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Examining market concentration levels of available global financial commodity products

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ABSTRACT

The primary objective of this study is to find disparities in the commodity product offerings in various financial markets across the world along with their market concentration levels. Identifying the product gaps in commodity-based financial products offered by the worldwide financial exchanges can assist the decision-makers to fill the existing gaps and strategically attain the worldwide competitive market of commodity exchanges for all nations. The Herfindahl-Hirschman Index, HHI, is used to measure market concentration grouped by geographical regions or exchanges. Our study is conducted for the time period between 2012 and 2016. The disparity analysis indicates a disparity between the various types of commodity products traded in several exchanges across different geographical regions. Our HHI values reflect a high level of commodity market volume concentration in region-wise analysis and a moderate level of market volume concentration in the exchange-wise analysis.

Keywords: Commodity Exchanges, Commodity Products, Herfindahl-Hirschman Index, Measure of Market Concentration, Commodity Market Regions.

1. Introduction

Rapid fluctuations in commodity prices have always been a concern for both commodity producers and consumers. Apart from the direct government intervention in regulating the market mechanism, there is always a better way to self-regulate the unstable prices using derivative products. Derivative products like forwards, futures, options, swaps, etc., are being introduced in both the developed and developing world to hedge the price fluctuation risk. We saw the development of commodity exchanges from the 17th century and how they have evolved over time. Each exchange includes specific commodity products based on the production and consumption patterns of market participants. Derivative exchanges offer a platform to connect hedgers, speculators and cash markets, which enables the financial growth of the country. Furthermore, exchanges provide price transparency to market participants through market regulations and policies. There was a significant increase in commodity trade volumes in the 20th century. Commodity Exchanges in various parts of the world also opened based on their specialty of commodities. The United States, Brazil, the United Kingdom, France, Korea, Japan and Australia opened exchanges with specific asset class trading. Trading was then measured in several contracts traded (volume-based) under the exchange. Exchanges all over the world got connected to electronic trading systems, and trading operations were carried out 24 hours a day during business days. Commodity futures and other asset class markets extended the trading activity by introducing benchmark indices.

The first options market was introduced in 1982 by the Chicago Board of Trade under which the buyer of an option contract was given the right to sell contract within the prescribed time. Options trading gained popularity in the United States. The Chicago Board Options Exchange was opened to encourage options trading. In 1994, the exchange started elec-

tronic trading system and facilitated a smooth transaction process. By 2009, CBOT had 3600 members and nearly 35 million US dollars were traded through an exchange. The type of commodity derivative products traded via local exchanges is also indirectly influenced by macroeconomic variables such as exports, price volatility, etc. These variables may affect the overall growth of the economy and financial markets. Another implication to commodity markets is price volatility. The inelastic curve of commodity demand and supply leads to volatility in prices (Knittel and Pindyck, 2016). Business cycles in commodity importing countries, changing weather conditions, political instability in export promoting countries, price speculations in commodity markets, exchange rate fluctuations are some of the factors that lead to commodity price volatility (Gubler and Hertweck, 2013; Hou et al., 2017). There is a linkage between the country's economic growth and commodity price fluctuations, along with the development of efficient commodity markets (Harvey et al., 2017). Price discovery of each commodity is unique and depends on the sector operated and its usage. Dimpfl, Flad, and Jung (2017) studied price discovery for corn, wheat, soybeans, soybean meal and oil, feeder, live cattle, as well as lean hogs, and found that prices of these commodities are almost uniquely formed in the spot market, and less than 10% price discovery can be attributed to the futures market.

Financialisation of commodities by setting up more commodity exchanges and increasing the product types available to trade in the commodity exchanges can directly or indirectly assist the creation of a new global market for those products and associated industries. Anderson, Asche and Garlock (2018) found that increased trade created a new global market for certain seafood species and in turn allowed to scale and modernise logistics by commoditising the main seafood species groups.

In contrast to the benefits associated with commodity markets development, there is also a concern that the commodity index trading by speculators has led to the increased prices of the necessary commodities like food grains. Boyd, Harris and Li (2018) showed that there is little evidence to prove that speculators cause market destabilisation. Speculators provide the necessary liquidity to hedgers. Haase, Seiler Zimmermann and Zimmermann (2016) have studied 100 published papers about the role of financialisation of commodity markets in the price distortion. They have found an equal number of studies that support and contradict the effects of speculation, and the results shift against the criticised effects if the studies use direct measures of speculation, except for the price.

