THE DERIVATIVES MARKET AND ECONOMIC DEVELOPMENT: ANALYSIS OF FIVE SIGNIFICANT ECONOMIES

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Abstract

Over the past three decades, the importance of the derivatives market within the financial market has been widely recognized. This paper investigates the relationship between the derivatives market and economic development in five significant economies, namely, Japan, China, India, the United States, and Eurozone. A panel fixed-effects model is used with data for the period of 2013 to 2018. The main empirical finding is that the derivatives market is positively associated with economic development, meaning that a 1 percent increase in derivatives market relates to a 0.10 percent increase in GDP. A growth path for GDP for the next five years for each country is projected, which may give an idea of how GDP will grow if the derivatives market goes up as provided by the moving average estimates. The paper concludes with recommendations that may help regulate the derivatives market efficiently and lead to economic development.

Keywords: derivatives market; economic development; five significant economies; panel fixed-effects model.

Acknowledgements

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List of Abbreviations

APR - Asia-Pacific Region

BIS – Bank for International Settlements

CDS – Credit Default Swaps

CME - Chicago Mercantile Exchange

EEU – European Economic Union

EMIR - European market infrastructure regulation

FDI – Foreign Direct Investment

GDP – Gross Domestic Product

IFS - International Financial Statistics

IMF - International Monetary Fund

IRF - Impulse Response Function

LTCM - Long-Term Capital Management Investment Fund

LSE – London Stock Exchange

OTC – Over-the-counter

S.E. – Standard Error

VAR – Vector Autoregression

VECM - Vector Error Correction Model

WB – World Bank

Chapter 1: Introduction

The derivatives market is one of the fastest growing segments of the financial market and the economy. It plays a crucial role in a financial system and vastly contributes to various aspects of an economy as a whole. First, the active mechanism of derivatives market facilitates the price risks' sharing for commodities traded on the market via helping players deal with price volatility. They offer smooth hedging and risk management by enhancing capital inflows in economies (Vo, Huynh, and Ha, 2019). Second, the derivatives market tends to serve as a channel of risk reduction and redistribution and a price stabilizer (Mai, 2018). In various studies, derivatives were discussed to analyze its relation to the economy. Most of the contemporary studies illustrate a link between the development of the derivatives market, the financial system, and economic growth (Komarov, 2007).

The derivatives market, as a direct part of the financial sector, is quite sensitive to changes in the economic situation but has significant resources and potential also to influence it. Komarov (2007) argues that the growing number of speculations in the market of structural derivatives, namely, credit default swaps (CDS), was one of the causes of a financial and economic crisis that began in 2007. The consequences of this crisis led to an inevitable transformation of the derivatives market, which manifests itself in the form of features of the development and establishment of "new" trade centers, as well as their modernization in the global economy (Till, 2014).

In a modern economy, the structure of the global financial market is a combination of such markets as foreign exchange, stock market, credit, derivatives market, insurance services, and direct investment.

In this research, the global market for derivatives or derivative financial instruments are considered. Since the beginning of the 70s of the 20th century after the liberalization of the

global financial system and the transition to floating exchange rates, this market began to develop at an unusually rapid pace. Being previously exclusively exchange-traded, the derivatives market is currently growing in two forms - exchange-traded and over-the-counter (OTC). Moreover, competition between the exchange and over-the-counter (OTC) sectors served as an additional incentive to develop the derivatives market. After all, the creation, along with the standard exchange contracts market of OTC contracts with specific conditions, has significantly expanded the possibilities of market participants and financial managers for risk insurance (Till, 2014).

The development of the derivatives market is primarily determined by the ongoing changes in the underlying asset markets, a change in their relative role. Thus, a twenty-fold increase in trading volume in the stock market over the past ten years has entailed an equally rapid development of the market for standard contracts for shares and stock indices (Fink, Haiss and Hristoforova, 2006).

Today, the volume of the derivatives market has reached unprecedented levels. According to Mark Mobius, at present, the value of derivatives in the world market exceeds the volume of world GDP by at least ten times (Mobius, 2020). This significant difference between the volume of derivatives market and GDP can be explained by the fact that financial markets usually have "the winners keep winning" strategy, where key large-cap companies grow in a unidirectional way. Schwarcz (2020) argues that this market continues to grow, where a vast number of transactions are made on it, and it is challenging to oversee due to the sheer volume, thus creating volatility on stock exchanges.

To explain these relationships, the basics of the functioning of the derivatives market is considered. In financial markets, a derivative is an instrument whose value is derived from the value of an underlying asset, which can be commodities, precious metals, currency, bonds, stocks, stocks indices, etc. (Singal, 2020). The most common types of derivatives are options

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(giving the holder the right to sell or buy a particular asset or underlying instrument), swaps (agreements on the exchange of financial instruments for a while), futures (contracts for the future delivery of assets at an agreed price) and forwards (mainly over-the-counter contracts) for the future supply of assets at an agreed price), as well as their combinations.

It is important to note that the derivatives exchange on which derivatives are traded is a pricing center for many assets, as well as a mechanism to redistribute a variety of financial risks between participants in this market. Moreover, derivatives trading is a convenient way for players to both obtain speculative profits and various hedge types of hazards. Therefore, derivatives are so prevalent in developed countries, where the volume of the derivatives market significantly exceeds the turnover of the spot market.

Today, according to the Bank for International Settlements (BIS), the derivatives market is worth about 700 trillion dollars, while global GDP does not exceed 84 trillion dollars. In 2018, the number of transactions with derivatives increased by more than a quarter. So, in the world, 30.1 billion contracts were processed over the year; among them, 13.2 billion options and 16.9 billion futures. The total volume traded was up 225% as compared to 2005, which showed an average growth rate of 10.1% over the last thirteen years.

