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An Empirical Study on the Relationship Between the Financial Derivatives Markets and Economic Development: The Case of North America, Europe, Asia and Pacific

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Abstract — *This paper investigates the relationship between derivatives markets and economic growth in three representative regions of the world, including North America, Europe and Asia Pacific, with data updated up to 2023. The study presents several findings including a cointegration relationship and assesses the impact between derivatives growth and per capita economic growth. The authors use DOLS and FMOLS models and Granger causality tests to measure the reciprocal effects between variables. These new findings are essential for policy makers in relevant regions and countries to consider regarding the development of their derivatives markets.*

Keywords — *Derivatives markets, economic growth, causality, DOLS, FMOLS.*

I. INTRODUCTION

Derivatives are a general term for financial instruments whose value depends on the value of one or more underlying assets. The underlying assets of derivatives can be stocks, stock indices, debt securities, foreign currencies, gold, investment portfolios or bankruptcy risks, etc. The derivatives market is where derivatives trading activities take place. In essence, the derivatives market is a place where participants can use derivatives to hedge risks in trading and seek profits. In the world, derivatives have become a popular tool and play an important role in the financial market in general.

Derivative financial instruments have a long history of development, starting in the 80s of the 20th century and it marks the development of the financial innovation trend. According to Setty & Dodd (2003), a derivative contract is understood as a financial contract whose value is linked to the price of a commodity, raw material, asset, exchange rate, index, event or scale of the event stated in the contract. According to Downes & Goodman (2010), a derivative financial instrument is a contract whose value depends on the performance of an original financial asset, an index or other investment instruments. According to the US Financial Accounting Standard No. 133 on Derivative Financial Instruments and Risk Hedging, a derivative financial instrument has one or more underlying assets and one or more capital amounts combined together into a block. According to International Accounting Standard No. 39 - Measurement and recognition of financial instruments, derivative financial instruments are considered as contracts whose value changes according to changes in market factors (underlying assets). Derivative financial instruments have low or almost zero initial investment and the derivative financial instruments are settled at a future date.

Based on different criteria, derivative financial instruments are divided into specific types. Classified according to the characteristics and nature of derivative contracts, including: forward contracts, futures contracts, swap contracts and options contracts. Classified according to the payment method, derivative financial instruments include: derivative financial instruments that transfer the derivative principal and derivative financial instruments that do not transfer the derivative principal. Classified according to the reference asset, including: interest rate derivative financial instruments, currency derivative financial instruments, commodity derivative financial instruments, and securities derivative financial instruments. Finally, classify derivative financial instruments according to their intended use, including hedging derivative financial instruments and trading derivative financial instruments.

Research on derivatives markets in countries around the world is very rich and diverse, including both qualitative research as well as using various quantitative methods. This shows the deep interest of researchers, investors as well as policy makers in this very important financial instrument.

Baluch and Ariff (2007) showed that some factors including liquidity, fixed physical capital formation and cash market in which the derivatives market has an impact on economic growth. The derivatives market not only acts as an information provider for investors, helping them determine the appropriate way to control the spot market effectively but also reacts more positively and quickly than the underlying cash market.

Lien and Zhang (2008) summarized the role and function of derivatives markets in emerging economies, both in theoretical and empirical studies. Accordingly, derivatives markets provide an effective mechanism to facilitate price risk sharing for commodities traded in the market, helping producers cope with price fluctuations. Furthermore, it is widely accepted that derivatives markets act as a channel for risk reduction and redistribution, a means of price discovery and price stabilization. Different derivatives seem to suit the risk

preferences of different agents. Derivatives markets are expected to increase the flow of information in the market. Future price information is more likely to reflect future demand, thereby influencing production and storage decisions and ultimately reducing the volatility of spot prices.

Haiss and Sammer (2010) studied the role of derivatives in the relationship between finance and growth through three channels: volume, efficiency, and risk. The results showed that the development of the derivatives market affects the financial market and economic growth by increasing capital accumulation. The efficient channel is beneficial for business, financial institutions, and governments to have greater integration between financial resources. with lower costs. In addition, the risk channel related to the negative impact of derivatives market development on the financial market and economic growth.

II. Overview of the Derivatives Markets

A derivative is defined as an asset whose value is derived from the value of the underlying assets. In the current world the derivative products are traded on organized exchanges or in over-the-counter (OTC) market, where deals are contracted over the telephone or through electronic media (Hammada 2024).