Having successful commodity exchanges that represent a wide variety of commodity-based financial products with a greater volume of transactions can hedge the risk of commodity producers in each country along with the creation of market efficiency (Larson et al., 1998). In this study, we will examine the number of commodity products traded in region-specific exchanges and analyse product distribution with respect to geographies. We also intend to examine concentration levels of the volume of contracts grouped by exchanges and grouped by regions to determine the commodity market share across the industry. This study will help decision-makers in both private and public sectors to understand the disparity between the available commodity products in the exchanges across different regions around the world and close the gap strategically.

The Herfindahl index – or Herfindahl-Hirschman Index, HHI, is used to measure market concentration. We will evaluate the volume concentrated HHI index to determine the factors associated with a change in market concentration levels.

2. Literature review

Rashid (2015) examined the benefits of Agricultural Commodity Exchanges (ACX) in developing countries and public policies associated with the agriculture commodity market. Some of the benefits explained were increased earnings in agriculture commodity exports, availability of small stakeholders to the commodity markets, price discovery, improvement and so on. The study stated that there was no empirical evidence of these claims. Commodity exchanges have played a major role in enhancing the agricultural commodity markets. This is true for the emerging or industrialised countries. For the developing countries, the growth of commodity exchanges has been unusual. Another observation was the exchanges led by the government or donor-funded exchanges, which failed in the developing countries such as Sub-Saharan Africa. Lack of enough research, absence of monitoring and evaluation systems were some of the reasons stated for the failure of exchanges. No evidence was found supporting increased export earnings and the availability of smallholders to the markets.

UNCTAD (2009) conducted a study on the development impacts of commodity exchanges in emerging markets. The objective of the study was to analyse how commodity exchanges have

impacted the growth and economic development of developing countries. The agriculture sector and farmers were the focus area of the study. The study revealed that apart from macroeconomic stability and government regulations, liquidity is one of the most important key indicators for the success of commodity exchanges. The study covered the exchanges that are successfully set up and operating in diverse market conditions and different economies. The analysis stated that successful commodity exchanges showed diversity in the pattern of development from country to country.

Amrouk, Poole, Mudungwe and Muzvondiwa (2013) examined the patterns of smallholder market participation in commodity markets. Four countries, Ethiopia, Peru, Tanzania and Zambia were taken as a base for evaluating smallholder participation in the agriculture commodity segment. Based on the project's case studies, it was found that Ethiopian farmers could apply economies of large-scale production in agriculture, and this benefitted them with several positive returns. Farmers gained production and post-harvest handling skills and new employment opportunities were created. They could also apply the processing of value-added products. In Peru, farmers could learn new techniques of farming, such as the use of organic manure, the use of bees for crop pollination, etc. The demand for agriculture labour was increased. Tanzania also showed a positive aspect of agricultural activity. Zambia also showed market participation in dairy products. Milk yield and quality showed an upper trend, and smallholders could apply innovative livestock feeding technologies. Employment opportunities also increased. The study revealed that smallholders were key participants in agricultural markets. They could contribute to overall expansion and innovations to economies.

REJNUŠ (2002) conducted a study to find the importance of commodity exchanges for agricultural commodity trading in the Czech Republic. The study covered some problematic areas in the smooth functioning of commodity exchanges in the Czech Republic. The problem areas identified were low-level liquidity and imperfect participation in international exchange operations. The study indicated that commodity trading via exchange did not provide any benefits to the agriculture industry in the Czech Republic and it identified two possible areas of development in agricultural commodity trading: 1) participation of Czech exchanges in the European system, and 2) agricultural commodity producers directly join foreign systems without channelising via the Czech commodity exchange. The study results stated the above two possibilities of development in the Czech agriculture commodity trading.

Agarwal and Kaur (2013) conducted studies to analyse the growth of commodity markets in India and how agricultural commodities serve as an arbitrage opportunity. The study also highlighted price volatility related to agriculture commodity markets. An overall study emphasised the landscape of commodity futures markets and how they evolved over time. The results of the study indicated that the status of the agriculture commodities market in India is uncertain. Many studies are available to understand equity markets, but no study has gone to analyse the shape of commodity markets. The study opens a door for researchers to further investigate the status and growth of commodity markets in developing countries.