Figure 1. The dynamics of exchange-traded derivatives traded on organized exchanges, by location 2010-2018
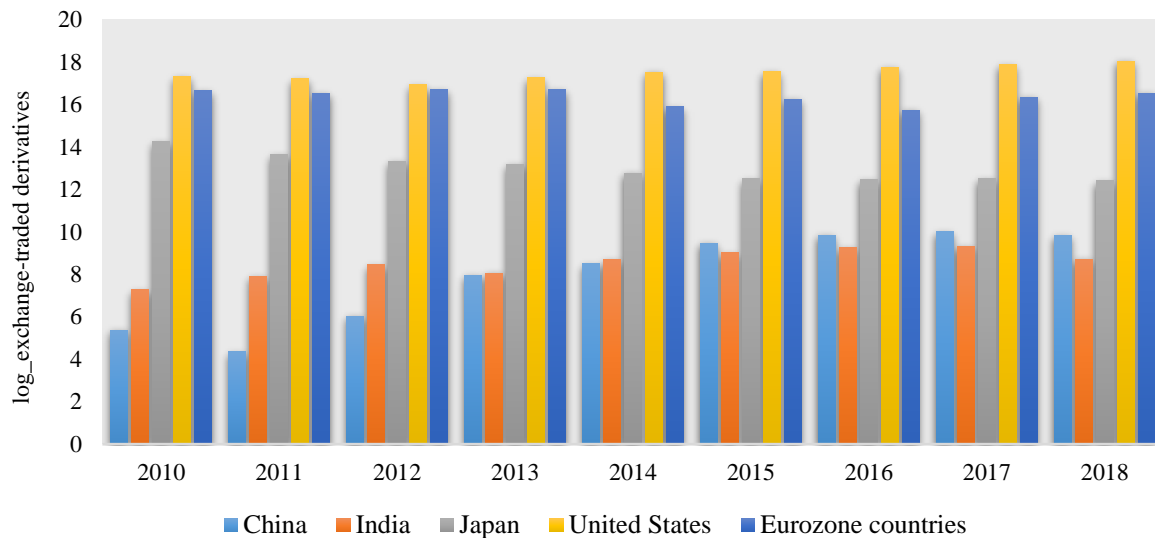
Source: Bank for International Settlements (BIS) data

In this indicator, futures and options overtook stock trading and most other classes of assets. This exchange sector has returned to growth after the global financial crisis, which had slowed its development for two years. Moreover, the world's largest exchange in terms of the number of transactions in the derivatives market was the Korean Exchange, which processed 3.8 billion contracts over the year, mainly due to the large structure in the Asia-Pacific region (APR). The main share fell on options for the Kospi 200 index.

It is important to note that at present, about 85% of the global derivatives trade falls on the OTC market, and only 15% on the exchange. Moreover, the OTC market accounts for 70-80% of fixed-term contracts for interest-bearing instruments, among which more than 75% are interest-rate swaps. On the exchange market, about 90% of trade falls on interest-bearing derivatives (**Figure 2**) (WFE IOMA Derivatives Report, 2018).

Figure 2. Breakdown of exchange-traded derivatives by products and regions (2018)

Breakdown by products in 2018 — Options, 44%; Futures, 56%

Breakdown by regions in 2018 — Americas 44%; Asia-Pacific 37%; EMEA 19%
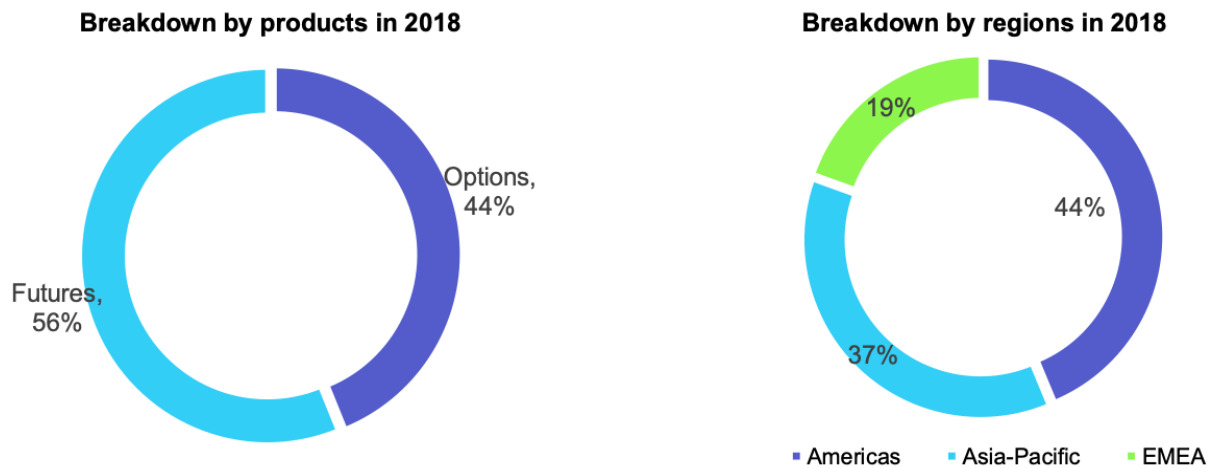
Source: World Federation of Exchanges (2018)

It is worth noting one more critical point: as a result of increased competition, there is a global consolidation of exchanges, including derivatives. The world has begun a new stage in the evolution of stock exchanges towards their incorporation, and this will undoubtedly facilitate the work of international investors. So, according to Bloomberg agency, from January 2000 to December 2010, mergers and acquisitions of exchanges were concluded totaling at least $98.5 billion around the world (Switzer and Shan, 2014).

In the global economy, the derivatives market has essential functions. Firstly, it allows entrepreneurs to coordinate their plans to plan the production process. After all, the conclusion of a fixed-term contract guarantees the sale or purchase of goods in the future. Secondly, it makes it possible to hedge price risks, because the price of future settlements is fixed in the contract, and this allows counterparties not to depend on market conditions that will develop by the time the contract expires. Thirdly, it helps to predict trends in the development of market conditions, since prices that are formed on the derivatives market with a certain probability reflect the expectations of market participants regarding the direction of the future movement of the economy. Therefore, an idea of the next economic prospects can be made today (Guay and Kothari, 2003).

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Figure 3 below depicts the relationship between the exchange-traded derivatives with GDP in the United States, the Eurozone countries, Japan, China, and India from 2003 to 2018.

