings reveal that the FTA yielded two primary effects: general and lagged. The general effect of the FTA was observed in the case of Peruvian exports to China and Korea, whereby a greater variety of exported goods became available. On the other hand, the FTA signed with Japan, Thailand, and Singapore resulted in a gradual reduction in the concentration of exported items over time. These findings underscore the importance of comprehending the multifaceted impacts of FTAs on export diversification and emphasize the need for a nuanced understanding of how trade agreements influence export dynamics across diverse markets.

Keywords: Export diversification – Free Trade Agreements – Peru – Asia Pacific.

1.- Introduction

International trade has been long acknowledged as a major factor in economic growth and development, enables nations to specialize in the production of goods and services in which they have a comparative advantage and to trade these goods and services with other nations for mutual gain. nevertheless, there are risks associated with trade including environmental shocks (such as natural disasters), negative shocks related to technological and operational incidents, and higher trade costs (Gnangnon, 2022). Many nations have followed export diversification strategies in an effort to broaden their export base beyond traditional primary commodities and into higher value-added manufacturing and services in order to reduce these risks and maximize the benefits of trade (Salinas, 2021).

In this study, we delve into the connection between export diversification and free trade agreements (FTAs), assessing the impact of FTAs on promoting export diversification and bolstering the robustness of a nation's trade portfolio in today's interconnected and ever-changing global economy. By examining the role of FTAs, we aim to shed light on how they can effectively address economic vulnerability among developing countries, offering unique opportunities that would be otherwise unattainable (DiCaprio & Santos-Paulino, 2011). The case of Peru provides an interesting example of the potential benefits of export diversification and free trade agreements. In recent years, Peru has made significant strides in diversifying its export portfolio, moving beyond its traditional reliance on minerals and metals and expanding into higher value-added products, specifically the non-traditional exports (Martinez et al., 2019). Besides, Peru has exhibited steady growth and established trade relationships with East Asian countries in recent years. Specifically, the empirical implications of Peru's

FTAs with China, Japan, Korea, Thailand, and Singapore are examined.

Also, these five countries collectively account for a significant share of Peru's total exports (40% in 2022), highlighting the importance of these markets for the country's trade performance. It is plausible that there exists undisclosed historical bias which may impact the examination of Peru's trade relations with Europe or the US. However, this bias is mitigated in the context of Peru's trade with East Asia. Consequently, our analysis is narrowed to encompass solely five trading partners.

To analyze the relationship between export diversification and free trade agreements in Peru, this paper uses new data on the top 20 Peruvian products by country of destination provided by SUNAT, the Peruvian national customs and tax authority. This data provides a detailed picture of the composition of Peru's exports to these five key Asia Pacific countries.

The remainder of this paper is organized as follows. Section 2 briefly reviews the related literature. The data and the econometric methods are described in Section 3. The empirical findings are reported and discussed in Section 4, and section 5 presents the conclusion.

II.- Literature Review

This section will primarily address the relationship between export diversification and two pivotal variables, namely economic instability and economic growth. Furthermore, an evaluation of the pertinent literature pertaining to the effects of Free Trade Agreements (FTAs) will be conducted.

Export diversification can have several implications in developing countries. One of the main benefits of export diversification is that it can create a more stable income inflow, which can help reduce income instability and high growth volatility. Export instability has negative effects on economic growth and on investment (Oladipo, 2014). The traditional theories of trade stress that each nation should focus on particular export product categories where they have comparative advantages, nevertheless, the Prebisch-Singer hypothesis altered this belief because it demonstrated that the concentration of primary commodities can adversely impact economic development by causing instability in export earnings (Gözgör & Can, 2017). High dependence on a reduced set of items is detrimental for the long run economic growth, therefore export diversification might work as a panacea, enhancing economic growth and strengthening the stability of a country. Numerous studies suggest that a more diversified export basket is statistically associated with lower output volatility (Haddad et al., 2013; D. Lee & Zhang, 2019; Rath & Akram, 2017). Additionally, having a more diversified production structure can lead to spillover effects in the economy, which can further contribute to economic growth. Acemoglu & Zilibotti (1997) findings indicate that export diversification holds a positive impact on economic growth in developing nations, this phenomenon occurs due to a consequential shift in investment composition towards endeavors that are more lucrative but also possess higher risk profiles. It is worth noting that a substantial dependence on primary product exports is often linked to heightened volatility in terms of trade and an inelastic and declining global demand associated with traditional primary exports, these to variables lead to adverse effects on exports, investment, and subsequently, economic growth (Munemo, 2011; Volpe Martincus & Gomez, 2010). Several empirical papers appointed the positive relationship between export diversification and

economic growth (Al-Marhubi, 2000; Hesse, 2008; Khodayi et al., 2014; Önder & Yilmazkuday, 2016). There are certain conclusions that carry a more radical perspective, as espoused by Mania & Rieber (2019) asserting that the evaluation of export diversification must be assessed on a country's ability to advance its productive configuration.

