

THE GLOBAL MARKET FOR EXCHANGE-TRADED DERIVATIVES: 21ST CENTURY TRENDS, INNOVATION AND FAILURE

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Abstract

Utilizing a comprehensive database spanning 110 exchanges in five geographic regions, we examine trends in trade activity and contract innovation of exchange-traded futures and options over the period 2002–2021. We find that global volume has experienced a ten-fold increase driven by significant increases at Asian and North American exchanges, and primarily in the equity, interest rate and currency asset classes. New contract innovation has been greatest in North America and in the energy and equity asset classes. Further, volume and open interest attributable to new contract innovation have now surpassed those of legacy contracts. Turnover showed a significant increase driven largely by trade activity in Asian markets. Finally, new contract failure rates have been highest at North American exchanges as well as in the interest rate and energy asset classes.

JEL Classification: G12; G13; G15; G23; L11

Keywords: Futures, options, derivatives, volume, open interest

1. Introduction

This study contributes to the special issue honouring Professor Robert I. Webb who has served as editor of the *Journal of Futures Markets* (JFM) for more than two decades. Under his leadership, the JFM has broadened its reputation as a leading field journal in financial economics while expanding interest in derivatives research. Over this same period the global market for derivatives has continued to grow and innovate. To illustrate, coinciding with the time of Professor Webb's assumption of editor duties in June 1998, the notional value of the open interest of exchange-listed futures and options on interest rate, currency and equity instruments stood at \$14.5 trillion, and by June 2021 had grown to over \$87 trillion. The larger OTC derivatives market also grew tremendously from \$72 trillion to \$610 trillion.¹ These parallel developments are not coincidental. Derivatives research has expanded in line with the growth of the market and the generation of data, and at the same time has played a significant role in educating market participants and furthering the acceptance of derivatives among both end users and policy makers as indispensable vehicles for risk transference and price discovery.

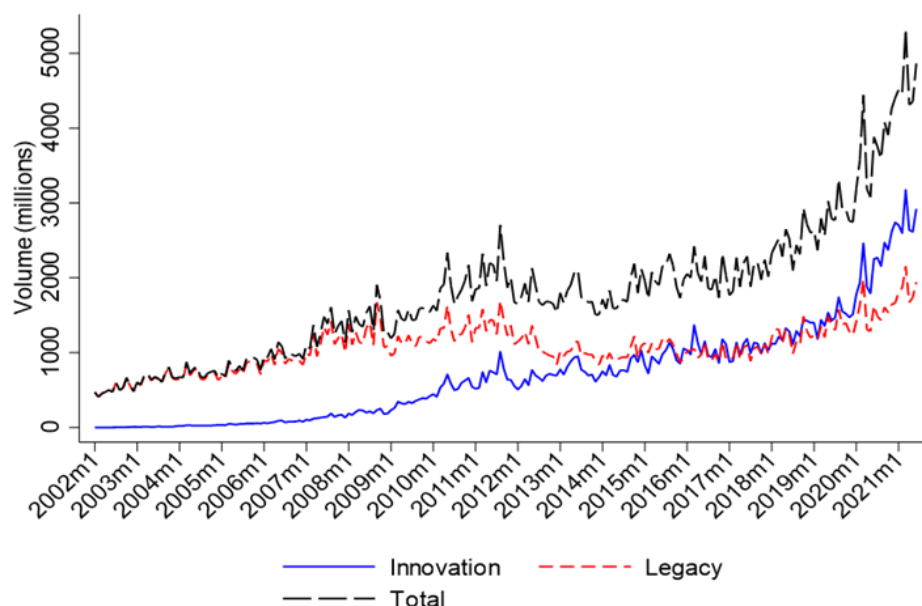
Our purpose in this paper is to provide a largely descriptive examination of how the global market for exchange-traded derivatives has evolved over the past two decades. Our study complements the

¹ See Bank of International Settlements (1999) and https://www.bis.org/publ/otc_hy2111.htm.

work of Emm and Gay (2005) who analyze the global market for OTC derivatives and Gorham and Kundu (2012) who study innovations in U.S. exchange-traded futures. Our analysis is facilitated by a database containing trade volume and open interest information for nearly all futures and option contracts listed on derivatives exchanges across the globe over the period 2002–2021. To help motivate our research questions we present two related illustrations depicting the growth in exchange-traded derivatives. Figure 1a presents the monthly time series of combined futures and option global volume that shows a nearly ten-fold increase from 472 million contracts in January 2002 to 4,866 million contracts in June 2021. The figure further provides volume breakdowns for “legacy” and “innovation” contracts. We deem legacy contracts as those already trading as of January 2002 and innovation contracts as those subsequently introduced.² We see that legacy volume grew to 1,943 million contracts in June 2021, representing 40% of total volume. Interestingly, innovation volume has now surpassed legacy volume, growing from 0 to 2,923 million contracts, or 60% of total volume.