In 2023, the total volume of exchange-traded derivatives contracts, encompassing both futures and options, reached 134.4 billion. A substantial portion of this total was attributed to equity derivatives, which comprised 103 billion contracts. Commodity derivatives followed, with 11.2 billion contracts traded (see Figure 1, source: Statista)

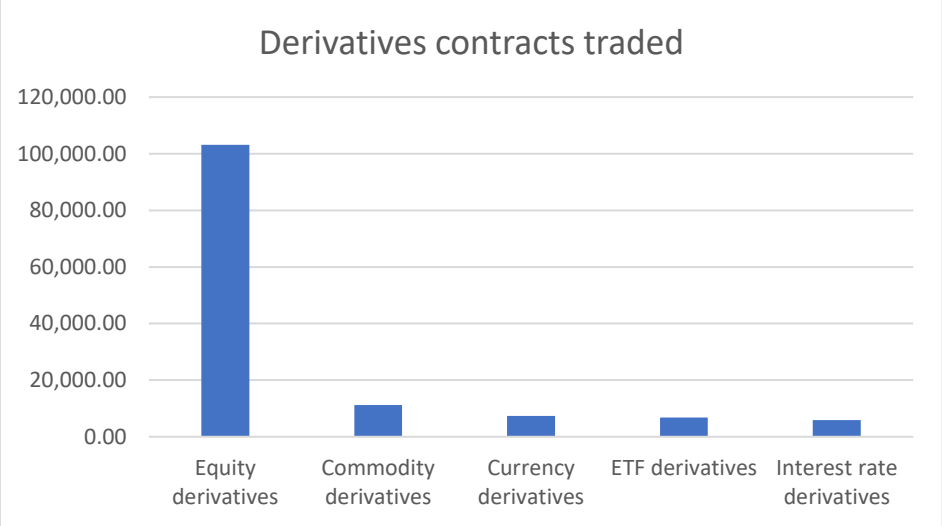

Figure 1. Volume of ETD contracts all over the world 2023

Source: Prepared by the researchers based on Statista

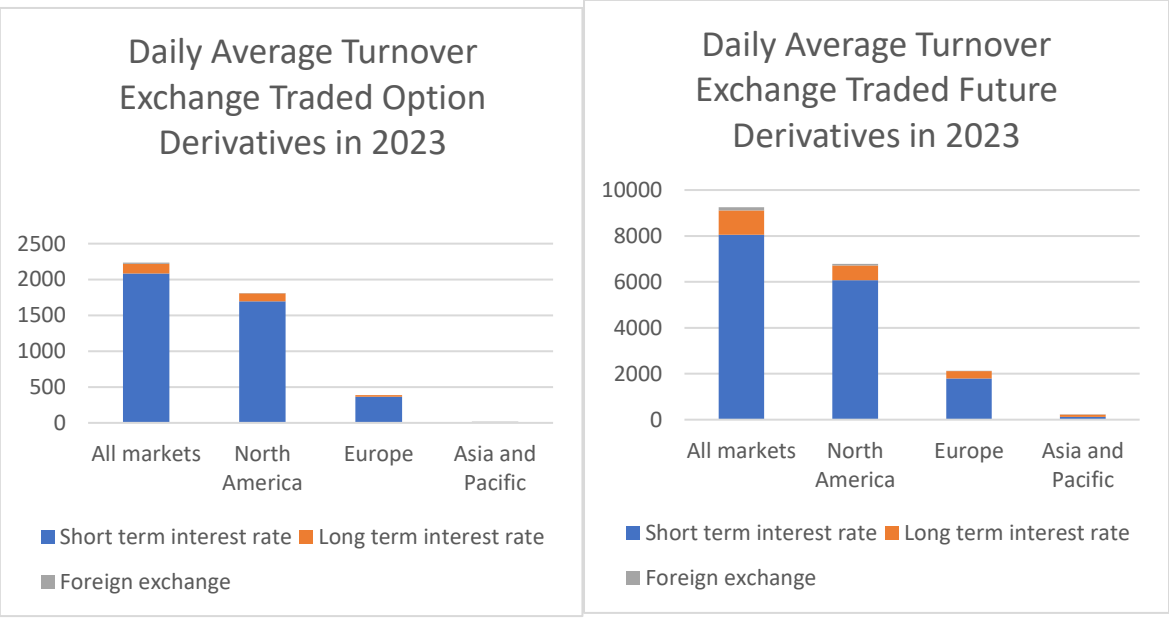

Figure 2: Daily average turnover ETD derivatives in year 2023

Source: Prepared by the researchers based on BIS

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According to the Bank for International Settlements (BIS) report, the value of outstanding derivatives in notional amounts grew by 8% overall in 2023. Amounts increased by 15% during the first half of the year and decreased by 6% in the latter half, showing a seasonal saw-tooth pattern noticeable since at least 2016. Interest rate derivatives, which grew by 8% year over year, drove overall growth in 2023 (up 17% in the first half and down 8% in the second). Outstanding FX derivatives (notional amounts) likewise grew in 2023, expanding by 10% in the first half yet falling by 0. 4% in the second half. The proportion of centrally cleared credit default swaps, which had continuously increased over the past decade, fell from 70% at the end of June to 65% at the end of December 2023. Figure 2 shows the daily average turnover ETD includes Option and Future derivatives in year 2023.

III. Data Sources and Methodology

The data utilized in this study were obtained from the International Monetary Fund (IMF) and the Bank for International Settlements (BIS). The GDP per capita (GDPPC) and inflation rate were sourced from IMF statistics, while the volume of exchange-traded derivatives was derived from the BIS database. In this study, the variable GDP stands for the growth rate of GDP per capita, the DER is for exchange-traded derivatives growth rate, INF is for the inflation rate and GP is the gold price rate year over year. This analysis focuses on a sample representing three major global economic regions: North America (NAC), Europe (EMU), and Asia-Pacific (EAS). The observation period spans 34 years, from 1990 to 2023, which enables the examination of the long-term dynamics of derivatives market development.