An intriguing aspect worth noting is that despite the positive association between export diversification and economic growth, empirical evidence suggests that it can also give rise to income inequality (Blancheton & Chhorn, 2019; C.-C. Lee et al., 2022; D. Li et al., 2022). However, it is important to emphasize that this specific relationship will not be further explored in the present research as it falls outside the scope of the study's primary focus.

There are noteworthy findings in the literature regarding the relationship between export diversification, economic globalization, and economic growth. Diversification of exports and economic globalization are positively related with economic growth merely in the upper middle economies (Gözgör & Can, 2017), also export diversification has a more significant impact on reducing output volatility than improving long run growth in small states (McIntyre et al., 2018), and the trade diversion and creation effects of the FTAs on trade flows may depend on the quality of economic and political institutions in the region (Alhassan & Payaslioglu, 2023). There's the hypothesis that the relationship between export concentration (diversification) and economic growth is nonlinear and has two stages, the first one reveals that export diversification is positively related to economic growth, and then after certain threshold the relationship became inverse (Siswana & Phiri, 2021). These papers were presented with the aim of establishing the unique nature of the relationship under study, suggesting that a case-by-case

examination may be more appropriate. Attempting to formulate a general theory in this context could introduce biases and overlook the nuanced characteristics of individual cases. The study conducted by Sarin et al. (2022) offers a highly valuable contribution to the existing body of literature regarding the topic under investigation, the authors conducted an extensive and comprehensive literature review, which provides an insightful analysis of the current state of knowledge in the field.

The structure of exports growth can be divided in two categories: extensive and intensive margin (Bernard et al., 2009), where the extensive margin encompasses the establishment of new commercial relations brought about by the net entry of exporting firms or the diversification in the product portfolio and destination markets of established entities; conversely, the intensive margin pertains to the sustenance and deepening of extant business relationships. In this paper, the focus of assessment lies on the extensive margin, which encapsulates the level of diversification under consideration. Amurgo-Pacheco & Pierola (2008) indicate that even though export growth is mostly explained by the growth at the intensive margin, diversification is on the rise among developing countries. This suggests that developing countries are recognizing the importance of export diversification and taking steps to achieve it.

Export diversification is objectively influenced by several determinants, including fundamental factors such as per capita income, size of accessible markets, innovation, financial development, developing human capital, exchange rate stability, infrastructure, public investment, institutional framework, and participation in free trade agreements (Agosin et al., 2012; Amurgo-Pacheco & Pierola, 2008; Parteka & Tamberi, 2013; Rahul Giri et al., 2019; Vogel, 2022), particularly, trade

facilitation policies[1] can help promote export diversification in developing countries (Dennis & Shepherd, 2011). Trade facilitation provisions in preferential trade agreements promote the export performance of global value chain firms, especially when they import inputs from the preferential trade agreement partner country. In the case of Peru, the main benefit of trade facilitation provisions results from efficiency enhancements at its own border, allowing global value chain firms to import inputs in a more timely and predictable manner (W. Lee et al., 2021). Within the realm of Trade facilitation policies, one notable component is the focus on free trade agreements (FTAs), which constitutes the primary subject of investigation in this paper, FTAs exert a profound influence on the expansion of import and export flows, fostering greater trade integration (Baier & Bergstrand, 2007; Hannan, 2017; Singh, 2021), also enhance export diversification (Beverelli et al., 2015; Choe, 2011; Nguyen & Phan, 2020), and have the potential to address economic vulnerability in the developing country partners in ways that would not be possible in their absence (Dicaprio & Santos-Paulino, 2011). In contrast, Dutt et al. (2013) present divergent findings, when examining preferential agreements, their analysis illuminates a unique positive effect on the intensive margin but detrimental effects on the extensive margin, this phenomenon stems from countries specializing in their export domains prior to entering into these trade agreements. It's important to notice that constrains in the public and private sector may diminish the effect of FTAs on export basket's diversification (Muñoz et al., 2021).

1 Trade facilitation policies refer to a specific set of measures that streamline and simplify the technical and legal procedures for products entering or leaving a country to be traded internationally.

Free Trade Agreements (FTAs) wield substantial influence on export product diversification through several pivotal channels. First and foremost, FTAs open up new market horizons by reducing or eliminating tariffs and trade barriers, encouraging exporters to broaden their product portfolio to suit the preferences of partner countries. Additionally, these agreements facilitate foreign direct investment, sparking technological transfers and skill acquisition that empower local industries to diversify their product offerings. The heightened competition in expanded markets prompts firms to identify and harness their comparative advantages, nudging them to diversify their product offerings accordingly. Knowledge and skills dissemination through collaboration and partnerships, driven by FTAs, further equip domestic producers to diversify and enhance the quality and variety of their export goods. Integration into global value chains, influenced by FTAs, can necessitate product diversification to align with specific stages of the value chain and cater to varied demands. Moreover, the policy reforms and structural adjustments triggered during FTA negotiations and implementation steer industries toward exploring and diversifying into new export products. In essence, FTAs act as catalysts, propelling export product diversification through the interconnected dynamics of market access, investment stimulation, competitive forces, knowledge exchange, supply chain integration, market insights, and policy evolution.