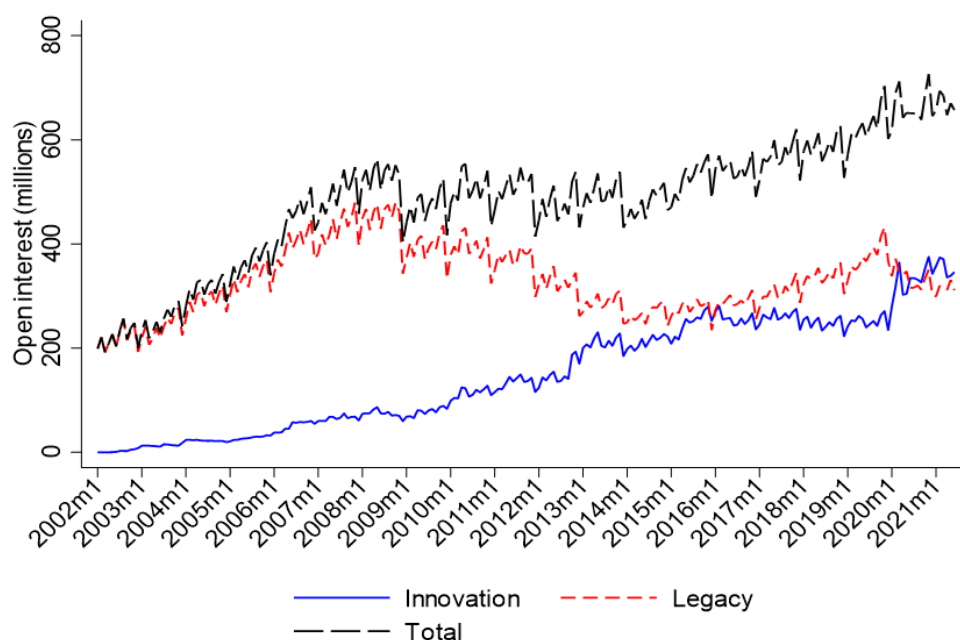
Figure 1b shows that combined futures and options global open interest also grew substantially, but at a much lower rate of about 230%, from 200 million to 657 million contracts. Legacy open interest grew from 200 to 311 million contracts, while innovation open interest grew from 0 to 346 million contracts, also surpassing that of legacy. Comparing total global volume to open interest (i.e., a coarse approximation of scaled turnover), the global ratio in January 2002 was about 236%, but increased by over a factor of three to 740% as of June 2021.

Figure 1A & B: Growth in global monthly volume and open interest: 2002–2021



Note: Figure 1a – Total, legacy and innovation contract volume

² As discussed in Gorham and Kundu (2012), a new contract innovation can fall within a broad spectrum ranging from being a true innovation, an extension of a similar contract at the same exchange, or an imitation of a contract at a competitor exchange.



Note: Figure 1b: Total, legacy and innovation contract open interest

To better understand these observations and other related developments, we explore the following research questions that focus on four primary areas of inquiry:

- (1) To what extent have the major geographic trading regions contributed to market growth and how have their respective market shares evolved over time?
- (2) What has been the attribution to market growth of the various instrument types (futures versus options) and asset classes (agriculture, currency, energy, equity, interest rates and metals)?
- (3) How do the observed increases in global scaled turnover, suggestive of an increase in speculative activity, relate to changes in market composition at the geographic region and asset class levels?
- (4) What has been the extent of new contract innovation, its breakdown by geographic region and asset class, and the associated failure rates of new contracts?

2. Data and Empirical Analysis

We utilize a database created for us by the Futures Industry Association (FIA), which is the leading global trade organization for futures, options, and other centrally cleared derivatives. Our data cover the period January 2002–June 2021 (henceforth “2002–2021” or “study period”) and include information on monthly futures and option trade activity on 110 exchanges in 40 countries spanning multiple (a) geographic regions, including North America, Europe, Asia, Latin America and Other (Greece, Israel, Turkey, and South Africa), and (b) commodity (agriculture, energy, and metals) and financial (currency, equity, and interest rates) asset classes.

2.1 Region Analysis

As noted above, over our study period the global market for exchange-traded derivatives increased approximately ten-fold based on trading volume and about 2.3 times based on open interest. To investigate how the various geographic regions contributed to this growth, we provide in Table 1 regional breakdowns of monthly volume and month-end open interest for the beginning and ending months, January 2002, and June 2021, of our study period. Panel A reports on trade activity of futures, while panel B reports that for options. In panel A we see that in January 2002 global futures volume was 179 million contracts (representing about 38% of total combined futures and options volume).

Europe and North America dominated futures trading with market shares of 41% and 34%, respectively. Asia was a distant third at 17%, while Latin America had a minor 8% market share. By June 2021, total futures monthly volume grew remarkably to 2,258 million contracts (now representing 46% of total combined volume) with all regions experiencing dramatic increases. Still, there were significant changes in market shares. Asia by far has the largest market share at 35%, or a 19% increase. Both Europe and North America declined notably to 17%, while Latin America tripled its market share to about 24%.

Table 1: Regional volume and open interest: January 2002 and June 2021

	January 2002				June 2021				Percentage change in market share	
	Volume	Percent	Open Interest	Percent	Volume	Percent	Open Interest	Percent	Volume	Open Interest
Panel A: Futures										
Asia	30.1	16.8%	6.7	14.6%	798.2	35.4%	47.7	18.2%	18.5%	3.6%
Europe	72.6	40.6%	13.4	29.2%	375.0	16.6%	71.7	27.4%	-24.0%	-1.8%
Latin America	14.2	7.9%	13.7	29.7%	538.7	23.9%	42.0	16.1%	15.9%	-13.6%
North America	60.9	34.1%	11.9	25.9%	374.3	16.6%	79.6	30.4%	-17.5%	4.5%
Other	0.8	0.5%	0.3	0.6%	171.4	7.6%	20.5	7.8%	7.1%	7.2%
Totals	178.7	100.0%	46.0	100.0%	2257.6	100.0%	261.5	100.0%		
Panel B: Options										
Asia	122.2	41.6%	4.3	2.8%	1353.4	51.9%	34.4	8.7%	10.2%	5.9%
Europe	65.3	22.2%	117.0	76.5%	74.9	2.9%	176.4	44.6%	-19.4%	-31.9
Latin America	6.8	2.3%	2.6	1.7%	221.9	8.5%	109.0	27.5%	6.2%	25.8%
North America	92.4	31.5%	26.3	17.2%	948.2	36.3%	69.4	17.5%	4.9%	0.4%
Other	6.9	2.3%	2.8	1.8%	10.5	0.4%	6.4	1.6%	-1.9%	-0.2%
Totals	293.6	100.0%	153.0	100.0%	2608.9	100.0%	395.5	100.0%		

Note: This table reports monthly volume and month-end open interest in millions of contracts by geographic region along with percent market shares for June 2002 and June 2021.