We address the impact of derivatives markets on economic growth in three regions using dynamic ordinary least squares (DOLS) and fully adjusted ordinary least squares (FMOLS). Furthermore, we approach the causal relationship between derivatives markets, macroeconomic variables, and economic growth, as well as growth volatility by applying causality tests. Finally, based on our results, we provide policy implications for regions on their path to developing derivatives markets, in order to contribute to promoting economic growth.

IV. Results

4.1. Descriptive statistics

Table 1 shows the variables used in this research as well as their averages, standard deviations, and maximum and minimum levels.

TABLE 1. Descriptive statistics result

Variable	N	Mean	Std. Dev.	Min	Max
INF	102	2.927	1.512	0.587	7.172
GDP	102	2.196	2.185	-6.176	6.856
DER	102	0.100	0.253	-0.317	0.929
GP	102	0.056	0.126	-0.155	0.359
	North America				
INF	34	2.400	1.300	0.620	7.100
GDP	34	1.500	1.800	-3.500	5.800
DER	34	0.140	0.250	-0.300	0.920
GP	34	0.056	0.130	-0.150	0.360
	Europe				
INF	34	2.800	1.600	0.590	6.300
GDP	34	1.300	2.200	-6.200	6.300
DER	34	0.140	0.240	-0.300	0.790
GP	34	0.056	0.130	-0.150	0.360
	Asia and Pacific				
INF	34	3.600	1.500	1.300	7.200
GDP	34	3.800	1.600	-0.670	6.900
DER	34	0.021	0.250	-0.320	0.930
GP	34	0.056	0.130	-0.150	0.360

Source: The authors' calculation.

From this table, the GDP per capita growth rate ranges from -6.176 to 6.856 with a mean of 2.196 and a standard deviation of 2.185, the derivatives growth rate has a minimum value of -0.317 and a maximum of 0.929, with an average value of 0.1 and a standard deviation of 0.253.

Figure 3 and Figure 4 show the boxplot on GDP per capita growth rate and Derivatives growth rate across three areas. The results indicate that the values of the variables are unevenly distributed across regions, with the Asia-Pacific region experiencing slower growth in the derivatives market compared to the other two regions.