Figure 3. Relationship between exchange-traded derivatives markets with GDP in the US, EU, Japan, China, and India (2003-2018)
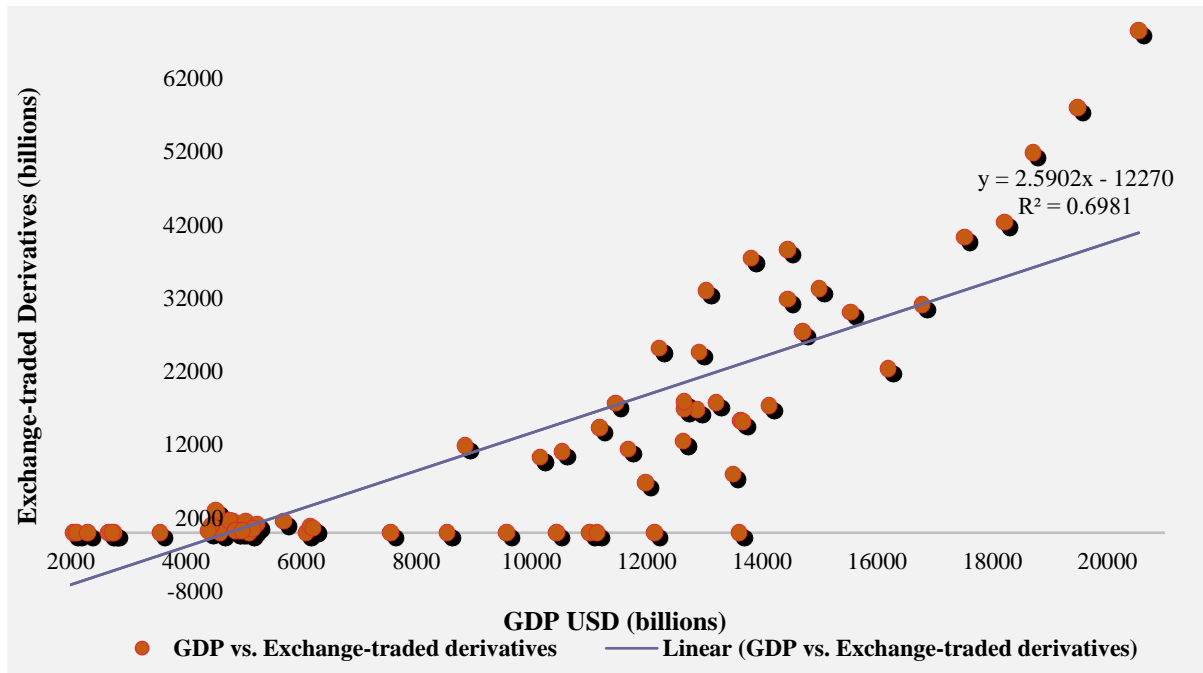
Source: Author's computation based on data from World Bank and BIS

A characteristic feature of the derivatives market is high potential profits, which can reach several thousand percents per year. However, it may generate tremendous losses. For instance, in February 1995, the English investment bank Barings Bank with 233 years of history was declared bankrupt, because a trader in the Singapore branch of the bank lost about 1.3 billion dollars on futures and options contracts on the Nikkei 225 index. And in 2006, the American hedge fund Amaranth Advisors lost more than $6.2 billion on natural gas futures contracts.

Another example is the Long-Term Capital Management Investment Fund (LTCM), founded in 1993 and carried out operations with interest rate swaps, betting on the change in asset returns between different markets. Interestingly, its managers included Robert Merton and Myron Scholes, who in 1997 received Nobel Prize in Economics for research on the technique of insurance of financial risks. The fund, whose net worth was about $5 billion, concluded

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futures contracts for more than 1.25 trillion. dollars. In 1995-1996, the fund's return on operations exceeded 40%, but in just a few months of 1998, LTCM lost more than $4 billion and was accused of creating a severe threat to the security of the global financial system (Haiss and Sammer, 2010).

Today, there is a strong argument that derivatives financial instruments, which have become the principal mechanism of the shadow banking system in recent years, should be strictly regulated. Now, authorities are limited to statements about the need for transparent reforms that could ensure that such products are traded only on exchanges. It is worth mentioning that the Dodd-Frank Act addresses certain perceived flaws in the over-the-counter (OTC) derivatives markets that may prevent another crisis. The primary goals under the act are to create transparency in the derivatives market, minimize the systematic risk of derivatives trading and prohibit entities holding customer deposits from engaging in speculative derivatives activity (Dodd-Frank Act Rulemaking: Derivatives, 2015).

This paper discusses the relationship between the development of the derivatives market, economic growth, and other macroeconomic variables such as trade, domestic credit, central bank assets, unemployment, and inflation. We consider the world's major economies: China, Japan, India, the Eurozone, and the United States. This study is a contribution to the literature by focusing on the economies mentioned above, which have sound and mature derivatives market. We examine how the derivatives and macroeconomic variables relate to the economy, expressed as Gross Domestic Product (GDP) of each economy using econometric panel techniques that offer an analytical approach suitable for the available data. Long panel data consisting of the sample of 5 significant economies and 16 years as the time period is analyzed using the fixed-effects model. The fixed-effects model is applied to capture any unobserved country-specific effects in the series. The analysis indicates that the derivatives markets, namely, exchange-traded derivatives, are positively correlated to the GDP of the analyzed

economies. The empirical findings that were carried out in this paper are a contribution to the literature that was done before.

The paper is organized as follows: Introduction; Chapter 1 reviews the relevant literature in theoretical and empirical studies. Chapter 2 offers an overview of the data used in the paper. Then, in Chapter 3, we introduce the methodology, and in Chapter 4, we employ econometric techniques to explain our empirical findings. In the end, based on results, I draw some conclusions and offer policy implications.

Chapter 2: Literature Review

The provision that the level of development of the financial system and the growth rate of the economy is interconnected and interdependent seems obvious. Meanwhile, the question of the nature and direction of this connection is not so clear. Researchers, back in the first half of the 20th century, having revealed a causal relationship between the processes under consideration, did not come to a consensus: finance follows production (Robinson, 2009) or, on the contrary, a high level of development of financial systems is the key to rapid economic growth (Schumpeter, 2007). In the second half of the 20th century, the problems of the relationship between financial structures and economic growth were addressed by Gerschenkron (1962), Cameron (1967), Chandler (1966), who focused on the features of financing economic development or the dominant forms of organization of the financial system. Empirical studies conducted by World Bank experts have confirmed the steady causal nature of indicators for the development of the financial system and long-term rates of economic growth under various institutional conditions; the channel of such a positive effect is increased investment and an increase in the overall productivity of factors of production (Demirgüç-Kunt and Levine, 2008).

Today, when comprehending the need to form a new model of economic development, this problem acquires a unique sound. The current stage, as never before, is characterized by increased conjugation of the quality of economic dynamics and the level of development of the financial system, including the derivatives market. The imbalance of growth leads to a worsening of financial irregularities, which, in turn, determines the growth of structural economic problems. In such conditions, the effectiveness of the national economy largely depends on the quality of the financial system, the availability of financial institutions' services for business and the public.