Tsetsekos Panos (2000) noted some factors that demand appropriate structuring of derivative exchanges in emerging countries. Derivative markets have created investment opportunities for institutional investors as they can hedge and manage their risks in the commodity asset class. Large business entities in emerging markets also have diverted to derivative markets to manage their commodity and financial risks. The study identified the need for structured derivative exchanges in emerging markets. There are several factors that need to be taken care of for successful derivative exchange functions, some of which are the products that are traded, the structure of the exchange and the strength of the foundation on which the exchange is built. On fulfilling these areas, exchange trading will benefit both investors and the emerging markets economy. The study enlists good lessons to build structured derivative exchanges in emerging markets.

Carter (1999) conducted a survey on commodity futures markets and the formation of commodity futures prices. He considered two pricing theories – the theory of normal backwardation and the theory of storage. The study stated that most recent work supported the theory of storage price, but its convenience yield component was controversial. The study highlighted that futures trading via the electronic platform and managed commodity funds play a significant role in the futures markets. The study concluded that the futures market is a major player in managing economic and financial risks.

Cashin, McDermott and Scott (2002) examined global commodity prices under business cycles such as booms and slumps. The study identified that booms and slumps in prices are prevailing issues in commodity-exporting countries. The study was conducted with two

main observations. Firstly, commodity price slumps stay longer than the price boom. Secondly, reduced commodity prices during slumps were found to be larger than the prices expected to increase in the subsequent boom. Another conclusion was that the association between the probability of an end of a price slump and the duration of slump time was independent of each other.

Cheung and Morin (2007) examined the impact of emerging Asia on commodity prices. The study considered oil and metal commodities for examining their prices in Asian markets. Due to rising production in China, demand for commodities has increased over some time. The study evaluated the impact of emerging Asia on oil and metal prices in the Bank of Canada Commodity Price Index (BCPI). Business cycles in emerging Asia have played a significant role in oil price movements, whereas metal price movements have also been affected due to growing industrial development in Asian economies. The study gave direction to examine the relationship between commodity prices and demand for commodities in emerging Asian countries.

Roache (2012) performed an analysis of China's impact on the world's commodity markets. Base metals and crude oil are considered to identify an impact under the demand-supply cycle. The autoregressions (VARs) methodology is used by estimating the impact of aggregate activity shocks such as world primary production of the commodity, the world's industrial production excluding China, China's consumption, the real short-term US interest rate, US dollar effective exchange rate, and real price of the commodity. The results of the study indicated a short-term impact on oil prices, and base metal was seen in China during shocks. At the same time, consumption did not influence commodity prices. In comparison to the United States, the study showed an increasing trend of China's impact on the world's commodity markets, but compared to the United States, China's impact was smaller. The study also highlighted the biggest challenge that was uncovered in the research. The challenge was to study the demand for commodities in China at the time of economic re-balance. Arnade, Cooke and Gale (2017) examined the transmission of international commodity prices to the domestic Chinese markets. The results showed that stabilisation policies carried out by the Chinese government to protect the prices of the domestic Chinese markets from the international commodity prices cannot be sustained over a long term.

Irwin and Sanders (2011) examined the correlation between index funds, financialisation and commodity futures markets. One part of the study showed that index investment influenced the prices of futures. At the same time, another part indicated no relation between index fund positions and commodity futures prices. Linkages between index investments and commodity futures prices were not consistent in different scenarios. The results of the study indicated that the belief that index funds influences prices was in doubt. The study gave direction to further research on finding the correlation between the behavior of commodity prices and other products under various macroeconomic variables.

Cabrales, Castro and Joya (2014) performed research on the effect of US monetary policy shocks on commodity prices in Colombia. As per the study, Colombia was one of the world's largest exporters of oil, coal, ferronickel and gold commodities in 2010. Colombia's commodity exports contributed to 64% of total exports. The empirical study was based on the VAR model and quarterly time series data were used between 1980-2010. The research indicated that there is a huge impact of US monetary policy shocks on exported commodity prices in Colombia. Monetary policy variables can be considered for examining commodity prices fluctuations.

