J.P.Morgan

November 8, 2022

Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

Source for data: J.P.Morgan Quantitative and Derivatives Strategy, Bloomberg Finance L.P.

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See Pages 32-35 for a full team list, contact details and legal affiliations.

Summary of Global Equity Index Futures Roll Cost (as the end of October 2022)

	Region / Index	Futures Ticker	Roll Frequency	Upcoming Roll Last Trading Day	Roll Cost (Annualized) Last	Past 1Y Avg	Avg since 2007*	Percentile*
Asia Pacific	TOPIX	TP	Quarterly	08-Dec-22	-0.67%	-0.47%	-0.28%	18%
	Nikkei 225	NK	Quarterly	08-Dec-22	-0.54%	-0.41%	-0.10%	15%
	JPX-Nikkei 400	JPW	Quarterly	08-Dec-22	-0.67%	-0.50%	-0.32%	13%
	S&P ASX 200	XP	Quarterly	15-Dec-22	0.01%	0.02%	0.12%	27%
	KOSPI 200	KM	Quarterly	08-Dec-22	-0.51%	-0.16%	0.14%	13%
	Thai SET 50^	BC	Quarterly	29-Dec-22	-0.93%	-0.10%	-0.54%	27%
	MSCI EM Asia	ANSA	Quarterly	16-Dec-22	-0.15%	-	-	-
	Hang Seng	HI	Monthly	29-Nov-22	-0.67%	-0.76%	0.09%	17%
	Hang Seng China Enterprises	HC	Monthly	29-Nov-22	1.03%	0.32%	0.07%	89%
	FTSE China A50	XU	Monthly	29-Nov-22	-2.73%	-2.47%	-2.24%	35%
	CSI 300	IFB	Monthly	18-Nov-22	-2.61%	-3.19%	-4.10%	62%
	CSI 500	FFD	Monthly	18-Nov-22	-5.78%	-7.13%	-14.16%	93%
	SSE50	FFB	Monthly	18-Nov-22	-0.56%	-0.78%	-4.09%	80%
	MSCI Taiwan	HJA	Monthly	29-Nov-22	-1.46%	-0.25%	-0.18%	16%
	FTSE Taiwan	TWT	Monthly	29-Nov-22	-2.83%	-0.62%	0.00%	4%
	Taiwan TAIEX	FT	Monthly	16-Nov-22	-5.58%	-1.45%	-1.40%	6%
	S&P CNX NIFTY (NSE)	NZ	Monthly	24-Nov-22	-4.92%	-1.61%	-2.05%	14%
	S&P CNX NIFTY (SGX)	IH	Monthly	24-Nov-22	-5.46%	-2.05%	-2.01%	14%
	MSCI Singapore	QZ	Monthly	29-Nov-22	-1.94%	-0.50%	0.43%	1%
	KLCI	IK	Monthly	30-Nov-22	-1.76%	-0.94%	-0.77%	26%
	Hang Seng Tech	HCTA	Monthly	29-Nov-22	0.21%	-	-	-
	MSCI China A50	MCYA	Monthly	18-Nov-22	-2.43%	-2.79%	-0.41%	9%
Europe	Euro Stoxx 50	VG	Quarterly	16-Dec-22	-0.53%	-0.55%	0.08%	2%
	FTSE 100	Z	Quarterly	16-Dec-22	-0.10%	0.07%	-0.16%	47%
	DAX	GX	Quarterly	16-Dec-22	-0.44%	-0.35%	-0.02%	8%
	SMI	SM	Quarterly	16-Dec-22	0.10%	-0.01%	-0.27%	90%
	FTSE MIB	ST	Quarterly	16-Dec-22	-0.39%	-0.24%	0.19%	6%
	SX7E	CA	Quarterly	16-Dec-22	-0.21%	-0.16%	0.92%	5%
	CAC	CF	Monthly	18-Nov-22	-0.31%	-0.29%	-0.13%	19%
	OMX	QC	Monthly	18-Nov-22	-1.20%	0.00%	0.12%	1%
	AEX	EO	Monthly	18-Nov-22	-0.38%	-0.10%	0.05%	8%
	IBEX	IB	Monthly	18-Nov-22	-0.37%	-0.51%	-0.15%	27%
Americas	S&P 500 Emini	ES	Quarterly	16-Dec-22	0.11%	0.32%	0.38%	6%
	S&P Mid 400 Emini	FA	Quarterly	16-Dec-22	-0.49%	-0.17%	0.23%	0%
	Russell 2000 Mini	RTY	Quarterly	16-Dec-22	-0.48%	-0.13%	-0.21%	34%
	NASDAQ 100 E-Mini	NQ	Quarterly	16-Dec-22	0.07%	0.29%	0.38%	2%
	DJIA Mini E-CBOT	DM	Quarterly	16-Dec-22	0.13%	0.32%	0.44%	4%
	S&P/TSX 60	PT	Quarterly	15-Dec-22	-0.83%	-0.66%	-0.28%	0%
	MSCI EM Mini	MES	Quarterly	16-Dec-22	-0.41%	-0.20%	0.43%	2%
	MSCI EAFE	MFS	Quarterly	16-Dec-22	-0.18%	-0.14%	0.24%	16%