However, despite the increasing influence of finance on economic processes (the so-called "financialization" of the economy), the level of development of the financial system remains derived from the state of the economic system. Modern crises indicate that the classical principles of economic theory on the interaction of the real and financial sectors as a critical condition for evolutionarily sustainable social reproduction are not outdated and cannot be replaced by the philosophy of a "new type of economy."

The derivatives market has long been a topic of interest among academicians, researchers, policymakers, and financial players. According to research conducted by Milken Institute in 2014, an increase of 1% of the volume of the derivatives market would have an impact of 1.1% ($149.5 billion) in GDP from 2003 to 2014, whereas an increase of 1% of employment rate would result in 0.6% increase of GDP and an increase of 1% of industrial production rate will impact GDP by 2.1% in 2012.

A number of other authors focus on the development of the derivatives by banks and non-financial firms and their impact on economic growth indirectly and via different channels. As one of the main features of derivatives instruments is to hedge risk, banks benefit from having additional protection against credit, interest rate, and other market risks, which enables banks to strengthen their financial position. In turn, banks with a strong and stable financial situation can provide more credit to the private sector, households, etc. The positive relationship between derivatives market and banks is discussed in previous empirical works (e.g., Brewer, Jackson, and Moser, 2001; Altunbasa, Gambacortab, and Marques-Ibanezc, 2009; Cebenoyan and Strahan, 2004; Brewer, Minton, and Moser, 2000; and Purnanandam, 2007). Banks act as an intermediary by providing credit and channeling funds to productive sectors. In economic research, the development of the banking sector (mostly expressed in the level of domestic credit to GDP) has a determinant effect on long-term growth (Levine and Zervos, 1998; Beck and Levine, 2004).

At the same time, much research is conducted on the effect of the derivatives market on non-financial firms. Non-financial firms usually use derivatives for risk management as a result of which to increase expected cash flows and firm value (Allayannis and Weston, 2001; Kim, Mathur, and Nam, 2006; Mackay and Moeller, 2007; Gay and Nam, 1998). Gay, Lin, and Smith (2011) emphasize in their work that firms using derivatives instruments have a lower cost of capital and fewer financial constraints. According to Jin and Jorion (2006) and Bartram, Brown, and Conrad (2011), firms can reduce risks and stock price volatility via using derivatives instruments. In turn, higher-value firms with lower risk and capital costs have more opportunities to make investments that stimulate economic growth in a long-term perspective. King and Levine (1993) analyze whether higher rates of financial development are positively correlated with economic development in their paper "Finance and Growth – Schumpeter may be correct." The empirical relationship between financial indicators and macroeconomic indicators was evaluated by using a cross-country analysis of data from over 80 countries over the period between 1960 – 1989. They find evidence that each financial indicator correlates strongly and significantly to each growth indicator. Their "classical" assumption is that the predetermined aspect of financial development is a reliable indicator of long-term growth and that financial development forecasts 1) the rate of accumulation of physical capital and 2) the rate of change in the efficiency in which economies assign physical capital. King and Levine (1993) conclude: "Finance does not only follow growth; finance seems important to lead economic growth." According to various empirical studies, it is predicted that finance has a positive impact on the economy, hence driving it up. They summarize that the financial metrics used are firmly and robustly associated with growth, the rate of physical accumulation, and improved resource allocation performance.

On the other side, Rousseau and Wachtel (2006, 2009) find evidence that the financial sector - economic development link weakened significantly over time. They re-examine the findings

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discovered by King and Levine (1993) by incorporating more recent data and answering the question "What is happening to the effect of financial deepening on economic development." Rosseau and Wachtel (2006, 2009) use cross-sectional and panel data on financial and macroeconomic indicators from 1960 through 2003. They noticed that the effect of financial deepening on economic growth was not as robust as it appeared in King and Levine's original study (1960-1989). Rousseau and Wachtel's key hypotheses about finance's declining impact in development were 1) the occurrence of the financial crisis and 2) the country's attempts to liberalize financially. Like in Lucas's critique, policymakers liberalize to exploit the positive correlation that has been discussed in previous paragraphs and thereby reduce the relationship itself. In their study, they highlight the position of financial crises and underpin excessive financial deepening.

In other findings, experts in the field of derivatives market in their scientific papers note that in case of instability in the market (increased volatility, etc.), investors pay more attention to the derivatives market, as derivatives allow participants to hedge risks on underlying assets and receive additional speculative income, resulting in increased trading activity in this market. A study conducted by Koshelev (2010) in his thesis on the role of derivatives in crises showed that the dynamics of exchange-traded derivatives is closely related to the stock market: prices in markets grow and fall simultaneously. The author, analyzing the data on the derivatives and stock markets in crisis periods (various market indicators have been the basis of the analysis since 1994), concludes that "in the pre-crisis periods and at the beginning of crisis periods, trading volumes of exchange-traded instruments increase, then stagnation goes on or decreases in volumes. The decrease in turnover in the post-crisis period is not confirmed." Also, according to the relationships of indicators considered in the study, it can be judged that the stock and derivatives markets move unidirectionally and with a high degree of synchronism. Thus, the correlation coefficient between the capitalization of the stock market and the volume

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of open positions on derivatives instruments amounted to 0.837, between the trading volumes on the stock and exchange derivatives market - 0.883, and between the capitalization of the stock market and volumes of open positions on the derivatives in shares - 0.865. Note that in statistics, the dependence is expressed when the correlation coefficient is above 0.8.

These conclusions are consistent with the opinion of Stern and Feldman (2009) that the functioning of the derivatives market has a stabilizing effect on the dynamics of stock markets, currencies, and interest in crises, as well as on the whole economy. One of our tasks in this work is to find out whether there are similar trends in the derivatives market.

Few theoretical studies highlight the impact of the development of the derivatives market on economic growth. Haiss and Sammer (2010) illustrate a link between risk and economic growth, indirectly representing one of the main features of the derivatives market. Acemoglu and Zilibotti (1997) mention in their model that undiversified agent risks influence aggregate volatility and economic growth by relocating funding, where agents prefer to invest in higher-return ventures that appear to have a more excellent prospect for diversification. Some studies reveal that eliminating idiosyncratic risk leads to a decline in the physical-human capital ratio and a rise in the degree of return on investment and welfare (Krebs, 2003). In summary, the presence of advanced financial instruments leads to a better distribution of human and financial capital to more productive activities, thus boosting economic development.