Cutler, Chan and Li (2005) conducted an empirical analysis to identify linkages between commodity and Consumer Price Index (CPI) in Mainland China and Hong Kong. Using Vector Autoregression (VAR) methodology, comparisons were made with the United States. Positive correlation was found between non-fuel commodity prices and CPI inflation. An increase in the non-fuel commodity prices led to an increase in CPI inflation in Mainland China and Hong Kong. Bivariate and Multivariate analyses were conducted to examine the relationship between these variables. Changes in energy prices were not indicators for an increase in CPI inflation. The results varied from commodity to commodity. No significant evidence was found to determine that all commodity prices are related to CPI inflation.

We have seen many studies explaining the benefits of financialisation of commodity markets, price discovery mechanics of commodities, the performance of commodity markets under macroeconomic variables along with the linkages between commodity markets and the status of the economy. Another set of studies explored the role of exchanges for smallholders in different countries, limitations of agricultu-

ral commodity exchanges in emerging markets, correlation of commodity markets with monetary policy changes, the connection between commodity price fluctuations and economic growth in terms of import / export parameters and so on. Many of these studies have proved the benefits of the commodity markets along with their links with overall economic factors and growth. But none of the above-mentioned studies captured the disparities or market concentration of commodity-based financial products in various exchanges across the world. Understanding the concentration levels help us to create more competitive commodity markets across all the regions of the world rather than confining them to only a few countries.

In this study, we are going to examine the variety of commodity products available in the world-wide commodity exchanges along with their traded volume and their market concentration levels as per various exchanges and different regions around the world. This analysis will help both the individual and institutional commodity market investors to have a global view of the available commodity products in various exchanges. This study also helps investors to analyse the number of commodity products available and their volumes traded in terms of exchanges and world regions. In turn, an investor can choose to invest in developed or developing markets as per their risk and return analysis. Arbitrageurs can use this study to find a list of similar commodity contracts traded across various exchanges and find their price differences to benefit from the price arbitrage.

We will also study market concentration levels of commodity products traded in terms of exchanges and world regions. This analysis will help the policymakers to spot the disparities in the development of commodity markets and their traded volumes. By spotting the disparities, policymakers can revisit their strategies and implement necessary steps to increase the number of commodity exchanges or the available commodity products in their respective countries or regions. Large scale private investors can also use the market concentration levels analysis to spot the opportunities in establishing a new commodity exchange in underserved countries or regions across the world. In this juncture, our study lays an important foundational analysis for the development of commodity markets and their product offerings from both the investment and policy-making perspectives.

3. Data Description

This section has three sets of data: 1) Product Types and Exchanges, 2) Contract Volume Exchange-wise (2012–2016), 3) Contract Volume Region-wise (2012–2016).

3.1. Dataset 1 – Product Types and Exchanges

The dataset contains region-wise exchanges list and each exchange authorised for trading commodity products. The following regions are covered with the exchanges. 58 exchanges are covered to perform disparity analysis. Refer to Table 1 for data information.

Table 1: Commodity Products vs. Exchanges

Specification	Africa & Turkey	South America	North America	Asia	Europe
No. of Exchanges	2	4	18	26	8
No. of Products Traded	493	455	8157	2689	1712

Note: The table shows the number of total exchanges per region and no. of products traded per exchange. This data is collected manually from various individual commodity exchange websites.
Source: own research.

Countries analyzed under Asian derivative markets are Australia, China, Hong Kong, India, Indonesia, Japan, Malaysia, New Zealand, Pakistan, Singapore, South Korea, Taiwan, Thailand and United Arab Emirates. Asian derivative markets cover the largest share of commodity trading. European derivative markets are covered in Germany, Hungary, Italy, Russia, Sweden and the United Kingdom. Latin American derivative markets taken for our analysis are Argentina, Brazil and Colombia. North American derivative markets observed are Canada and the United States. South Africa and Turkey are taken as another region.

3.2. Dataset 2 – Region-wise Commodity Contracts Volume

Commodity contracts volume traded in Asia, North America, Europe, Latin America and other regions (Africa and Turkey) are taken for the years 2012, 2013, 2014, 2015 and 2016. Refer to Table 3 for region-wise information.

3.3. Dataset 3 – Exchange-wise Commodity Contracts Volume

Commodity contracts volume traded in exchanges across all regions specified above are taken for the years 2012-2016. Refer to Table

1 (Appendix) for contract volume data exchange-wise.