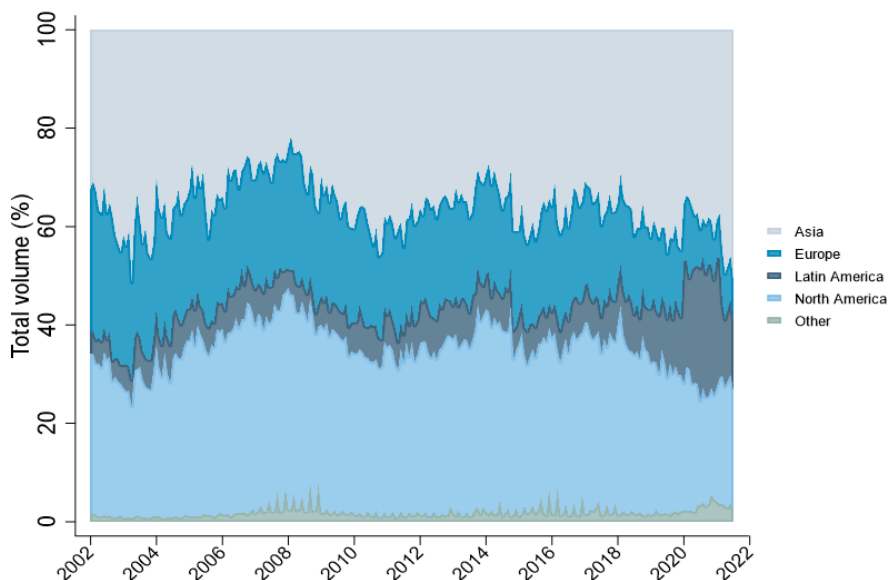
Based on futures open interest, in January 2002, Europe, Latin America and North America had similar levels of market share (26-30%) followed by Asia (15%). In June 2021, North America and Europe remained dominant at 30% and 27%, respectively, while Latin America was at 16%. In contrast to Asia's dominant market share of 35% based on volume, its market share based on open interest was only 18%, suggesting a large increase in turnover.

In panel B, in January 2002 global option volume was about 294 million contracts or 62% of total combined volume. Of this total, Asia had the largest market share (42%) followed by North America (32%) and Europe (22%). Based on option open interest, Europe was largest at 77% followed by North America at 17%. Option volume also grew significantly over time and by June 2021 reached 2,609 million contracts, of which Asia's market share further increased to 52%. North America and Latin American also grew notably to 36% and 9%, respectively, while Europe shrank to a distant fourth at 3%. Based on option open interest, Europe was largest at 45% followed by Latin America 28% and North America at 18%. Similarly, to the trade activity of futures, despite Asia having the largest option volume in June 2021, its market share of option open interest was the lowest of the four main regions at 9%.

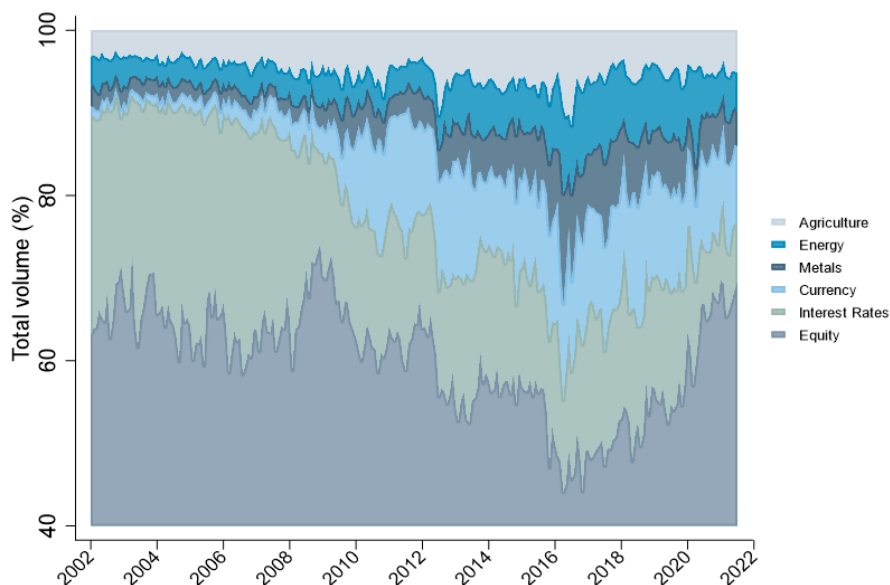
To provide additional context, we present in Figure 2a the time series graph of the regional market shares of combined futures and option global volume. For Asia in the upper portion of the figure, we

observe a reduction in market share from the beginning of the time period up to shortly before the commencement of the financial crisis in late 2007 to early 2008. In contrast, North America shows an increase over the same period. Subsequently, Asia exhibited a general increase to the end of the study period, while North America declined. Europe's market share is somewhat stable throughout the study period but declined notably in early 2020 upon the outbreak of the Covid-19 pandemic. In contrast, Latin America showed a large increase in market share coinciding with the pandemic.