In conclusion, the extensive literature review on export diversification and its impact on economic growth and the reduction of instability provides compelling evidence of a positive relationship between the two, also FTAs are a trade facilitation policy that potentially help deconcentrating the basket of exported goods.

III.- Data and Methodology

The first step is to define what export diversification is, because the definition of export diversification used will lead the measures employed (Ali et al., 1991). Contrary to the widely accepted definition put forth by Dennis & Shepherd (2011) it is crucial to recognize that export diversification encompasses more than just a modification or alteration in the composition of the export basket. It is essential to acknowledge that a significant concentration of exports also constitutes a form of "change," albeit one that does not align with the notion of diversification. In this paper is defined as the increase of participation of merchandises with little proportion in the composition of exports, and also can be seen as the diminution of participation of more traditional exports; therefore, a country is deemed to have achieved export diversification when there is an observable increase in the number or variety of exported goods categories. A similar definition is to think about diversification as the transition from conventional goods to non-conventional ones (Samen, 2010).

An alternative methodology for assessing export diversification is provided in Appendix 1. This approach involves utilizing a dataset comprising the top 20 goods exported from Peru to a specific destination country. The analysis focuses on evaluating the degree of concentration within the export portfolio. Theoretically, a perfectly concentrated set would allocate 100% of the market share to a single item, while a perfectly diversified portfolio would distribute an equal 5% share to each of the top 20 items. This method offers a quantitative framework to measure the level of diversification achieved within Peru's export structure to the given destination country. It's insightful to understand this index as a distance measure of how far the set of exports is from the perfect diversification

portfolio. Please refer to Appendix 1 for further details and a comprehensive understanding of the applied methodology.

This research will seek to inquire if the commercial agreements had enabled a more diversified basket of exports. For this purpose, Peruvian exports to five Asia Pacific countries are studied utilizing monthly data spanning from June 2005 to December 2022. The primary variable of interest is a binary dummy variable, which takes a value of 1 during the periods following the date when the Free Trade Agreement (FTA) became effective, and 0 otherwise. Most studies use dummy variables to capture the effects of FTAs on trade creation and diversion (Thangavelu et al., 2021). As a simplifying assumption, it is conjectured that the utilization rates of the FTAs are significant. Table 1 presents a summary of the trade agreements that have been signed and the corresponding trade facilitation policies, the source is the Peruvian Ministry of Foreign Trade and Tourism. For simplification, these policies will be referred to as FTAs. Additionally, the displayed dates serve as input for the creation of a running variable that encompasses the months subsequent to the effective date of the agreement.

Table 1. Progress of Peru's FTAs with Asia Pacific

Partner	Title	Signed	Effective
China	Peru - China Free Trade Agreement	28-Apr-2009	01-Mar-2010
Japan	Economic Partnership Agreement between Peru and Japan	31-May-2011	01-Mar-2012
Singapore	Peru - Singapore Free Trade Agreement	29-May-2008	01-Aug-2009

South Korea	Peru - South Korea Free Trade Agreement	21-Mar-2011	01-Aug-2011
Thailand	Protocol between Peru and the Kingdom of Thailand to accelerate trade liberalization	18-Nov-2010	31-Dec-2011

Source: Ministerio de Comercio Exterior y Turismo (2022)

The analysis incorporates several control variables obtained from the Central Bank of Peru, including the annual variation of copper price, GDP, and Credit to Firms. These variables control for price variations on the exports, economic growth, and the level of financial development, respectively. Notably, cooper is the primary export commodity from Peru to the Asia Pacific (Vera, 2022), thus its price is used as approximation to the overall trend in export prices. Considering that the period of analysis encompasses the COVID-19 pandemic era, two dummy variables are included in the model. The first variable, referred to as the 'covid' variable, takes on a value of 1 for the time interval between March 2020 and July 2021 and 0 otherwise. The second variable, denoted as the 'post_covid' variable, captures the period of economic recovery and is assigned a value of 1 for the time span ranging from August 2021 to December 2022. This particular time interval was selected based on the initiation of a contractionary monetary policy by the Central Bank of Peru in July, which serves as a reliable proxy for the commencement of the Peruvian economy's recovery phase. A summary of the variables can be found in Table 2.

Table 2. Descriptive Statistics

Statistic		N	Mean	St. Dev.	Min	Max
Diversification Index	China	211	0.280	0.089	0.139	0.482
	Japan	211	0.334	0.085	0.148	0.546
	Korea	211	0.263	0.089	0.122	0.480
	Thai	211	0.394	0.105	0.194	0.612
	Singapore	211	0.259	0.084	0.133	0.532
FTA dummy variable	fta_Chn	211	0.730	0.445	0	1
	fta_Jpn	211	0.616	0.487	0	1
	fta_kor	211	0.649	0.478	0	1
	fta_tha	211	0.626	0.485	0	1
	fta_sgp	211	0.763	0.426	0	1
Control Variables	p_cobre	211	11.154	35.212	-58.086	147.337
	covid	211	0.081	0.273	0	1
	post_covid	211	0.081	0.273	0	1
	PBI	211	4.748	7.746	-39.060	59.329
	cred_emp	211	11.920	8.507	-1.361	38.578