In this study, we will use dataset 1 to conduct disparity analysis between the number of exchanges located in each region versus the number of product types traded in each region. This analysis is conducted to gain a clear idea about the gaps existing in the global commodity markets.

Dataset 2 will be used for performing market-level concentration analysis using region-wise data on the contract volume for 5 years. This analysis gives us the idea of the commodity market concentration level and its interpretation using the HHI calculation methodology. Dataset 3 will be used for measuring market-level concentration using exchange wise data on total contract volume for 5 years. This analysis gives us the idea of the commodity market concentration level and its interpretation using the HHI calculation methodology. It will give us some insight into the growth of the commodity futures and options market.

4. Methodology

4.1. SCP and NEIO

In an industrial organization (IO), the Structure-Conduct-Performance (SCP) paradigm was the main framework for empirical research between the 1950s and early-1980s. There was a causal chain running from the market structure and the firm's conduct, to its performance. By the 1980s, the empirical opponent of this theory is the New Empirical Industrial Organization (NEIO). In the last two decades, the NEIO is the front runner in the empirical IO literature, but it is lagging in the number of studies being carried out. This situation could be due to the fact that the SCP paradigm has evolved over time and is still carried out strongly in most developing countries (Lee, 2007). Thus, we will use the SCP approach in our analysis using Market concentration measures due to its popularity among readers across the globe.

4.2. Market Concentration Measures

Market concentration is a function of a number of firms and their respective market share of the total industry. The modern scientific literature offers multiple measures on Market concentration but none of them are perfect (Ginevičius and Čirba, 2007). In economics, the Concentration ratio (CR) and the Herfindahl index (HHI) are commonly used market concentration measures due to their simplicity in calculation. N-firm concentration market ratio (CR(n)) provides us with a common measure for the market structure, which shows the combined market share of N largest firms on the market. Concentration ratios can range 0 to 100 percent. 0% represents the perfect competition scenario, and 100% represents the monopoly.

The Herfindahl index (HHI) measures the size of a firm in relation to the total industry and an indication of the total amount of competition among them. The HHI is defined as the sum of squares of the market shares of the firms within the industry. The result can range from 0 to 1.0. In the case where the whole percentages are used, the result ranges from 0 to 10,000 points. An increase in the HHI value indicates a decrease in competition. The N-firm concentration ratio does not take changes in the size of the largest firms into account. The Herfindahl index (HHI) avoids this problem. Kvålseth (2018) made a comparison between the N-firm concentration market ratio (CR(n)) and the Herfindahl index (HHI) and found that the HHI has an advantage over the CR(n) by following strict Schur-convexity if market shares are known for all the firms within a market. The Herfindahl index (HHI) is also used by the US Justice Department and the Federal Trade Commission (FTC) to evaluate any mergers and acquisitions.

The main drawback of the Herfindahl index (HHI) is that it requires the market shares of all the companies in the market to be known. In our case, we know the market shares of all the commodity exchanges as they are quite limited in number per region. The Herfindahl index (HHI) critics argue that the methodology cannot account for the benefits of network industries (Toby Roberts, 2014). Commodity Exchanges cannot be classified as network industries so that we can use the Herfindahl index (HHI) due to its popularity and simplicity in the calculation.

4.3. Region-wise Commodity Contracts Volume

In this section, we are using the volume concentration index, HHI, to measure the commodity market concentration using region-wise data for 5 years and see the trend of how the industry performs. The HHI is calculated by squaring the number of contracts of all regions and then summing up those squares. The equation of HHI_{Region} is as follows –

$$HHI_{Region} = \sum_{i=1}^{k} p_i^2 \quad (1)$$

where:

$$p_i = \frac{No.\,of\ contracts\ per\ region}{Total\ Contract\ Size}$$

The number of contracts traded in the region for the year and total contract volume of the year is given. Contract volume concentration is measured for the year between regions in terms of the total number of contracts traded in the region with respect to total commodity contracts traded across the world. The period analysed is 2012-2016. Contract Volume is the total no. of commodity futures and options contracts. The HHI will determine the level of commodity market concentration per year.