Figure 2 A & B: Monthly market shares of combined futures and option volume: 2002–2021



Note: Figure 2a: Market shares by geographic region



Note: Figure 2b: Market shares by asset class

2.2 Asset Class Analysis

Table 2 (organized similarly to Table 1) compares the breakdowns of both volume and open interest by each asset class. In panel A, in January 2002 interest rate futures volume comprised more than one-half (58%) of all futures volume followed by futures on equity (18%), energy (9%) and agriculture (8%). Currency futures volume comprised a somewhat low 2% market share. By June 2021, we observe several notable changes. While interest rate futures volume more than tripled, its market share dropped dramatically to just 15%. In contrast, equity futures volume increased significantly to 44%. Currency futures volume also increased notably to a 13% market share. Based on open interest, the market share of interest rate futures at the beginning of the study period was largest at 61% followed by equity (18%) and agriculture (9%). At the end of the study period, interest rate futures again had the largest market share (33%) followed by equity (28%) and energy (19%).

Table 2: Volume and open interest by asset class: January 2002 and June 2021

	January 2002				June 2021				Percentage change in market share	
	Volume	Percent	Open Interest	Percent	Volume	Percent	Open Interest	Percent	Volume	Open Interest
Panel A: Futures										
Commodity										
Agriculture	13.7	7.7%	4.2	9.1%	229.5	10.2%	16.5	6.3%	2.5%	-2.8%
Energy	15.3	8.6%	2.5	5.5%	193.5	8.6%	50.6	19.4%	0.0%	13.8%
Metals	10.6	6.0%	1.8	4.0%	216.5	9.6%	12.6	4.8%	3.6%	09.9%
Financial										
Currency	3.2	1.8%	1.2	2.7%	296.1	13.1%	22.0	8.4%	11.3%	5.7%
Equity	31.9	17.9%	8.2	17.7%	992.5	44.0%	73.4	28.1%	26.1%	10.3%
Interest rates	103.9	58.1%	28.0	61.0%	329.5	16.4%	86.3	33.0%	-43.5%	-28.0%
Totals	178.7	100.0%	46.0	100.0%	2257.6	100.0%	261.5	100.0%		
Panel B: Options										
Commodity										
Agriculture	1.4	05%	1.7	1.1%	15.8	0.6%	7.0	1.8%	0.1%	0.7%
Energy	2.0	0.7%	2.0	1.3%	14.8	0.6%	18.1	4.6%	-0.1%	3.3%
Metals	0.6	0.2%	0.7	0.5%	5.4	0.2%	2.6	0.7%	0.0%	0.2%
Financial										
Currency	1.6	0.5%	1.2	0.8%	165.1	6.3%	8.6	2.2%	5.8%	1.4%
Equity	265.6	90.5%	128.4	83.9%	2336.0	89.5%	255.3	64.5%	-0.9%	-19.4%
Interest rates	22.4	7.6%	19.1	12.5%	71.8	2.8%	103.9	26.3%	-4.9%	13.8%
Totals	293.6	100.0%	153.0	100.0%	2608.9	100%	395.5	100.0%		

Note: This table reports monthly volume and month-end open interest in millions of contracts by geographic region along with percent market shares for June 2002 and June 2021.

In panel B of Table 2 for options, in January 2002 the market was dominated by equities with a 91% market share based on volume followed by interest rates at a distant 8%. These market shares changed modestly in June 2021 with equities remaining at 90% and interest rates declining to 3%. Currency options did experience a noticeable increase from 1% to 6%. Based on open interest, options on equities remained dominant throughout the period, followed by interest rates.

We next observe in Figure 2b the time-series graph of the combined futures and option volume for the various asset classes. We noted earlier that North America lost a significant portion of global market share over the study period commencing with the outset of the financial crisis. We observe in the figure

a large decline in the market share of interest rate derivatives, which make up a large portion of North America volume. This trend is consistent with the start of a long-term decline in global interest rate volume. We also observe around the time of the financial crisis a large increase in the market share of currency futures.

2.3 League Tables and Discussion

We report in Table 3 the ten leading derivatives exchanges (by overall volume) at the beginning and ending of the study period. In 2002 the two largest derivatives exchanges were the Korea Exchange and Eurex (Germany).³ Further, six of the top exchanges were based in the U.S. In total, the ten exchanges comprised 83% of global volume. In 2021, the two leading derivatives exchanges were the National Stock Exchange of India and the B3 of Brazil. Further, five out of the ten exchanges were carryovers from 2001. Interestingly, the concentration of trading on these ten leading exchanges fell to 68% of global volume.

Table 3: Exchange league tables: January 2002 and June 2021

Exchange	Country	Volume	Percent
January 2002			
1 Korea Exchange	South Korea	125.9	26.7 %
2 Eurex	Germany	65.3	13.8 %
3 ICE Futures Europe	France	55.6	11.8 %
4 Chicago Mercantile Exchange	US	44.2	9.4 %
5 Chicago Board Options Exchange	US	26.2	5.5 %
6 Chicago Board of Trade	US	22.8	4.8 %
7 NYSE Amex	US	17.7	3.7 %
8 B3	Brazil	15.1	3.2 %
9 International Securities Exchange	US	11.3	2.4 %
10 New York Mercantile Exchange	US	9.2	1.9 %
Other		78.8	16.7 %
Total		472.2	100.0 %
June 2021			
1 National Stock Exchange of India	India	1,229	25.3 %
2 B3	Brazil	751	15.4 %
3 Chicago Mercantile Exchange	US	205	4.2 %
4 Korea Exchange	South Korea	193	4.0 %
5 Shanghai Futures Exchange	China	185	3.8 %
6 Eurex	Germany	168	3.4 %
7 Borsa Istanbul	Turkey	149	3.1 %
8 Moscow Exchange	Russia	147	3.0 %
9 Chicago Board of Trade	US	141	2.9 %
10 Dalian Commodity Exchange	China	140	2.9 %
Other		1,558	32.0 %
Total		4,867	100.0 %

Note: This table reports the top ten futures and options exchanges by trading volume in millions of contracts for January 2002 and June 2021.