Several graphs are presented, depicting scatter plots that provide an estimation of the relationship without considering control variables. These graphs serve as a reference point and aim to illustrate the main point of this research. For instance, the Figure 1 focuses on the Export Diversification Index specifically for Peruvian exports destined for China, with the cutoff point occurring when the Free Trade Agreement (FTA) came into effect in March 2010. Prior to the implementation of the FTA, it appears that Peruvian exports to China exhibited a tendency towards greater diversification. However, after the break point, the Index shows an increase, indicating that after the effectiveness of the FTA there was a concentration of exports, this finding is consistent with Fairlie Reinoso (2020). It is crucial to note that these findings can be subject to change

when control variables are incorporated. The observed increase in export concentration could potentially be attributed to various factors, including economic growth, price levels, and other influential variables. Consequently, evaluating the relationship between export diversification and trade agreements without incorporating appropriate control variables may lead to the introduction of an omitted variable bias.

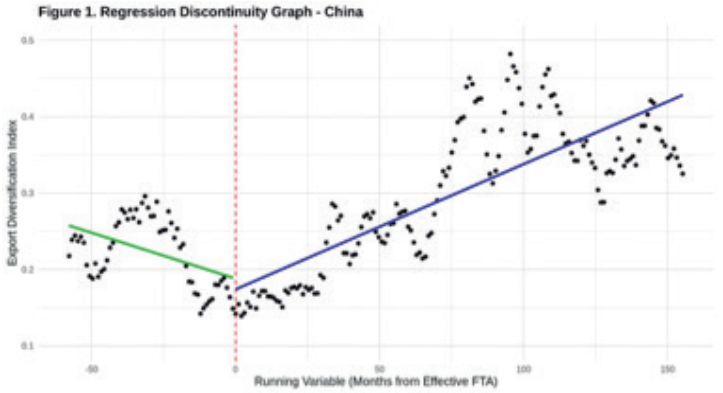


Figure 2 depicts the relationship between the export diversification index and the running variable, which represents the elapsed months since the signing of the Free Trade Agreement (FTA). The data displayed pertains specifically to the exports of Peru to Japan and reveals two distinct phases. In the pre-FTA phase, the concentration of Peruvian exports to Japan was increasing, as reflected by higher values on the export diversification index. In contrast, during the post-FTA phase, the scatter plot suggests a shift towards greater diversification in Peruvian exports to Japan after the FTA came into effect. The export diversification index decreases, indicating a reduction in export concentration and a move towards a more diversified export portfolio.

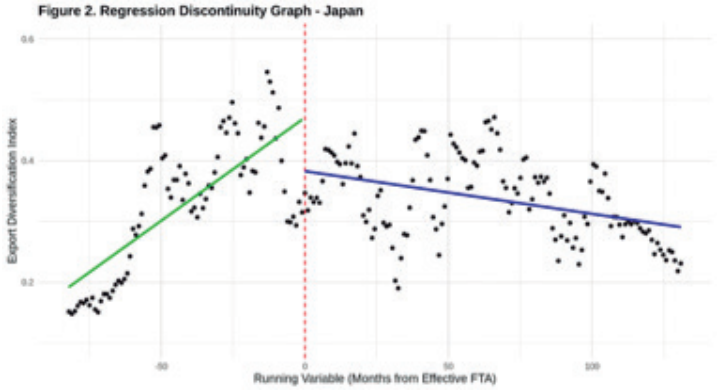


Figure 3 presents the diversification index of Peruvian exports to South Korea. Notably, an examination of the graph reveals a slight negative slope both before and after the cutoff point. However, the key observation from this exploratory graph is the occurrence of a clear discontinuity, this may represent a regime transition, indicating an immediate effect of the Free Trade Agreement (FTA) on export diversification. This suggests a regime change in the pattern of diversification following the implementation of the FTA.

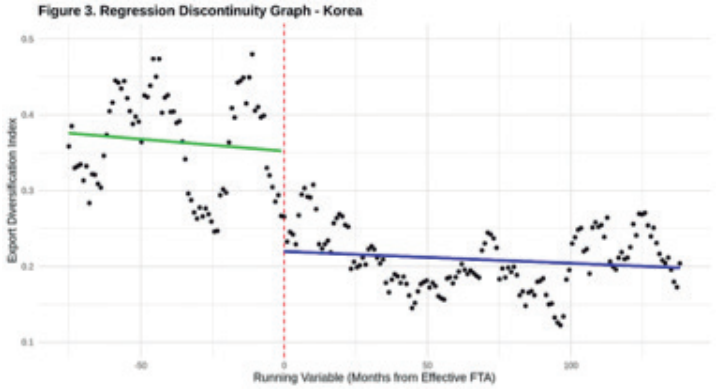


Figure 4 presents the relationship between the export diversification index and the running variable; the dataset pertains to Peruvian exports to Thailand and reveals two distinct phases. During the pre-FTA phase, the scatter plot displays a relatively constant pattern, indicating a consistent level of export diversification prior to the implementation of the FTA. In contrast, the post-FTA phase showcases a notable shift towards greater diversification in Peruvian exports to Thailand. Finally, Figure 5 reveals the lack of any discernible effect of the Free Trade Agreement (FTA) on the diversification of Peruvian exports to Singapore, in both pre and post FTA phases.