4.4. Exchange-wise Commodity Contracts Volume

In this section, we are using the volume concentration index, HHI, to measure the commodity market concentration using exchange data for 5 years and see the trend of how the industry performs. The HHI is calculated by squaring the number of contracts of all exchanges and then summing up those squares. The equation of $HHI_{Exchange}$ is as follows –

$$HHI_{Exchange} = \sum_{i=1}^{k} p_i^2 \quad (2)$$

where:

$$p_i = \frac{No.of\ contracts\ per\ exchange}{Total\ Contract\ Size}$$

The number of contracts traded in the commodity exchange for the year and total contract volume of the year is given. Contract volume concentration is measured for the year between all the given exchanges in terms of the total number of contracts traded with respect to the total number of commodity contracts traded across all exchanges. The period analysed is 2012-2016. Contract Volume is the total no. of commodity futures and options contracts. The HHI will determine the level of commodity market concentration per year.

5. Results

5.1. Contract Volume - Regions

Table 2 shows the volume of commodity contracts traded in each region. During the period between 2012 and 2016, Asia saw tremendous growth in the volume of traded commodity contracts by 144.22%, followed by Europe with 120.4%. Africa and Turkey displayed 92.2% growth, but the total number of contracts traded were still low in number. North America had a reasonable growth rate of 46.35%, whereas Latin America displayed a negative growth rate of -14.01%.

Table 2: Contract Volume – Regions

Region	2012	2013	2014	2015	2016
Asia	1,823,605,643	2,212,697,689	2,497,395,023	3,536,767,906	4,453,664,421
North America	961,399,350	1,179,065,722	1,094,054,710	1,223,078,382	1,407,073,536
Europe	489,841,445	552,931,828	547,895,364	700,937,578	1,079,612,267
Africa and Turkey	4,396,606	4,494,258	4,244,986	4,928,336	8,451,467
Latin America	3,475,867	3,171,776	3,103,778	2,536,412	2,988,729
Grand Total	*3,282,718,911*	*3,952,361,273*	*4,146,693,861*	*5,468,248,614*	*6,951,790,420*

Note: This data is collected manually from various individual commodity exchange websites.
Source: own research.

5.2. Product Types vs. Exchanges

Table 1 shows the number of total exchanges per region and the number of products traded per exchange. This table gives a clear idea of the ratio of exchanges versus the number of commodity products traded. North America tops the market with 8157 types of tradable commodity products followed by Asia with 2689 types of tradable commodity products. Europe has 1712 commodity product offerings. Africa and Turkey have only 493 types of tradable commodity products followed by South America with only 455 product offerings, despite being commodity-rich regions. There is a clear need for development of commodity exchanges and product offering in Africa, Turkey and South America in order to increase the awareness and hedge the price risk of local commodity producers of those regions.

5.3. Market Concentration – Region Wise

Table 3 shows the HHI values for each location for 2012-2016. The volume concentration for Asia, North America, Europe, Latin America and other (Africa, Turkey) regions are taken as the input parameter for the HHI calculation.

The annual commodity contracts volume of 2012 for all regions amounted to 3,282,718,911 with 0.41 HHI. The volume increased in 2013 to 3,952,361,273 with 0.42 HHI. For 2014, the annual commodity contracts volume for all regions showed the amount of 4,146,693,861 with 0.45 HHI. The volume for 2015 increased to 5,468,248,614 with 0.48 HHI and 2016 showed the volume of 6,951,790,420 with 0.48 HHI.

Table 3: Region-wise – HHI

Specification	2012	2013	2014	2015	2016
HHI	0.41	0.42	0.45	0.48	0.48

Note: The table shows the volume concentration for Asia, North America, Europe, Latin America and other (Africa, Turkey) regions. Market concentration levels are clearly shown in the above data. These results are calculated on the basis of the values presented in Table 3.
Source: own research.

Commodity markets are highly concentrated in some regions of the world, leaving behind others in the development. Our results show that policy-makers in Africa, Turkey and Latin America have an opportunity to develop their commodity exchanges to increase their overall economic growth rate.

5.4. Market Concentration – Exchange Wise

Table 4 shows the HHI values for each exchange for 2012-2016. The volume concentration for all the exchanges specified in dataset 3 is taken as the input parameter for the HHI calculation. The annual commodity contracts volume of 2012 for all exchanges sh amounted to 3,282,718,911 with 0.11 HHI. The volume increased in 2013 to 3,952,361,273 with 0.11 HHI. For 2014, the annual commodity contracts volume for all regions showed the volume of 4,146,693,861 with 0.13 HHI. The volume for 2015 increased to 5,468,248,614 with 0.14 HHI and 2016 showed the volume of 6,951,790,420 with 0.15 HHI.