Sendeniz-Yüncü (2018) highlights in the study the causal relationship between the derivatives market and economic growth in both developed and developing counties. The research is based on time-series data. It shows that the two variables of concern have a long-run relationship in 29 countries out of 32 surveyed and that middle-income countries have a Granger-causality effect from the derivatives market to economic growth. In contrast, in high-income countries, the result is reversed. The authors feature those unidirectional causes between the development of the derivatives market and economic growth.

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Some contemporary studies investigate the influence of the development of the derivatives market on different aspects of financial systems. Haiss and Sammer (2010) examine the role of derivatives in the finance-growth nexus across three channels: risk, volume, and efficiency. First, in the risk channel, the adverse effects on the stock market and economic growth of derivatives market developments are discussed. The risk channel may raise speculation over underlying assets, leading to more volatile financial markets and uncertain economy. The use of derivatives as hedging tools, however, may be advantageous for companies and agents. Second, in the volume channel, an increase in the volume of derivatives market affects the financial market and economic growth by enhancing the accumulation of capital. This increases the allocation of resources to investment activities at higher levels of a return via the mobility of savings and higher investment capacity in a vast array of risky projects. (see, e.g., Allayannis and Ofek, 2001; Bartram, 2009; Hammoudeh and McAleer, 2013; Huang, 2017; Tanha and Dempsey, 2017). Third, the efficiency channel is the accumulation of many features such as an efficient replacement for cash market trading, time and space resource transfer, and risk management and price policy information provider. Therefore, it is advantageous for agents such as corporations, financial institutions, and the government to have a higher combination of funding sources at lower costs.

According to the various empirical studies, a link between economic growth and financial market development has been primarily emphasized compared to the derivatives market. Multiple research has addressed economic growth through the financial intermediaries' development, such as stock market development (Tsouma, 2009; Ang and McKibbin, 2007; Huang, 2000), bond market development (Coskun, 2017; Thumrongvit, 2013), and banking sector development (Beck, 2000; King and Levine, 1993; Levine, 2000; Levine, 2005; Menyah, 2014; Pradhan, 2014; Chaiechi, 2012). The research conducted by Pradhan (2014) includes an analysis of paired relations among four economic components, such as economic growth,

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stocks, and the banking sector. It also includes macro variables such as trade openness, inflation rate, foreign direct investment (FDI), and government consumption and expenditure. From the given variables, the components boosting economic growth are the financial sector, banking, and the derivatives market, while the macro variables such as trade openness and FDI tend to stimulate economic growth via the stock market and the banking system.

Theoretical and empirical research, which has addressed the role of these macroeconomic variables in the relationship between economic growth and financial sector development or the stock market, involves the derivatives market (Banerjee and Prashanta, 2017). Macroeconomic determinants can be used either separately (Kim, 2010) or simultaneously (Coskun, 2017; Gries, 2009; Menyah,2014; Pradhan, 2014; Rousseau and Wachtel, 2002). Kim (2010) considered the impact of trade openness on the development of the financial market. In contrast, Menyah (2014) discussed the interlink between trade openness, financial development, and economic growth. According to Pradhan (2014), the mature financial market in line with the firm macroeconomic policy of keeping inflation under control would lead to a higher growth rate for more than four decades, based on a large sample of Asian countries. Besides, Thumrongvit (2013) and Ruiz (2018) use various macroeconomic indicators to investigate the effects of financial development on economic growth, whereas Bowdler and Malik (2017) reveal a statistically significant impact of trade on inflation volatility.

Vo, Huynh, and Ha (2019) address the impact of the derivatives market on economic growth and growth volatility in four significant economies using time-series analysis in the short and long run. They use the impulse response function (IRF) for the short-run impact via either a vector error correction model (VECM), if a long-run relationship exists, or a vector autoregression (VAR) model. They construct the analytical framework of the derivatives market, economic growth, and two macroeconomic factors such as interest rate and trade openness, which act as control variables, based on the literature review on financial

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development, economic growth, and empirical studies. In the study, four significant economies are covered: India, Japan, China, and the United States.

The different timeframe was used across countries, starting in 2006 for China, 2007 for India, and 1998 for Japan and the US. Most of the data are collected from the Bank for International Settlements (BIS) database, the International Monetary Fund (IMF), and International Financial Statistics (IFS). Due to the difficulty of defining a good measure for the derivatives market, which has a diverse array of products, exchange-traded derivatives (total outstanding notation amounts) are used.

Sipko (2011), in his study, analyses the relationship between the derivatives market development and economic growth. He emphasizes that there has been a significant increase in the derivatives market's trading volume in recent decades and that this increase enormously impacted the global financial crisis. Also, the author makes a comparison between the overall growth of the nominal and real GDP with the derivatives market in the world, and primarily the over-the-counter market (OTC). Baluch and Ariff (2007) discover a positive relationship between economic growth and the derivatives market. According to their research, sound liquidity in the underlying cash market leads to maintained derivatives trading and thus making an essential contribution to economic growth via transferring risk.

Following up, Aali-Bujari, Venegas-Martínez, and Pérez-Lechuga (2016), in their study, predict a positive correlation between the financial sector and economic growth. They assume that the increase in the volume of the derivatives market may raise the real per capita GDP. More clearly, the further development of the derivatives market tends to drive up real GDP per capita. In their research, they develop a panel data model that studies the relationship between the derivatives market and GDP growth in a sample of six major world economies: the European Union, the United States, Japan, China, India, and Brazil during 2002-2014. The main empirical finding is that derivatives markets have a positive correlation to economic

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growth in these countries. For constructing a model, the variables are expressed in logarithms. According to the estimates GMM in the differences model, an increase of 1% of the derivatives market volume will lead to a per capita GDP growth of by 0.17% in six economies. The abovementioned studies corroborate the interconnection of the derivatives market, financial sector development, and economic growth, emphasizing that the latter can shape significant macroeconomic variables.

Chapter 3: Data Description

The data used in this research were sourced from the World Bank and the Bank for International Settlements (BIS). GDP current, Trade, Domestic credit, Central Bank assets, Unemployment rate, and Market Capitalization to GDP were obtained from World Bank statistics (in USD), while the volume of the exchange-traded derivatives was taken from the BIS statistics. The derivatives volume is received as the exchange-traded derivatives (total outstanding notation amounts) due to the difficulty of defining a good measure for the derivatives market, which has a varied list of products. This work is based on a sample of five major economies: the Eurozone countries, China, Japan, India, and the United States. The observation period for the sample is on 16 years (from 2003 to 2018), which allows us to track the dynamics of the development of the financial sector over a long period. The research is carried out using a panel data analysis for the period under study. **Table 1** represents the notation and statistics for all the variables. The modeling was carried out using the modern econometric package STATA.