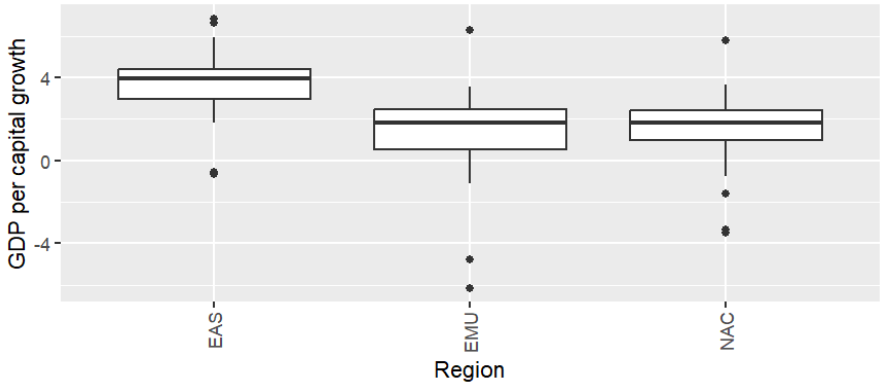

Figure 3. Box plot on GDP per capita growth rate across three areas

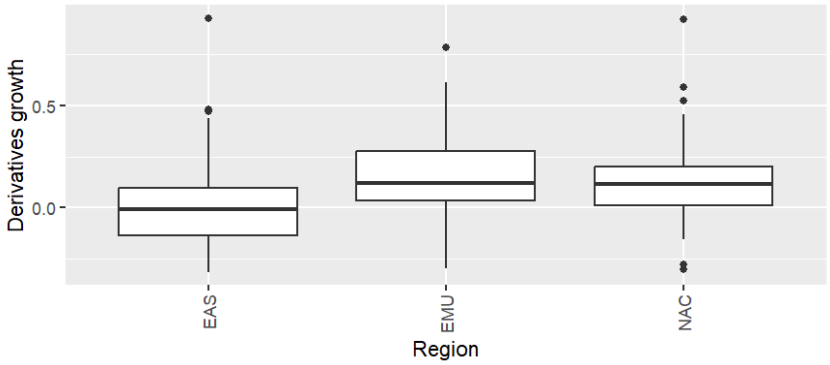

Figure 4. Box plot on Derivatives growth rate across three areas

Source: The authors' calculation

Figure 5. The trend on GDP per capita growth across regions from 1990-2023

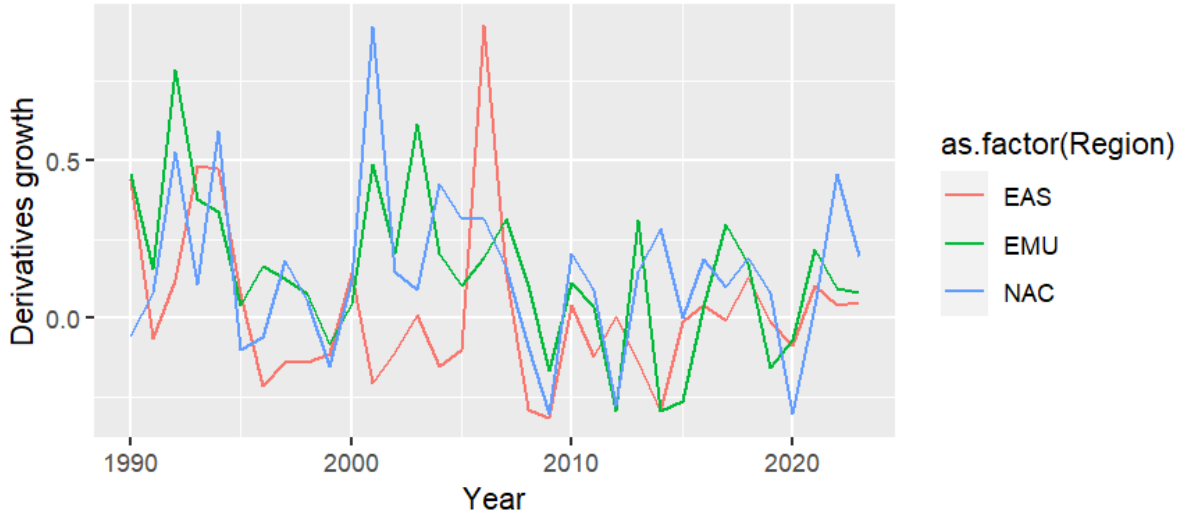

Figure 6. The trend on derivatives growth across regions from 1990-2023

Source: The authors' calculation

Figure 5 and Figure 6 show trend on GDP per capita growth rate and Derivatives growth rate across three areas over the period 1990 to 2023. The results show that the trends fluctuate unevenly over the years and there are quite large differences between regions.

4.2. Unit Root tests and cointegration tests

For panel data, before testing stationarity, the authors tested the cross-sectional dependence between variables in the model. Using Pesaran's CD test function, the p-value is less than 0.1%, indicating that the collected data has cross-sectional dependence. After that, testing stationarity when working with panel data is one of the indispensable requirements to avoid misleading results when applying least squares methods. In fact, quantitative studies use a number of different methods to test the usability of data, such as Levin & Lin (1992) assuming that the panel data is balanced and the ratio N/T (number of observations/number of years) approaches 0. Haris & Tzavalis (1999) and Im et al (2003) rely on a stationary approach to the time series. There are also many other methods mentioned in the studies of Breitung & Meyer (1994), Choi (1999), Baltagi & Kao (2001).