In Table 4 we similarly report the ten leading futures and option contracts.⁴ In panel A, in 2002, the Chicago Mercantile Exchange's (CME) Eurodollar futures contract was the most actively traded futures followed closely by the Euro-Bund futures traded on Eurex. Of note, nine of the ten leading futures were from the interest rate asset class. The one exception was the CME's E-mini S&P 500 stock

³ For profiles of the leading exchanges around the start of our study period, see Battley (2000).

⁴ We focus on individual contracts and do not include broad groupings such as "all futures [or options] on individual equities [or ETFs]."

index. In 2021, the leading futures by far was the Mini Ibovespa stock index futures traded on Brazil's B3, which as a result became the second largest exchange by volume as seen earlier in Table 3. Also, the leading contracts represented a significant mix of asset classes. Further, only four futures from 2002 remained in the top ten.

Table 4: Contract league tables: January 2002 and June 2021

Name	Exchange	Country	Asset class	Volume	Percent
Panel A: Futures					
January 2002					
1	Eurodollar	Chicago Mercantile Exchange	US	Interest Rates	19.5 10.9%
2	Euro-Bund	Eurex	Germany	Interest Rates	17.9 10.0%
3	Euro-Bobl	Eurex	Germany	Interest Rates	9.6 5.4%
4	Euro-Schatz	Eurex	Germany	Interest Rates	9.6 5.4%
5	3-Month Euribor	ICE Futures Europe	UK	Interest Rates	8.6 4.8%
6	10-Year Treasury Note	Chicago Board of Trade	US	Interest Rates	5.5 3.1%
7	TIE 28	Mexican Derivatives Exchange	Mexico	Interest Rates	5.5 3.1%
8	E-mini S&P 500	Chicago Mercantile Exchange	US	Equity Index	4.9 2.8%
9	20-Year Treasury Bond	Chicago Board of Trade	US	Interest Rates	4.1 2.3%
10	One-Day Interbank Deposit	B3	Brazil	Interest Rates	4.0 2.2%
	Other			89.4	50.0%
Total				178.7	100.0
June 2021					
1	Mini Ibovespa Index	B3	Brazil	Equity Index	387.2 17.2%
2	Mini US Dollar Spot	B3	Brazil	Currency	71.3 3.2%
3	Eurodollar	Chicago Mercantile Exchange	US	Interest Rates	60.6 2.7%
4	One-Day Interbank Deposit	B3	Brazil	Interest Rates	58.5 2.6%
5	US Dollar/Russian Ruble	Moscow Exchange	Russia	Currency	57.2 2.5%
6	US Dollar/Indian Rupee	National Stock Exchange of India	India	Currency	54.3 2.4%
7	Steel Rebar	Shanghai Futures Exchange	China	Non-Precious Metals	50.6 2.2%
8	Brent Oil	Moscow Exchange	Russia	Energy	35.0 1.5%
9	10-Year Treasury Note	Chicago Board of Trade	US	Interest Rates	33.5 1.5%
10	E-mini S&P 500	Chicago Mercantile Exchange	US	Equity Index	32.5 1.4%
	Other			1,416.9	62.8%
Total				2,257.6	100.0%
Panel B: Options					
January 2002					
1	KOSPI 200	Korea Exchange	South Korea	Equity Index	120.9 41.2%
2	3-Month Eurodollar	Chicago Mercantile Exchange	US	Interest Rates	11.3 3.9%
3	DAX	Eurex	Germany	Equity Index	3.6 1.2%
4	TA-35 Index	Tel-Aviv Stock Exchange	Israel	Equity Index	3.4 1.1%
5	3-Month Euribor	ICE Futures Europe	UK	Interest Rates	3.3 1.1%
6	10-Year Treasury Note	Chicago Board of Trade	US	Interest Rates	2.5 0.9%
7	Euro STOXX 50 Index	Eurex	Germany	Equity Index	2.2 0.7%
8	S&P 500 Index (SPX)	Chicago Board Options Exchange	US	Equity Index	2.2 0.7%
9	All Share Index	JSE Securities Exchange	South Africa	Equity Index	1.7 0.6%
10	Euro-Bund	Eurex	Germany	Interest Rates	1.6 0.5%
	Other			140.9	48.0%
Total				293.6	100.0%
June 2021					
1	Bank Nifty Index	National Stock Exchange of India	India	Equity Index	632.0 24.2%
2	CNX Nifty Index	National Stock Exchange of India	India	Equity Index	332.3 12.7%
3	US Dollar/Indian Rupee	National Stock Exchange of India	India	Currency	115.6 4.4%
4	US Dollar/Indian Rupee	BSE	India	Currency	41.0 1.6%
5	KOSPI 200	Korea Exchange	South Korea	Equity Index	34.2 1.3%
6	S&P 500 Index (SPX)	Chicago Board Options Exchange	US	Equity Index	28.1 1.1%
7	Eurodollar Mid-Curve	Chicago Mercantile Exchange	US	Interest Rates	19.5 0.7%
8	Avg. One-Day Interbank DRI	B3	Brazil	Interest Rates	19.2 0.7%
9	Euro STOXX 50 Index	Eurex	Germany	Equity Index	17.5 0.7%
10	India 50 Index	India International Exchange	India	Equity Index	17.2 0.7%
	Other			1,352.4	51.8%
Total				2,608.9	100.0%

Note: This table reports the top ten futures and options contracts by trading volume in millions of contracts for January 2002 and June 2021.