Table 1. Statistics for the analyzed economies 2003-2018

Variable	Observations	Mean	Std. Dev.	Min	Max
GDP (current in billions USD)	80	8334.2	5559.2	607.6	20544.3
Log (GDP)	80	8.7	0.9	6.4	9.93
Trade	80	46.4	19.3	21.5	88
Domestic credit	80	136.1	50.6	31.6	206.6
Central Bank assets	79	2.5	2.1	0	8.5
Market Capitalization	80	81	34.2	17.5	164.8
Derivatives (in billions USD)	70	11930.4	16134.7	0.044	68474.4
Unemployment	80	5.9	2.2	2.4	11.9
Inflation	80	2.7	2.7	-1.3	11.9

Source: Author's computation based on data from World Bank and BIS

In **Table 2**, variables are described in detail, including the unit of measure, source, and formal definition.

Table 2. A detailed description of variables

Variable	Unit of measure	Source	Definition
GDP	current in billions USD	Word Bank	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates.
Trade	% of GDP	Word Bank	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.
Domestic credit provided by the financial sector	% of GDP	Word Bank	Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, except for credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available.
Central Bank assets	% of GDP	Word Bank	Claims on the domestic real non-financial sector by the Central Bank as a share of GDP.
Market Capitalization of listed domestic companies	% of GDP	Word Bank	Market capitalization is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded. Data are end of year values.
Derivatives	in billions USD	Bank for International Settlements	Exchange-traded derivatives statistics cover the turnover and open interest in foreign exchange and interest rate futures and options.
Unemployment rate	% of the total labor force	Word Bank	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.

Inflation rate (consumer prices)	annual %	Word Bank	Inflation, as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

Source: Author's compilation

Most of the data come from the World Bank. In this research, due to the lack of data, exchange-traded derivatives are used to express the derivatives market and collected from Bank for International Settlements (BIS).

Chapter 4: Methodology

This chapter empirically investigates the correlation between derivatives markets and the economy by using a panel data model. The panel dataset consists of 80 observations. In detail, in this paper, it is investigated if a set of explanatory variables and financial market variables, such as the volume of derivatives expressed in the volume of exchange-traded derivatives, are correlated with economic growth as measured by the nominal GDP (y). The empirical analysis is built on five major economies: the Eurozone countries, China, Japan, India, and the United States. The multiple regression analysis is conducted to consider the correlation between GDP and the derivatives variable, as well as the control variables. This research is based on the methodology introduced by Vo, Huynh, Vo, and Ha (2019) in their paper, where they consider the impact of the derivatives market on economic growth in four significant economies, namely, the United States, Japan, China, and India. First, for constructing a model, they express variables in logarithms. To build a model, they use the impulse response function (IRF) for the short-run impact via either a vector error correction model (VECM), if a long-run relationship exists, or a vector autoregression (VAR) model. They construct the analytical framework of the derivatives market, economic growth, and two macroeconomic factors such as interest rate and trade openness, which act as control variables. Due to the difficulty of defining a good measure for the derivatives market, which has a diverse array of products, exchange-traded derivatives (total outstanding notation amounts) are used. In this study, the approach is to check the correlation relation of derivatives markets and macro variables to GDP. While most of the methodology in this paper relies on the study by Vo, Huynh, Vo, and Ha (2019), there is a slightly different approach in regression: panel fixed-effects model is used and followed by the forecasting estimates within the model. Considering the literature review, we add stock market capitalization (MARCAP), unemployment (UNEMP), central bank assets (CBASSETS),

domestic credit (DOMCR), trade (TRADE), derivatives (DER) and inflation (INFLAT) as explanatory variables to start with the following regression:

$$log\ (GDP) = \alpha + \beta_{lnder}(lnDER_{i,t}) + \beta_{lntrade}(lnTRADE_{i,t}) + \beta_{lndomcr}(lnDOMCR_{i,t})$$
$$+ \beta_{lncbassets}(lnCBASSETS_{i,t}) + \beta_{lnmarcap}(lnMARCAP_{i,t})$$
$$+ \beta_{lnunempl}(lnUNEMPL_{i,t}) + \beta_{inflat}INFLAT_{i,t} + f_i + f_t + \varepsilon_{i,t},\ \ where$$

i - country, t - time

log (GDP) - log-transformed dependent variable

lnder$_{i,t}$ - log-transformed exchange-traded derivatives

lntrade$_{i,t}$ - log-transformed trade as a share of GDP

lndomcr$_{i,t}$ - log-transformed domestic credit by the financial sector as a share of GDP

lncbassets$_{i,t}$ - log-transformed central bank assets as a share of GDP

lnmarcap$_{i,t}$ - log-transformed market capitalization of domestic companies as a share of GDP

lnunempl$_{i,t}$ - log-transformed unemployment rate

inflat$_{i,t}$ - inflation

f$_i$ - country fixed-effect, f$_t$ - time fixed-effect, $\varepsilon_{i,t}$ - error term.

For all the explanatory variables to have a similar effect on GDP regardless of country and time, country- and the time-fixed effect is implemented in the model. Thus, a fixed effect allows avoiding any biases or external factors that may change the outcome variables and control the specific unobserved effects. They take out any effect that is specific to the country that does not change across the country, and they take out any effect that is specific to the time period that does not change over time.

Possible economic effects of variables

GDP: The data was a subject to log transformation to make it closer to a normal distribution and more readable. It is expected to have a positive correlation with derivatives.

Derivatives (exchange-traded derivatives): According to the literature review, it is expected to be positively related to GDP.

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Market capitalization: Based on the literature review, market capitalization and derivatives market move together: rise or fall in one of the sectors leads to the same output for the second. Both areas tend to be associated with economic growth according to various research discussed in the literature review.

Domestic credit: It is expected to be positively related to GDP based on the literature review.

Central Bank assets: It is expected to be positively correlated to GDP.

Unemployment rate: Based on the literature review, this indicator is expected to be negatively related to GDP.

Trade: Based on the literature review, it is expected to be positively related to GDP.