Figure 4. Regression Discontinuity Graph - Thailand

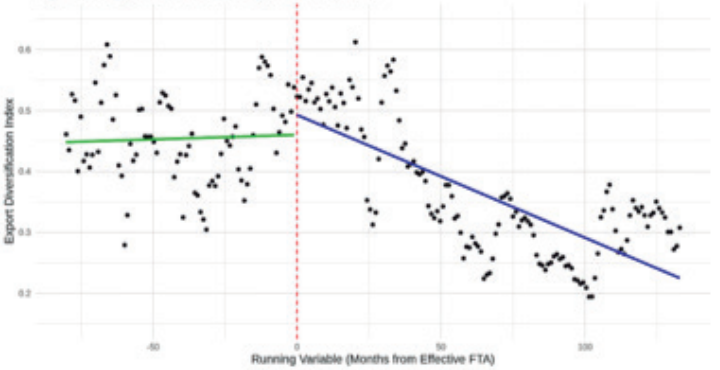
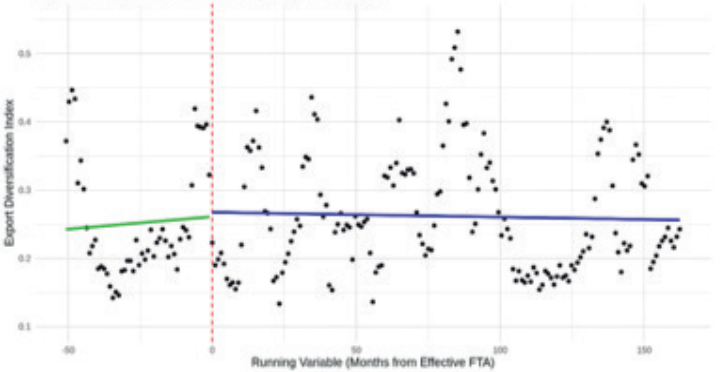


Figure 5. Regression Discontinuity Graph - Singapore



To accurately assess the impact of the Free Trade Agreement (FTA) on export diversification, it is crucial to account for various control variables. Export diversification is influenced not only by the signing of the FTA but also by macroeconomic and structural factors. Failure to consider these variables would introduce an omitted variable bias and potentially distort the true relationship between the FTA and export diversification. The following equations are estimated with OLS for each destination country of the Peruvian exports:

$$(1) \quad Div_{it} = \beta_{0i} + \beta_{1i}FTA_{it} + \alpha X_{it} + \varepsilon_{it}$$
$$(2) \quad Div_{it} = \beta_{0i} + \beta_{1i}FTA_{it} + \beta_{2i}Months_{it} + \alpha X_{it} + \varepsilon_{it}$$

Let Div_i is the diversification index by destination country, *FTA* is the free trade agreement dummy, and X_i signify a set of control variables. The second equation considers the months from Effective FTA. The explanation regarding these variables has been previously outlined in preceding pages. Both mathematical expressions incorporate the temporal dimension by utilizing monthly data covering the period from June 2005 to December 2022.

IV.- Empirical Results

In this section I discuss the results found when estimating equations (1) and (2) for the FTA with China, Japan, South Korea, Thailand, and Singapore. The significance of considering the distinct characteristics and impacts of each FTA when evaluating their influence on export diversification is underscored by the findings of Baier et al. (2019), this provides the rationale for estimating separate models for each country. The regressions presented in Table 3 provides key insights into the relationship between the independent variables and the

dependent variable, which is the export diversification index, for China, Japan, and Korea. Two equations are estimated per country, one including a running variable, which is comprises the months after the signing of the agreement, this considers the differential effect of a plausible lagged relationship. Regression 1 demonstrates a non-significant coefficient for the FTA, suggesting that it does not have a statistically significant impact on the export diversification of Peruvian items to China. Nevertheless, including the variable that months after the FTA became effective (Regression 2) it shows that the Peru-China FTA was concomitant to a diversification in the Peruvian exports, the coefficient related to the FTA is negative and statistically significant to one percent, this implies that during the regime characterized by the effective FTA, there was a reduction in export concentration by 0.053 units, as defined by the employed diversification index. This relationship holds true even after controlling for important factors such as cooper price, economic growth (GDP), financial development (credit to firms), and the influence of the COVID-19 pandemic. Regressions 3 and 4 summarizes the Peru-Japan FTA, in both equations the coefficient related to the FTA is significantly positive that suggests there was a concentration of exports when the FTA became effective, nevertheless when the running variable is included, the estimated coefficient associated with it turns out to be negative. This discovery suggests that with each passing month, the export basket becomes increasingly diversified. The Peru-Korea FTA is empirically assessed in regressions 5 and 6, in both estimations the FTA improved the diversification significantly, the effect was a reduction of the diversification index around 0,1. The running variable also exhibits a negative impact, although it is not statistically significant.