In panel B, the most actively traded option in 2002 was the KOSPI 200 equity index option. Six of the ten leading contracts were based on equity indices, while the other four were based on interest rates. In 2021, the three leading options all traded on the National Stock Exchange of India with the leading two options based on equity indices. Again, six of the leading options were based on equity indices with two on interest rates and two on currencies.

2.4 Turnover

The above analyses suggest that turnover, at least at the global level, increased notably over our study period. Such change in trade activity could be attributed to several factors. In particular, changes in macro conditions can affect both hedging and speculative demand and, accordingly, the mix of commercial (hedgers) and non-commercial (speculators) participants in a specific contract market, who may each have differing trade horizons.⁵ The change in turnover could also be an artifact of changes in market composition at the region or asset class levels. We focus on this latter dimension to understand whether such fixed effects related to turnover are present.

Table 5: Monthly turnover by geographic region and asset class

Asset class	Asia	Europe	Latin America	North America	Total
Panel A: January 2002					
<i>Commodity</i>					
Agriculture	3.9	0.9	0.8	2.2	2.6
Energy	6.7	5.2	0.7	2.9	3.9
Metals	5.0	5.2	0.3	2.7	4.4
<i>Financial</i>					
Currency	5.6	0.5	1.5	2.5	1.8
Equity	25.3	0.6	3.5	1.7	1.7
Interest rates	2.6	4.8	0.8	2.5	2.6
Total	13.8	1.1	1.2	2.3	2.0
Panel B: June 2021					
<i>Commodity</i>					
Agriculture	19.2	1.7	1.7	4.1	10.5
Energy	26.7	3.6	9.3	1.4	3.1
Metals	21.0	6.6	3.6	6.2	15.2
<i>Financial</i>					
Currency	26.9	12.1	13.3	6.8	17.5
Equity	30.2	1.0	9.2	6.9	7.5
Interest rates	6.1	2.9	1.0	2.7	2.1
Total	26.2	1.8	5.0	3.1	6.1
Panel C: Monthly average					
<i>Commodity</i>					
Agriculture	16.8	1.6	1.6	3.6	8.9
Energy	21.8	3.6	1.1	1.5	3.1
Metals	19.6	6.3	0.3	5.4	13.6
<i>Financial</i>					
Currency	26.8	11.7	11.7	6.0	16.4
Equity	29.7	0.8	9.0	4.9	5.7
Interest rates	4.8	3.4	1.0	2.7	2.2
Total	24.8	1.6	4.7	2.9	5.1

Note: This table reports monthly turnover statistics for January 2002, June 2021, and monthly averages over the period January 2002–June 2021. Turnover is computed as the ratio of monthly volume to month-end open interest.

⁵ Wiley and Daigler (1998) and Ederington and Lee (2002) show that hedgers hold positions longer than speculators in financial and commodity futures, respectively.

For each month in our study period, we compute the scaled turnover for each contract as the ratio of its monthly volume to its month-end open interest.⁶ We require that each contract have a minimum month-end open interest of 100 contracts. We then compute weighted average turnovers at the asset class and region levels, where the weighting is based on the open interest of each contract. We present in panels A, B and C of Table 5 turnover statistics for the beginning and ending months as well as the monthly average over the study period, respectively. In the last row of Panel A for January 2002, we see that Asia had the highest turnover (13.8) of the four major regions, North America (2.3) was a distant second, and Europe (1.1) had the lowest turnover. Further, Asia had the highest turnover in four of the six asset classes. In panel B for June 2021, we observe increases in turnover across all regions and asset classes (with the exception of energy and interest rates) with the increases most pronounced in Asia and to a lesser extent in Latin America. Moreover, Asia had the highest turnover in all asset classes.

To see whether these observations are unique to these two months, we report in panel C the average turnovers across all months and observe consistent findings. To test the hypotheses that all regions and asset classes have equal turnover, we compute *F*-tests on the total row and column values. For regions, the *F*-statistic was a highly significant 10.62 suggesting a strong region fixed effect. On the other hand, the *F*-statistic based on asset classes was an insignificant 1.50.

2.5 New Contract Innovation

Table 6: Total number of contracts: January 2002 and June 2021

Region	Futures	Options	Commodity			Financial			Total
			Agriculture	Energy	Metals	Currency	Equity	Interest rates	
Panel A: January 2002									
Asia	105	28	48	6	8	3	39	29	133
Europe	109	77	23	7	18	11	97	30	186
Latin America	29	11	11	1	2	6	7	13	40
North America	137	122	64	13	14	53	83	32	259
Other	12	12	8	0	0	2	11	3	24
Total	392	250	154	27	42	75	237	107	642
Panel B: June 2021									
Asia	475	85	82	79	104	123	151	21	560
Europe	556	172	20	194	33	44	369	68	728
Latin America	72	24	22	1	1	39	22	11	96
North America	455	237	74	223	54	128	168	45	692
Other	75	30	24	8	13	26	34	0	105
Total	1,633	548	222	505	205	360	744	145	2,181
Panel C: Percent legacy contracts, June 2021									
Asia	7.2 %	15.3 %	3.7 %	3.8 %	1.9 %	0.8 %	19.2 %	42.9 %	8.4 %
Europe	8.3 %	22.1 %	25.0 %	1.5 %	42.4 %	4.5 %	11.1 %	27.9 %	11.5 %
Latin America	13.9 %	16.7 %	18.2 %	0.0 %	0.0 %	10.3 %	18.2 %	18.2 %	14.6 %
North America	14.5 %	21.5 %	48.6 %	2.7 %	16.7 %	20.3 %	15.5 %	31.1 %	16.9 %
Other	8.0 %	33.3 %	33.3 %	0.0 %	0.0 %	7.7 %	17.6 %	n/a %	15.2 %
Total	9.9 %	21.2 %	25.2 %	2.4 %	12.2 %	9.7 %	14.2 %	30.3 %	12.7 %

Note: This table reports in Panels A and B, respectively, the total number of contracts in January 2002 and June 2021 with breakdowns by geographic region, product group and asset class. Panel C reports the percent of legacy contracts still traded as of June 2021.