Inflation: Inflation is expected to be positively related to GDP since GDP is expressed in current terms.

Chapter 5: Empirical Findings

Before estimating the model, the unit root test is performed to see the stationary/non-stationary variables. The Augmented Dickey-Fuller (ADF) test is conducted to check that feature. The logarithmic values are introduced for all variables except inflation to normalize the distribution of data and make it more interpretable. It is highly essential to check the presence of any persistence of unit root since the lack of stationarity would result in a violation of classical linear model assumptions. Below in Table 2, the results of the ADF test are illustrated.

Table 3. The results of Panel Unit Root Test (ADF test)

Variables		**Statistics**	**Prob.****
Log (GDP)	Level	39.04	0.0000
Log (Trade)	Level	37.3	0.0001
Log (Domestic credit)	Level	54.12	0.0000
Log (Central Bank assets)	Level	23.86	0.0080
Log (Market capitalization)	Level	49.61	0.0000
Log (Derivatives)	Level	22.80	0.0115
Log (Unemployment)	Level	17.07	0.0727
Inflation	Level	49.71	0.0000

Source: Author's computation based on data from World Bank and BIS

According to the ADF test, all indicators tested, such as GDP, trade, domestic credit, central bank assets, market capitalization, derivatives, unemployment, and inflation, are stationary, t statistics are significant and null hypotheses that there is a unit root series is rejected.

The central hypothesis that this thesis tries to check through the regression is how the derivatives market, financial indicators with macroeconomic variables relate to GDP variables in five major economies. In addition to the other empirical paper results about the derivatives' impact, the thesis uses the approach of Aali-Bujari, Venegas-Martínez, and Pérez-Lechuga (2016). Their study predicts a positive correlation between the financial sector indicators,

including derivatives market and economic growth, which were discussed above (see Chapter 1).

The results of the fixed-effects estimation are presented in Table 3. A new variable, inflation, was added in the analysis as GDP data reflect current prices. The objects of this study are five major economies: Japan, China, India, the United States, and Eurozone countries. Eurozone countries have aggregated data. The outcome is that derivatives variable, unemployment rate, trade, domestic credit, and inflation are statistically significant, while central bank assets do not have a substantial influence on the GDP variable. According to the findings, an increase of derivatives by 1 percent is associated with a 0.10 percent increase in GDP. Results also suggest that the rise in domestic credit by1 percent is associated with a 0.9 percent increase in GDP. The descriptive statistics show that the multiple regression analysis can explain ~63% of data.

Table 4. Fixed-effects estimation results

Dependent variable: *log of GDP (y)*	
Regressors	**Coefficient**
Derivatives *(log)*	0.106**
	(0.025)
Unemployment *(log)*	-0.107
	(0.160)
Trade *(log)*	0.005
	(0.515)
Domestic credit *(log)*	0.916*
	(0.356)
Central Bank assets *(log)*	0.031
	(0.029)
Market capitalization *(log)*	-0.181
	(0.094)
Inflation	-0.004
	(0.033)
R-squared	0.63

*Note: standard errors are in parentheses (clustered by country); *p<0.10, **p<0.05, ***p<0.01*

Hence, the fixed-effects model is chosen to explain the relation of derivatives markets to the economy. Estimates indicate that derivatives markets are positively related to GDP. The fixed-effects estimates model shows that an increase of 1 percent of the exchange-traded derivatives

market's volume is associated with a 0.10 percent increase in GDP in economies that were the objects of this study from 2003 to 2018. We can observe that the effect is significant. The statement can explain this result that the derivatives market help form future expectations of asset prices. Firms, in line with expectations and appropriate risk management, may end up with future stability and growth, which, as a result, will have a significant impact on economic activity. It is worth mentioning that the exchange-traded derivatives variable has the sign, which was assumed and expected, and it is substantial.

Projection scenarios for the next five years (2018 – 2023)

This section will project a growth path for GDP for the next five years for each country. During this period, GDP grows in response to change in derivatives keeping everything else constant. I am assuming a projection path for derivatives using average growth rates of derivatives for the last three years. The coefficient of the correlation between GDP and derivatives is retrieved from regression results in **Table 4**.

The following figures present the projections for China, Japan, India, the United States, and Eurozone (2016 -2023). Since the derivatives are too volatile for some countries, it was hard to make a reasonable trend projection. Although my projection path for derivatives may not be realistic, it may still give some idea on how GDP will grow if the growth of the derivatives as given by my moving average estimates. India, for example, has a constant path of contraction in the volume of derivatives according to these estimates and it is not likely the actual realization of these values will remain so low in the next five years, but at least I can see how important it might be for GDP to have sustainable growth in the derivatives market for India. Eurozone, on the other hand, has a sharp trend increase in derivatives, which translates to substantial growth in GDP. The United States and China, like Eurozone, have a consistent growing derivatives market, which again predicts continuous GDP growth assuming everything else remains constant. Finally, Japan has an unlikely declining derivatives path for

the next five years. In recent years, it had a sudden drop in the derivatives market, which lowered the average growth for the last three years. If I assume this is a bad scenario for Japan, then Japan's GDP growth would suffer from a shrinking derivatives market based on my regression results.