Table 4 shows the regressions for Thailand and Singapore. the FTA Peru-Thailand seems to have a lagged effect on diversification, the running variable is statistically significant at one percent, although the coefficient related to the FTA dummy indicates an increase in the concentration of exports in the period when the FTA is effective. In the case of Singapore, a similar pattern is observed, the coefficient related to the Free Trade Agreement (FTA) is not statistically significant; however, the coefficient of the running variable, is. Over time, Peruvian exports to Singapore gradually diversified, with the diversification index decreasing by 0.001 each month after the Free Trade Agreement came into effect.

In summary, the Free Trade Agreement (FTA) yielded two primary effects: general and lagged. The general effect of the FTA was observed in the case of Peruvian exports to China and Korea, whereby a greater variety of exported goods became available. On the other hand, the FTA signed with Japan, Thailand, and Singapore resulted in a gradual reduction in the concentration of exported items over time.

Table 3: Regression Results (1)

	Dependent variable:					
	China Diversification Index		**Japan Diversification Index**		**Korea Diversification Index**	
	(1)	(2)	(3)	(4)	(5)	(6)
Cooper price	-0.0003*	0.0001	0.0003	0.0003	0.001***	0.001***
	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)
GDP	0.0002	-0.0002	-0.001	-0.001	0.0001	0.0001
	(0.001)	(0.0005)	(0.001)	(0.001)	(0.0004)	(0.0004)
FTA China	0.021	-0.053***				
	(0.015)	(0.011)				
Months after FTA		0.002***				
		(0.0001)				

FTA Japan			0.071*** (0.018)	0.090*** (0.020)		
Months after FTA				-0.0005** (0.0002)		
FTA Korea					-0.101*** (0.010)	-0.100*** (0.011)
Months after FTA						-0.00002 (0.0001)
Credit to Firms	-0.005*** (0.001)	0.001 (0.001)	0.005*** (0.001)	0.004*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
Covid	0.081*** (0.021)	-0.083*** (0.018)	-0.070*** (0.025)	-0.041 (0.028)	-0.029** (0.013)	-0.027* (0.016)
Constant	0.319*** (0.018)	0.209*** (0.014)	0.237*** (0.022)	0.250*** (0.022)	0.282*** (0.012)	0.283*** (0.013)
Observations	211	211	211	211	211	211
R2	0.307	0.692	0.127	0.147	0.763	0.763
Adjusted R2	0.290	0.683	0.105	0.122	0.758	0.756
Residual Std. Error	0.075 (df = 205)	0.050 (df = 204)	0.081 (df = 205)	0.080 (df = 204)	0.044 (df = 205)	0.044 (df = 204)
F Statistic	18.158*** (df = 5; 205)	76.446*** (df = 6; 204)	5.945*** (df = 5;205)	5.844*** (df = 6;204)	132.255*** (df = 5; 205)	109.708*** (df = 6; 204)
Note:	*(p<0.10),		**(p<0.05)		***(p<0.01)	

Table 4: Regression Results (2)

	Dependent variable:			
	Thailand Diversification Index		**Singapore Diversification Index**	
	(1)	(2)	(3)	(4)
Cooper price	0.001*** (0.0002)	0.001*** (0.0002)	-0.001*** (0.0002)	-0.001*** (0.0002)
GDP	0.001 (0.001)	0.001 (0.001)	0.0003 (0.001)	0.001 (0.001)

FTA Thailand	0.004 (0.019)	0.084*** (0.017)		
Months after FTA		0.002*** (0.0001)		
FTA Singapore			-0.020 (0.017)	0.002 (0.018)
Months after FTA				-0.001*** (0.0002)
Credit to Firms	0.006*** (0.001)	0.003*** (0.001)	-0.002** (0.001)	-0.004*** (0.001)
Covid	-0.163*** (0.026)	-0.043* (0.024)	0.044* (0.023)	0.100*** (0.028)
Constant	0.324*** (0.023)	0.382*** (0.019)	0.298*** (0.021)	0.338*** (0.024)
Observations	211	211	211	211
R2	0.366	0.592	0.085	0.132
Adjusted R2	0.350	0.580	0.062	0.106
Residual Std. Error	0.085 (df = 205)	0.068 (df = 204)	0.082 (df = 205)	0.080 (df = 204)
F Statistic	23.634*** (df = 5; 205)	49.293*** (df = 6; 204)	3.799*** (df = 5; 205)	5.170*** (df = 6; 204)
Note:	*(p<0.10),	**(p<0.05)	***(p<0.01)	