⁶ Measuring volume on a daily basis, Garcia, Leuthold and Zapata (1986), Etienne, Irwin and Garcia (2015) and Bohl and Stefan (2020) refer to this ratio as the speculation ratio.

Market growth is a function of three inter-related factors: the volume growth of legacy contracts, the degree of new contract innovation and their growth, and the failure rate of both legacy and innovation contracts. We first inspect the number of legacy contracts at the outset of our study period with these statistics reported in Panel A of Table 6. In January 2002 there were 642 actively traded contracts, including 392 futures contracts and 250 option contracts. As shown in panel B, by June 2021 these totals had grown to 2,181 contracts, with futures (1,633) largely outnumbering options (548). Inspecting the distribution across the geographical regions, in January 2002, North America had the largest number of contracts at 259 (40%), followed by Europe with 186 contracts (29%) and Asia with 133 contracts (21%). As of June 2021, while North America still had the largest number of contracts at 692, Asia had the largest increase in the number of contracts at 321%. Further, the global market became less concentrated as Europe, North America, and Asia became more evenly distributed with 728 contracts (33%), 692 contracts (32%), and 560 contracts (26%), respectively.

Panel C of Table 6 reports on the percent of contracts in June 2021 that were originally legacy contracts. We see that only 13% of all legacy contracts were still trading nearly two decades later. Of the four major regions, North America (17%) and Latin America (15%) had the highest percentages of remaining legacy contracts, while Asia had the lowest at 8%. The option survival rate (21%) exceeded that of futures (10%). Among the various asset classes, interest rates had the highest survival rate at 30% and energy had the lowest at 2%.

We report in Table 7 statistics on the extent and sources of new contract innovation. As shown in the last row of panel A, there were 5,715 new contracts, of which North America accounted for 2,482 (43%), followed by Europe (28%) and Asia (20%). North America also had the largest share of both new futures (39%) and options (57%). With respect to innovation in the specific asset classes shown in panel B, Asia was the leader in agriculture (45%) and metals (55%), whereas Europe was the leader in equity (43%) and interest rates (43%). North America was the predominant region for innovation in energy (70%) and to a lesser extent in currency (32%).

Table 7: New contract innovation: February 2002–June 2021

	Number of new contracts						Percent of row totals					
	Asia	Europe	Latin America	North America	Other	Total	Asia	Europe	Latin America	North America	Other	Total
Panel A: Product group												
Future	1,029	1,261	175	1,669	159	4,293	24%	29%	4%	39%	4%	100%
Option	137	361	54	813	57	1,422	10%	25%	4%	57%	4%	100%
Total	1,166	1,622	229	2,482	216	5,715	20%	28%	4%	43%	4%	100%
Panel B: Asset class												
<i>Commodity</i>												
Agriculture	268	90	52	132	53	595	45%	15%	9%	22%	9%	100%
Energy	159	416	7	1,379	12	1,973	8%	21%	0%	70%	1%	100%
Metals	230	55	7	107	20	419	55%	13%	2%	26%	5%	100%
Total	657	561	66	1,618	85	2,987	22%	19%	2%	54%	3%	100%
<i>Financial</i>												
Currency	195	213	56	243	47	754	26%	28%	7%	32%	6%	100%
Equity	259	646	39	497	64	1,505	17%	43%	3%	33%	4%	100%
Interest rates	55	202	68	124	20	469	12%	43%	14%	26%	4%	100%
Total	509	1,061	163	864	131	2,728	19%	39%	6%	32%	5%	100%

Note: This table presents the number of new contract innovations by geographic region, product group and asset class.

2.6 New Contract Failure

Next we examine the failure rates of contract innovations for the different regions and asset classes. We deem a contract to have failed upon the determination of its last month of having positive trading

volume.⁷ For each contract innovation we determine if it failed and, if so, the time to failure. We present in Table 8 the failure rates for futures and options combined.⁸ In the last row of the table we see that the overall failure rate was 68% or about two-thirds of all new contracts. Approximately 21% of contracts failed within their first year of trading, 48% within 5 years, and 62% within 10 years.

Table 8: New contract failure rates: February 2002-June 2021

Failure within	Number of contracts	Failure rate	Cumulative failure rate
1 year	1,221	21%	21%
2 years	518	9%	30%
3 years	434	8%	38%
4 years	318	6%	44%
5 years	244	4%	48%
6 years	228	4%	52%
7 years	140	2%	54%
8 years	161	3%	57%
9 years	128	2%	59%
10 years	133	2%	62%
11 years	88	2%	63%
12 years	68	1%	64%
13 years	43	1%	65%
14 years	39	1%	66%
15 years	25	0%	66%
16 years	32	1%	67%
17 years	24	0%	67%
18 years	15	0%	68%
19 years	9	0%	68%
Total failures	3,868	68%	
Total new contracts	5,715		

Note: This table reports failure rates by years of trading for all new contract innovations from February 2002 to June 2021.