Figure 4. GDP growth projections 2016 - 2023
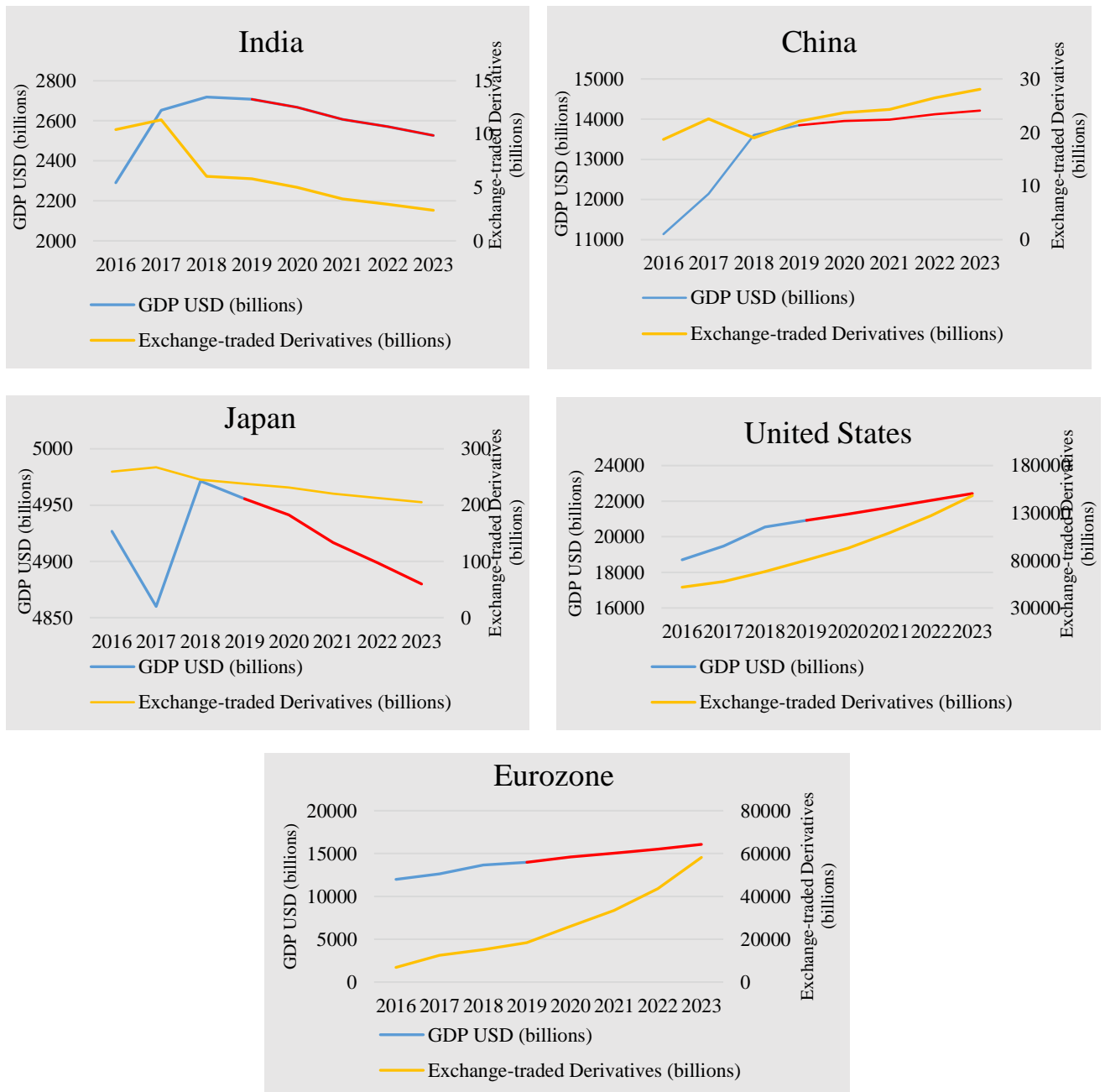
Source: Author's computation based on data from World Bank and BIS

Chapter 6: Conclusion and Policy Recommendations

This thesis examined how the increase in the derivatives market, together with financial and macroeconomic indicators such as trade and inflation, relates to five significant economies, namely, China, India, Japan, Eurozone, and the United States. The empirical analysis reveals that the derivatives variable has a meaningful relationship with the GDP of each economy, with variables like the domestic credit. In contrast, central bank assets, trade, unemployment, inflation, and market capitalization are not related to GDP.

Sipko (2011) highlights that healthy financial and derivatives market development has a positive impact on economic growth. Most importantly, he emphasizes that there has been a significant increase in the derivatives market's trading volume in recent decades and that this increase enormously impacted the global financial crisis.

We concluded that the development of the derivatives market has a positive relation to the GDP variable of the observed economies. My results are consistent with what was found in the study carried out by Sipko (2011). This paper supports theories on the favorable effect of the derivatives market on economic development. As such, it is encouraged to introduce any strategy for boosting or enhancing the volume of the derivatives market. It is highly essential to have a proper regulatory framework in order to prevent unintended consequences of derivatives markets. Haiss and Sammer (2010), in their study, raised the potential unfavorable effect and a warning that the development of derivatives markets may bring uncertainty to the domestic economy.

The leaders in the regulation of the derivatives market are the United States and the European Union. In the United States, the section of the 7th Dodd-Frank Law is wholly devoted to the regulation of over-the-counter risks, adopted in 2010 after analyzing the consequences of the 2008 crisis to reduce systemic risks. The negative impact of OTC derivative transactions on

the market situation and the economy in 2008 was evident. In 2012, the European Union adopted a regulation on the over-the-counter derivatives transactions, central counterparties and trade repositories via the European market infrastructure regulation (EMIR), which established uniform rules for all transactions that may affect the markets of the countries of the European Economic Union (EEU). In both the US and the EU, all major types of derivatives are regulated.

Summing up, we note that for the further development of the derivatives market, it is advisable on a country level to carry out a few measures: to continue to improve the regulatory framework governing transactions with derivatives; to consider and if necessary to resolve any issues/drawbacks related to taxation of transactions with derivatives, judicial protection by the state of the execution of such instruments; to identify precise accounting mechanisms in accordance with the requirements of international and national accounting and tax accounting standards; to increase the level of financial literacy and professionalism of potential participants in the market of derivatives; approve the list of licensed rating companies engaged in assigning ratings to participants in the market of derivatives; to develop a unified methodology for assessing the value of derivatives. All these measures will ultimately lead to an increase in liquidity and transparency of this market.

In addition to this analysis, the institutional view implying the strength and stability of other macroeconomic indicators is essential for further economic development. The result is like a two-sided scale, where the perfect balance needs a careful and in-depth approach. For that reason, several advanced, country-specific, and robust econometric techniques should be used to develop the model further.

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Appendices

Table A.1. Correlation matrix

```
                  |  GDPUSD     Trade Domest~t CBassets Market~P Unempl~t Exchan~s Inflat~u
------------------+----------------------------------------------------------------------
          GDPUSD  |  1.0000
           Trade  | -0.7205    1.0000
     Domesticcr~t |  0.5604   -0.3468    1.0000
         CBassets |  0.2616    0.0565   -0.0254    1.0000
      MarketCapt~P |  0.6682   -0.5594    0.4777    0.0545    1.0000
     Unemployment | -0.3305    0.6713    0.0502   -0.1099   -0.2446    1.0000
      Exchangetr~s |  0.6404   -0.1846    0.5667    0.0253    0.6709    0.2359    1.0000
       Inflationc~u | -0.1496    0.1696   -0.7129    0.1249   -0.1053   -0.0519   -0.1199    1.0000
```

Source: Author's computation