Our analysis shows moderate market concentration in terms of commodity exchanges across the world. We can improve the overall market competition by focusing on the development of new commodity exchanges in the regions of Africa, Turkey and Latin America.

Table 4: Exchange-wise – HHI

Specification	2012	2013	2014	2015	2016
HHI	0.11	0.11	0.13	0.14	0.15

Note: The table shows the volume concentration for the commodity products traded. Market concentration levels are clearly shown in the above data. These results are calculated on the basis of the values presented in Table 3.
Source: own research.

6. Conclusion

The study shows that the ratio of commodity products available in exchanges is not consistent across various regions of the world. During the analysed period between 2012 and 2016, Asia showed tremendous growth in terms of commodity contracts trade volume, followed by Europe. North America showed moderate constant growth as the market had been well-developed before Asia and Europe. Although Africa and Turkey showed a good growth rate, still these countries need further development in order to catch up with the total number of traded contracts. Surprisingly, Latin America depiceted a negative growth rate.

North America still tops the market with the variety of tradable commodity contracts offered, followed by Asia, Europe, Africa and Turkey, as well as Latin America (in decreasing order). Market concentration from the region's perspective showed a high concentration dominated by regions like North America, Asia and Europe, whereas Latin America, Africa are Turkey are lagging. The exchange-wise market concentration showed a moderate concentration ratio. All the above analyses offer untapped opportunities in the development of commodity markets in regions of Africa, Turkey and Latin America. Policy-makers in these regions should create the environment which will be suitable for the development of commodity markets in order to attain overall economic growth. With the establishment of useful policies by the policy-makers in Africa, Turkey and Latin America, large scale private investors will be attracted to invest in the establishment of private commodity exchanges in these regions.

Development of commodity exchanges in Africa, Turkey and Latin America will also decrease market concentration in terms of both exchanges and regions, thereby contributing to the overall competitiveness of global commodity markets. The study gives a thought of further research to identify a need to analyse the parameters that influence the successful establishment of exchanges with a greater number of commodity products under the exchange. The role of the government, liquidity, exchange regulations and policy pre-requisites are some of the parameters that can be highlighted to initiate further studies. After analysing the results, more questions arise concerning such disparities. What are the factors responsible for the disparities seen?

Our study has identified the existing ratio of the number of exchanges and products ava-

ilable. Thus, providing the base to identify an optimal number of exchanges a country should have for the entire derivative market or specific commodity markets. This can be further extended to a country level exchange with a specific asset class.

The study is limited to examine disparities between products available and a number of exchanges across all regions. Further research may be extended by segregating the disparity between Over-the-Counter (OTC) markets and exchange-traded commodity derivatives. Other issues to be addressed are linkages between the factors affecting derivative exchanges and the commodity products available for the exchange. The correlation between mergers and acquisition of exchanges and the growth of commodity products may also be an area of research. This study gives multiple dimensions of further research on identifying the product mix and concentration ratios in the commodity futures markets and the role of exchanges in the growth of commodity derivatives.

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Appendix – Table 1: Exchange-wise – HHI

Exchange	2012	2013	2014	2015	2016
Shanghai Futures Exchange	365,329,379	642,473,980	842,294,223	1,050,494,146	1,680,711,841
Dalian Commodity Exchange	633,042,976	700,500,777	769,637,041	1,116,323,375	1,537,479,768
Zhengzhou Commodity Exchange	347,091,533	525,299,023	676,343,283	1,070,335,606	901,297,047
New York Mercantile Exchange	431,476,470	427,094,038	415,633,905	503,429,700	618,424,303
Moscow Exchange	22,618,770	36,545,272	20,215,684	123,283,868	466,803,780
ICE Futures Europe	282,120,115	333,595,466	335,485,082	390,679,743	438,905,081
ICE Futures U.S.	141,607,334	386,574,783	307,828,353	304,256,123	303,019,500
Chicago Board of Trade	255,441,570	228,684,657	246,873,523	286,763,094	300,630,935
Multi Commodity Exchange of India	388,751,074	264,627,693	133,751,848	216,346,961	245,077,515
London Metal Exchange	159,719,781	171,099,643	177,151,712	169,540,184	156,491,501
Commodity Exchange (COMEX)	84,989,357	92,130,643	79,644,996	81,786,800	110,102,193
Chicago Mercantile Exchange	33,629,296	31,480,288	35,810,346	34,788,631	33,816,457
Nasdaq NFX				3,523,298	31,950,258
Tokyo Commodity Exchange	25,479,111	26,845,712	21,856,063	24,399,068	26,917,289
National Commodity & Derivatives Exchange	44,885,711	32,435,100	30,141,298	29,545,534	20,339,532
SGX Asiaclear	337,591	660,372	2,962,587	7,919,551	15,619,086
Euronext Derivatives Market		10,552,390	13,165,310	14,295,804	13,758,816
Malaysia Derivatives Exchange	7,443,964	7,992,369	10,201,345	11,026,883	11,464,872