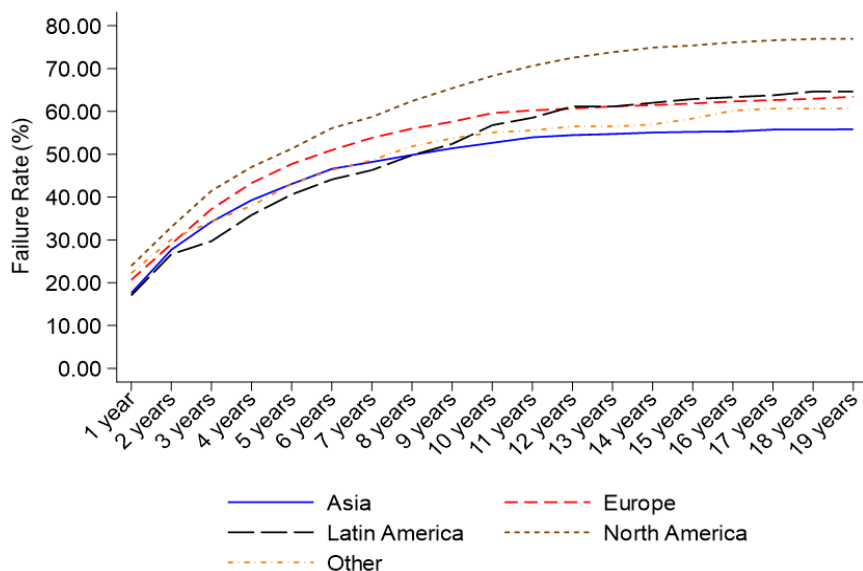
We illustrate in Figure 3a the failure rates by region. While North America had the largest number of contract innovations (2,482), it also had the highest failure rate at all times to failure. To illustrate, its one- and ten-year failure rates were 24% and 68%, respectively, and its overall failure rate was about 77%. Latin America had the lowest one-year failure rate (17%), while Asia had the lowest long-term failure rate at 56%.

⁷ Our defining of contract failure does not necessarily imply a contract was otherwise a "success." There is a literature proposing alternative measures as to what constitutes a successful contract at an exchange. For a summary of this literature, see Gorcham and Kundu (2012).

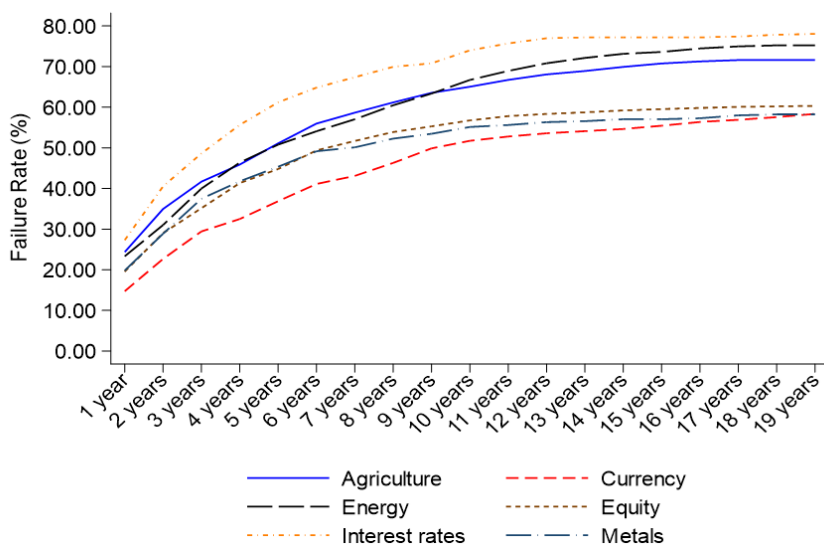
⁸ In results not reported, we find little overall differences in the failure rates of futures and options separately and, hence, report results for futures and option failures combined.

For failures by asset class, we show in Figure 3b that interest rates had the highest failure rate at all times to failure with a 78% long-term failure rate and that 27% of these contracts failed within one year. Energy and agriculture contracts also had relatively high failure rates at most of the times to failure. Interesting, metals had relatively high short-term failure rates, but its long-term failure rate was among the lowest.

Figure 3 A & B: New contract failure rates by years to failure



Note: Figure 3a: Failure rates by region



Note: Figure 3b: Failure rates by asset class

5. Conclusion

We document a dramatic growth in global trade activity of exchange-traded derivatives over the 2002–2021 period. For futures, volume and open interest grew by factors of 12.6 and 5.7, respectively, while for options the growth factors were 8.9 and 2.6, respectively. While all major trading regions

experienced significant growth in volume, Asia and Latin America were the largest contributors followed by North America. Similarly, there was significant growth in all asset classes with equity and currency derivatives showing the largest increase and with interest rate derivatives the lowest, perhaps due to a generally declining and low interest rate environment over a significant portion of the study period.

Noting the disparity in growth between volume and open interest over the study period, we find that scaled turnover at the global level increased by a factor of three. While we do not assert that this was necessarily driven by a general increase in speculative trading, we do find that this increase in turnover was prevalent across all regions and asset classes. Of note, Asia was the largest contributing region, while currency and metals had the largest turnover among asset classes.

We also document the importance to market growth of new contract innovation. We find that North American exchanges accounted for 43% of all new contracts, followed by exchanges in Europe (28%) and Asia (20%). With respect to specific asset classes, Asia led in the growth of agriculture and metal derivatives, Europe led in equity and interest rates, and North America led in the innovation of energy and currencies. Finally, we find an overall long-term failure rate of 68% in new contract innovations. Failure rates were highest in the North American region (77%) and in the interest rates (78%) and energy (75%) asset classes.

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