*Average of roll cost and percentile of the latest roll cost based on the data since 2007 (since Jun-09 for US listed futures, since Sep-11 for MSCI EM, since Sep-12 for MSCI EAFE, since 2010 for S&P/TSX 60, since Jul-12 for MSCI Indonesia, since Nov-10 for FTSE China A50, since May-10 for CSI 300 and since Jan-16 for CSI 500/SSE50). **For China, Korea, Taiwan, India, Malaysia, Indonesia and Thailand, the roll costs in the table above are based on offshore rates. ^ S&P ASX 200 and Thai SET 50 futures now have monthly contracts while their liquidity has yet to pick up.

Contents:

Please note we transitioned our roll cost calculations and restated historical roll cost figures from a LIBOR to SOFR rate basis in the US, and from EONIA/CHF LIBOR to ESTR/SARON rates in Europe, due to LIBOR's discontinuation as a reference rate. See our December US and Europe Roll Outlooks for details

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Methodology and Definitions

Investors wishing to extend their equity index exposure beyond the futures contract expiry must roll their futures position by liquidating their near-month position and re-establishing a position in the contract with a later expiry date. The actual roll spread can be at a premium or a discount to the theoretical fair spread. All the roll cost figures in this report are for long futures positions. The cost for rolling a short futures position would be the opposite of that of a long futures position. Positive roll costs for a long roller represent long-rolling at a premium (rich) to fair value whereas negative roll costs represent long-rolling at a discount (cheap) to fair value. Hence, positive roll costs are actually beneficial to a short roller and vice versa.

Futures Fair Value

The futures fair value is calculated by the cost of carry method, i.e. the cash price plus financing charges, less cash dividends received net of taxes:

$$Futures\ Fair\ Value = Underlying\ Spot + Interest - Net\ Cash\ Dividend$$

$$Interest = Underlying\ Spot \times Interest\ Rate \times (Days\ to\ Expiry / 365) \quad and \quad Net\ Cash\ Dividend = \sum_{i=1}^{n} \{Index\ Shares_i \times Cash\ Dividend\ Per\ Share\ Before\ Expiry_i \times (1 - Tax\ Rate)\}$$

Roll Cost*

The cost of rolling futures contracts is computed as the volume weighted average premium/discount to estimated fair value of the futures roll spread during the roll period*

$$Futures\ Roll\ Cost = \frac{\sum_{i=1}^{n} Volume_i \left(\frac{Actual\ Roll\ Spread_i - Fair\ Roll\ Spread_i}{Cash_i} \right)}{\sum_{i=1}^{n} Volume_i}$$

$$Actual\ Roll\ Spread_i = Futures\ Price_{NextContract\_i} - Futures\ Price_{NearContract\_i}$$

$$FairRollSpread_i = FairValue_{NextContract\_i} - FairValue_{NearContract\_i} \quad or \quad Actual\ levels\ traded\ in\ the\ spread\ market\ (if\ available)$$

where "i" represents the relevant observation day in the roll period and "n" represents the total number of observation days in the roll period. For roll cost calculation, we use the last ten trading days prior to the expiry (excluding the last trading day) as the roll period. Since liquidity is usually greatest in the nearest month contract, investors normally roll from the near month to the next near month contract which becomes the most liquid contract as the near month contract approaches expiry. The formula above represents the futures rolls cost for a long futures position. The cost for rolling a short futures position would be the opposite of that of a long futures position.

Interest rate and cash dividend withholding tax assumptions are stated for each index futures in page 3-18. Offshore interest rates are used for Korea, Taiwan, India, Malaysia, Indonesia and Thailand. For Korea, Taiwan and India, we also show roll costs based on onshore rates due to the high levels of activities by onshore investors.