For the collected data, due to the existence of cross-sectional dependence, the authors will use the second-generation stationarity test CIPS test (Pesaran, 2007) for each variable. The results show that the data satisfy the stationarity conditions at I(1) with p-values less than 0.01. Regarding the cointegration test, the authors continue to perform the cointegration test according to Engle-Granger with the coint.test function in the aTSA package on R software.

4.3. Regression Result

Given the presence of cointegration between derivatives, inflation rates, and economic growth across regions, we further analyze their long-run relationship using two long-run estimates, DOLS and FMOLS, and present the results in Table 2. First, in addition to revealing a significant positive impact of inflation rates on economic growth in the long run, the two approaches show different results on the impact of derivatives markets on economic growth. In detail, DOLS method indicates that the derivatives markets have negative impact to the volatility of the economic growth, while in FMOLS method, we do not find the relationship between the two variables.

Our study provides additional evidence supporting both theoretical and empirical conclusions about the long-term relationship between financial market development and economic growth (Ang 2008; Beck et al. 2000; Levine 2005; Levine et al. 2000). In particular, our findings seem to contradict the theory of Baluch and Ariff (2007), who emphasize the role of derivatives market liquidity in promoting economic growth.

For the next step, we performed Granger causality tests to detect any causal relationship between the variables. Table 3 reports the results regarding the causal relationship between the variables in the model. We found no causal relationship between economic growth and derivatives markets in all three regions. Meanwhile, a unidirectional effect of inflation rate on economic growth was found in both NAC and EMU and the effect of inflation rate on derivative markets was recognized in EAS.

Our findings regarding the causal relationship are quite different from recent studies. Vo et al. (2019) showed a bidirectional Granger causality relationship between derivatives markets and international economic growth using panel vector regression method, while Sendeniz-Yüncü et al. (2018) illustrated a unidirectional causal relationship in high-income countries from economic growth to the development of futures markets.

TABLE 2. Long-run impact of the derivatives markets on economic growth

	DOLS				FMOLS			
	Estimate	Std.Err	t.value	p.value	Estimate	Std.Err	t.value	p.value
INF	0.9681	0.1167	8.2954	0.0000***	0.7754	0.0961	8.0684	0.0000***
DER	-5.3443	2.0180	-2.6483	0.0094***	-0.9802	1.0950	-0.8951	0.3729
GP	-0.4954	2.8685	-0.1727	0.8632	-1.2772	2.1062	-0.6064	0.5457

*Notes: ***, **, * denote significance at the level of 1%, 5%, and 10%, respectively*
Source: The authors' calculation

TABLE 3. Causality tests results

Null Hypothesis	NAC	EMU	EAS
Derivatives growth does not Granger-cause GDP growth	0.4057	1.5851	0.1429
GDP growth does not Granger-cause Derivatives growth	0.2314	0.2789	0.9356
Inflation rate does not Granger-cause GDP Growth	2.4568*	4.6913*	1.4939
Inflation rate does not Granger-cause Derivatives growth	0.4994	0.6435	2.7151*
Gold price growth does not Granger-cause GDP growth	0.0727	0.0465	0.1491
Gold price does not Granger-cause Derivatives growth	1.6701	0.5682	0.3097

*Notes: ***, **, * denote significance at the level of 1%, 5%, and 10%, respectively*
Source: The authors' calculation

V. CONCLUSION

The overall objective of this study is to examine the relationship between exchange-traded derivative instruments and economic growth across three regions: North America, Europe, and Asia-Pacific from 1990 to 2023. The study uses GDP per capita as a measure of economic growth, while the growth in the volume of exchange-traded derivatives is used as the independent variable. Inflation rates and gold price growth are included in the model as control variables. We performed unit root tests and cointegration tests on the data and found that there was a cointegration relationship between the time series data. From there, the authors used two models DOLS and FMOLS to further analyze the relationship between the variables in the model. The data analysis results indicated that inflation affects economic growth in both two models, but the impact of derivatives markets on economic growth has statistically significant in the DOLS model. The study also

conducted a Granger causality test to examine the causal relationships among the variables in the model. However, no statistically significant causality relationship between derivative markets and economic growth was found. The research results support both the findings of previous studies presented in this work, as well as theoretical contributions suggesting the impact of financial derivative markets on economic growth by promoting capital accumulation, encouraging investment through diversification, and their role as risk-hedging tools.

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