Exchange	2012	2013	2014	2015	2016
ICE Futures Canada	5,039,160	5,688,295	5,676,345	5,720,023	6,431,546
Borsa Istanbul	1,397,073	1,737,293	1,515,027	1,428,271	5,025,387
Nasdaq Commodities	880,917	848,765	1,708,870	3,013,983	3,530,916
Pakistan Mercantile Exchange		4,608,831	3,776,229	3,890,968	3,481,167
JSE Securities Exchange	2,999,533	2,756,965	2,729,959	3,500,065	3,426,080
Thailand Futures Exchange	3,805,018	2,255,001	1,574,234	1,487,506	2,923,276
Minneapolis Grain Exchange	1,239,741	1,483,657	2,177,740	2,315,186	2,185,098
ICE Futures Singapore				167,663	1,998,054
Dubai Mercantile Exchange	1,176,056	1,600,918	2,119,936	1,709,888	1,949,658
Bolsa de Mercadorias&Futuros	2,543,758	2,238,113	2,503,796	1,884,786	1,872,974
Singapore Exchange	256,995	346,303	489,79	654,853	1,413,696
Dubai Gold &Commodities Exchange		533,541	607,783	570,343	971,186
Rosario Futures Exchange	588,654	677,878	363,223	406,268	840,079
Indonesia Commodity & Derivatives Exchange	946,828	934,685	691,238	575,896	558,409
North American Derivative Exchange	232,73	304,924	409,502	495,527	513,163
Osaka Dojima Commodity Exchange	209,765	261,445	309,874	412,875	447,734
ASX 24	572,046	375,1	377,359	481,587	418,614
Mercado a Termino de Buenos Aires	343,064	255,537	236,759	245,318	275,676
Japan Exchange		74,612	132,531	175,45	253,607
Taiwan Futures Exchange	138,379	152,524	97,092	131,595	185,624
New Zealand Futures Exchange	7,207	6,981	10,455	27,702	127,275
Eurex	320,999	275,909	156,462	116,676	115,947
Hong Kong Exchanges and Clearing	2		8,79	55,753	29,171
Borsaltaliana (IDEM)	1,239,219	9,47	8,424	3,779	3,61
Budapest Stock Exchange	4,496	4,913	3,82	3,541	2,616
NYSE Amex					83
Kansas City Board of Trade	5,404,241	5,624,265			
NYSE Liffe US	1,799,234				
NyseLiffe European Derivatives Market	22,937,148				
Tokyo Stock Exchange	60,388				
Hong Kong Mercantile Exchange	1,442,705	156,351			
OCC					
Singapore Mercantile Exchange	1,003,184	414,2	1,301		
Chicago Climate Futures Exchange	21,658				
Korea Exchange	22,655	34,926	10,723	34,703	
Bolsa de Valores de Colombia	391	248		40	
Tokyo Grain Exchange	1,603,076	107,245			
Chicago Board Options Exchange	29	52			
Nasdaq Futures Exchange (PBOT)	518,36				
CBOE Futures Exchange	170	120			
Grand Total	*3,282,718,911*	*3,952,361,273*	*4,146,693,861*	*5,468,248,614*	*6,951,790,420*

Note: This data is collected manually from various individual commodity exchange websites. Blank spaces represent non-availability of data for those years. In some cases, this is the result of commodity exchange closure or the establishment of commodity exchange later.

Source: own research.