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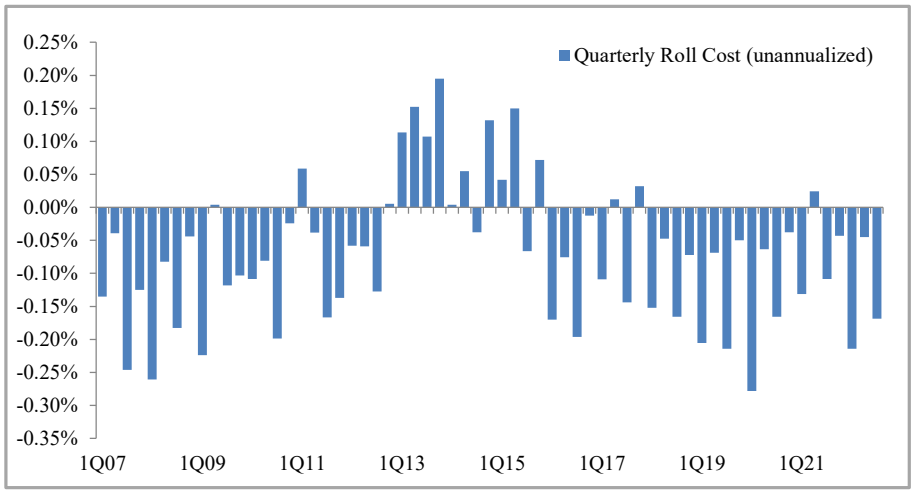
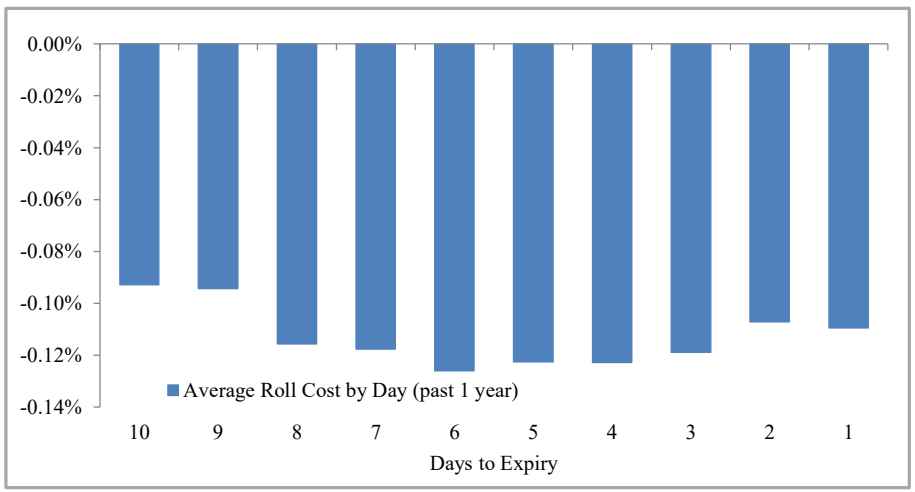
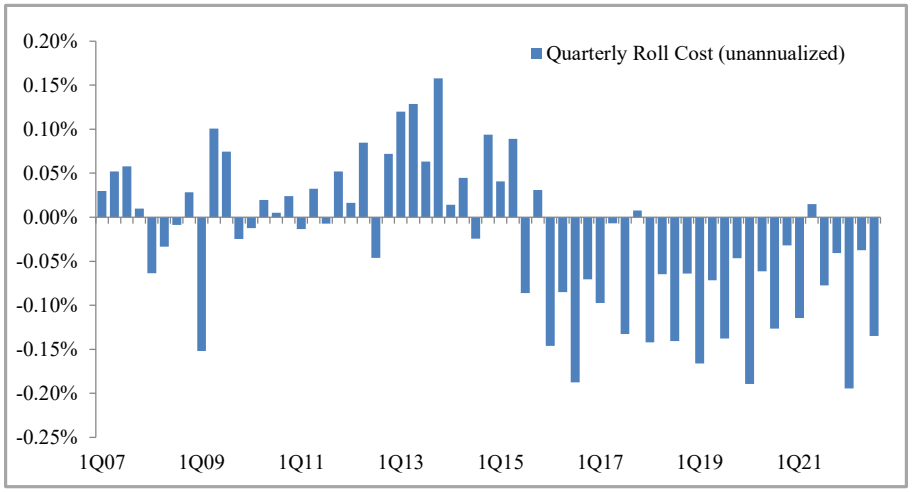
TOPIX