Endogeneity, a potential issue in linear regression analysis, may manifest in two primary forms: omitted variable bias and simultaneity. The period under study may coincide with a surge in globalization, a phenomenon that could influence the variables of interest. Specifically, the intensification of globalization could stimulate an increase in the diversity of exported goods. Concurrently, this process could impact international relations among countries, potentially leading to the signing of Free Trade Agreements (FTAs). Thus, the

dynamics of globalization could introduce endogeneity into the model, necessitating careful consideration in the analysis. In order to deal with endogeneity, the dynamic Generalized Method of Moments (GMM) developed by Arellano & Bond (1991) has been employed. The dynamic GMM method utilizes internal instruments (i.e., lags of the explanatory variables) to address this issue. Specifically, Arellano-Bond uses a first difference to eliminate unobserved fixed effects that are constant over time, and then uses additional lags of the dependent variable as instruments for the lagged differences. This allows the dynamic GMM method to provide consistent estimates even in the presence of endogeneity (J. Li et al., 2021; Schultz et al., 2010).

Table 5: Regression Results (Dynamic Panel - GMM Estimation)

	Dependent variable:
	Diversification Index
Lag of Diversification Index	-0.213***
	(0.064)
FTA	-0.103***
	(0.027)
Observations	211
Note: *(p<0.10), **(p<0.05), ***(p<0.01)	

Table 5 presents the outcomes derived from the dynamic panel data analysis utilizing the Generalized Method of Moments (GMM) estimation technique, it is observed that both the Lag of Export Diversification Index and the Free Trade Agreement (FTA) dummy variable are significant at the one percent level. The Lag of Export Diversification Index has a coefficient of -0.213, indicating that a unit increase in the diversification index from the previous period is associated

with a 0.213 unit decrease in the current period's diversification index, holding all other variables constant. The FTA variable has a coefficient of -0.103, suggesting that the signing of a Free Trade Agreement is associated with a 0.103 unit decrease in the diversification index, holding all other variables constant, this suggests that periods following the signing of an FTA are characterized by a lower diversification index, implying a more diversified basket of exported goods.

V.- Conclusion

In conclusion, Free Trade Agreements (FTAs) are widely associated with fostering economic integration, characterized by increased flows of exports and imports. A body of literature argues that the signing of these agreements also influences export diversification. This assertion is of paramount importance as the productive stability of an economy is closely linked to reduced dependence on exports, which, in turn, affects economic growth. Building upon this theoretical foundation, the present study empirically addresses the following question: Does the signing of FTAs correlate with increased export diversification? Peru serves as a suitable example for analysis, given its status as an emerging economy that has experienced sustained growth in recent years and has initiated trade ties with countries in East Asia. Consequently, the FTAs between Peru and China, Japan, Korea, Thailand, and Singapore have been examined empirically. To accomplish this objective, a diversification index is formulated, in this new measurement values approaching 1 indicate a higher degree of concentration, while values approaching 0 signify closer proximity to a theoretically perfect diversified export basket containing 20 items.

(1) The empirical findings reveal a nuanced relationship between the Free Trade Agreement (FTA) between Peru and China and export diversification. Initially, when examining the Peru-China FTA in isolation, a counterintuitive pattern emerges, indicating a concentration of exports rather than the expected diversification. However, when employing a regression framework that incorporates relevant control variables, including copper price as a proxy for the general export price level, GDP, credit to firms, the influence of the COVID-19 pandemic, and a variable accounting for the temporal proximity to the FTA's signing, a statistically significant effect of the FTA on export diversification becomes evident. Consequently, the Peru-China FTA exhibits a positive association with export diversification, suggesting a favorable impact on expanding the range of exported goods. (2) The empirical findings unveil a multifaceted relationship between the Free Trade Agreement (FTA) between Peru and Japan and the diversification of exports. Initially, the empirical regression analysis controlling for relevant variables demonstrates an apparent association with export concentration. However, upon introducing a variable that captures the temporal dimension by accounting for the number of months elapsed since the FTA's inception, a nuanced pattern emerges. Notably, each successive month following the implementation of the FTA exhibits a statistically significant improvement in the diversification index. Consequently, the Peru-Japan FTA does not manifest an immediate effect akin to the China-Peru FTA; rather, it exhibits a discernible effect that becomes more pronounced over time, resulting in enhanced export diversification. (3) The effect of the Free Trade Agreement (FTA) signing on export diversification of Peruvian items to South Korea stands out prominently within the group of five economies under investigation. It is observed to be statistically significant when analyzed independently, controlling for relevant

variables, and accounting for the temporal dimension. The implementation of the Peru-Korea FTA yields an immediate effect, leading to enhanced export diversification. Moreover, as time progresses, the diversification of exported goods further improves, indicating a continued positive influence of the FTA on the expansion of export variety. (4) The effects of the Free Trade Agreements (FTAs) between Singapore and Thailand with Peru exhibit similar patterns in the context of export diversification. Contrary to an immediate impact, empirical evidence confirms that as time elapses, these FTAs lead to a reduction in the concentration of exported goods.

Furthermore, to address the issue of endogeneity, a dynamic panel data model is estimated using the Generalized Method of Moments (GMM) approach as proposed by Arellano and Bond. The findings from this estimation align with those obtained from the Ordinary Least Squares (OLS) linear regression models. In summary, the Free Trade Agreement (FTA) engendered two distinct effects: a general effect and a lagged effect. The general effect manifested in the context of Peruvian exports to China and Korea, wherein a broader range of exported goods became accessible. Conversely, the FTA concluded with Japan, Thailand, and Singapore fostered a progressive decline in the concentration of exported items as time elapsed.

Appendix 1: Diversification Index

Common measures of diversification are the Herfindahl - Hirschman Index (HHI), Gini Index, and Theil Index (Agosin et al., 2012; Da Ponte, 2021; Haini et al., 2023). For reasons elaborated upon in the subsequent discourse, I have chosen to reconsider the approach to constructing a diversity index.

Given certain N number of exported goods. Let's imagine a perfectly diversified basket, in this utopic situation the market share is 1/N. Then the distance from the real portfolio distribution to this chimeric basket, shall be the measure of economic diversification. The nearer the distance, the more diversified export portfolio. Then, we have a measure of distance:

$$d\left(R, \frac{1}{N}\right) = \sum_{i=1}^{N} \left(R_i - \frac{1}{N}\right)^2$$

Where i represents each exported good, R_i is the real share of the i-item relative to the total exported, and N is the number of exported goods as mentioned before. The special case of perfect dependency would be when the nation depends entirely on one exported good, as it follows:

$$\left(1 - \frac{1}{N}\right)^2 + (N-1)\left(0 - \frac{1}{N}\right)^2$$

$$\left(\frac{N-1}{N}\right)^2 + \frac{N-1}{N^2}$$

$$\frac{N^2 - 2N + 1 + N - 1}{N^2} \Longrightarrow 1 - \frac{1}{N}$$

Therefore, to standardize the index it's assumed that 1 would be the perfect dependency, also it should be clear that the closer to one, the least diversified portfolio. Finally, we have our main indicator of export diversification:

$$General\ Export\ Diversification\ Index = \frac{\sum_{i=1}^{N}\left(R_i - \frac{1}{N}\right)^2}{1 - \frac{1}{N}}$$

When N tends to infinity or is a sufficiently large number the index became a simple HHI, then for data with a great number of items the HHI should be used, because it's assumed that the imaginary perfectly diversified basket is when each item have a market share close to zero, but this situation could lead to potential bias if the used data have a small ranking, in this paper it's used a set of top 20 products, then the perfectly diversified basket market share for each item is 5% and not zero, that's why the index used her is:

$$Export\ Diversification\ Index = \frac{\sum_{i=1}^{N}\left(R_i - \frac{1}{20}\right)^2}{1 - \frac{1}{20}} = \frac{\sum_{i=1}^{N}(R_i - 0.05)^2}{0.95}$$

To eliminate the noise of the data, a 6-month moving average is used. That's the diversification index used in this empirical approach. Finally, in order to enhance the robustness of the findings, additional estimations are conducted using the Herfindahl-Hirschman Index (HHI) as the dependent variable. Importantly, the results remain statistically significant when compared to the regressions utilizing the diversification index employed in this study. This highlights the consistency and validity of the observed relationships.

Regression Results (Robust test with HHI)

	Dependent variable:				
	China Diversification Index	**Japan Diversification Index**	**Korea Diversification Index**	**Thailand Diversification Index**	**Singapore Diversification Index**
	(1)	(2)	(3)	(4)	(5)
Cooper price	0.0001	-0.0002	0.001***	0.001*	-0.001***
	(0.0002)	(0.0003)	(0.0003)	(0.0005)	(0.0004)

GDP	0.0004 (0.001)	-0.0001 (0.001)	-0.0003 (0.001)	0.001 (0.002)	0.001 (0.002)
FTA China	-0.040** (0.017)				
Months after FTA	0.002*** (0.0002)				
FTA Japan		0.052 (0.034)			
Months after FTA		-0.001* (0.0004)			
FTA Korea			-0.096*** (0.024)		
Months after FTA			-0.0002 (0.0002)		
FTA Thailand				0.084* (0.046)	
Months after FTA				-0.002*** (0.0005)	
FTA Singapore					0.020 (0.036)
Months after FTA					-0.0004 (0.0004)
Credit to Firms	-0.0001 (0.001)	0.002 (0.002)	0.002 (0.001)	0.003 (0.002)	-0.001 (0.002)
Covid	-0.068** (0.027)	0.005 (0.048)	-0.004 (0.034)	-0.027 (0.064)	0.076 (0.058)
Constant	0.254*** (0.021)	0.342*** (0.038)	0.339*** (0.028)	0.391*** (0.052)	0.308*** (0.049)
Observations	211	211	211	211	211
R2	0.458	0.037	0.371	0.161	0.037
Adjusted R2	0.442	0.009	0.352	0.136	0.008

Residual Std. Error (df = 204)	0.076	0.136	0.097	0.183	0.166
F Statistic (df = 6; 204)	28.679***	1.309	20.039***	6.508***	1.291
Note:	*(p<0.10),		**(p<0.05)		***(p<0.01)

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