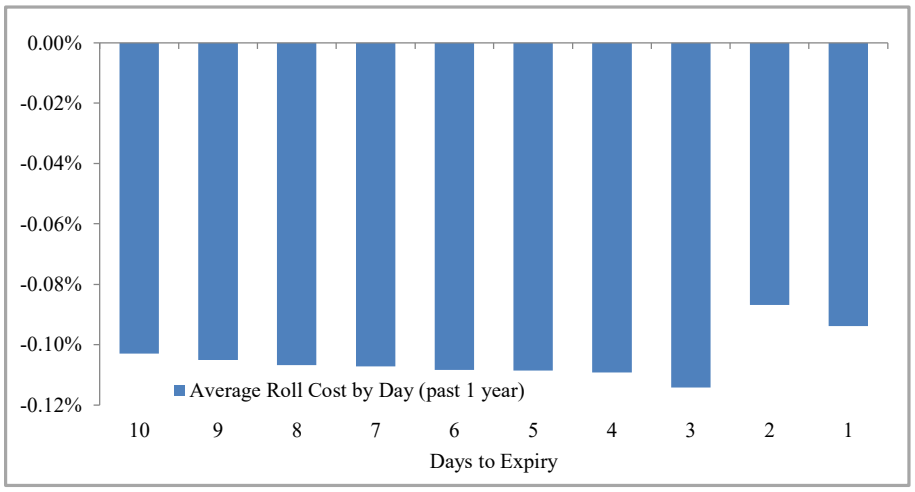




Interest rate: JPY swap rates (Bloomberg ticker: JY0003M <Index>) / Cash withholdings tax rate: 15.315%

Nikkei 225





Interest rate: JPY swap rates (Bloomberg ticker: JY0003M <Index>) / Cash withholdings tax rate: 15.315%

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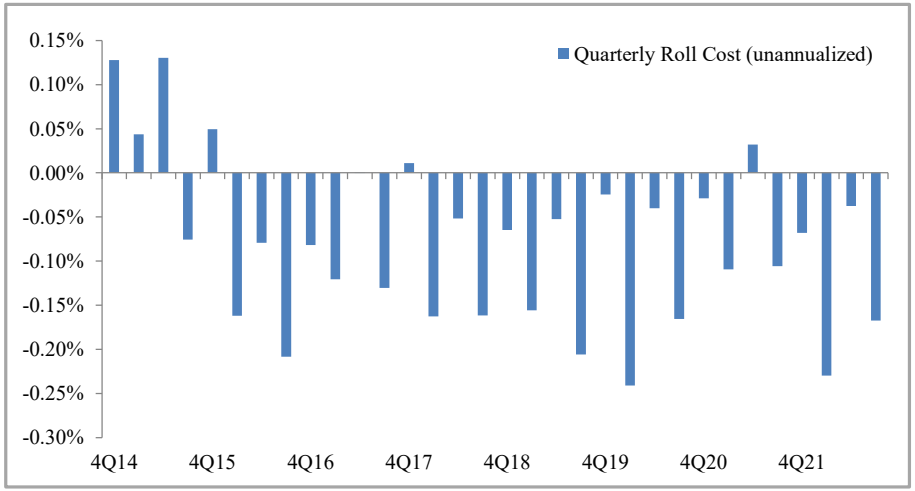
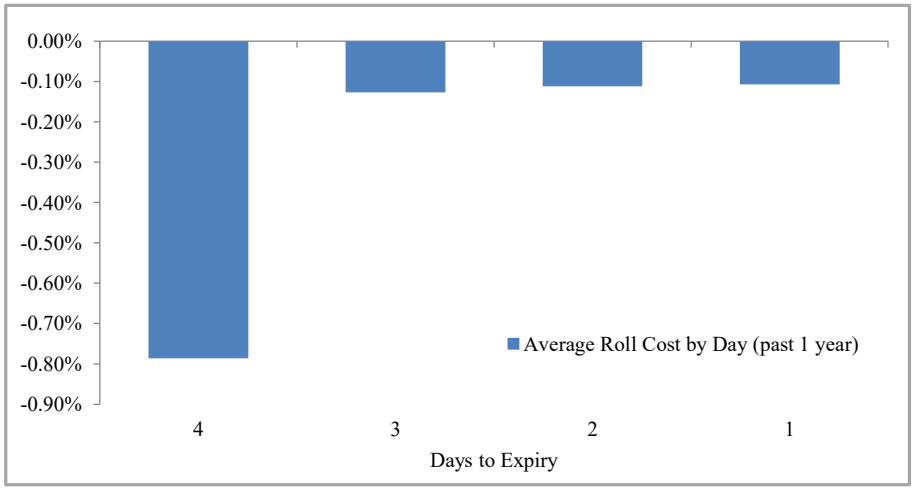
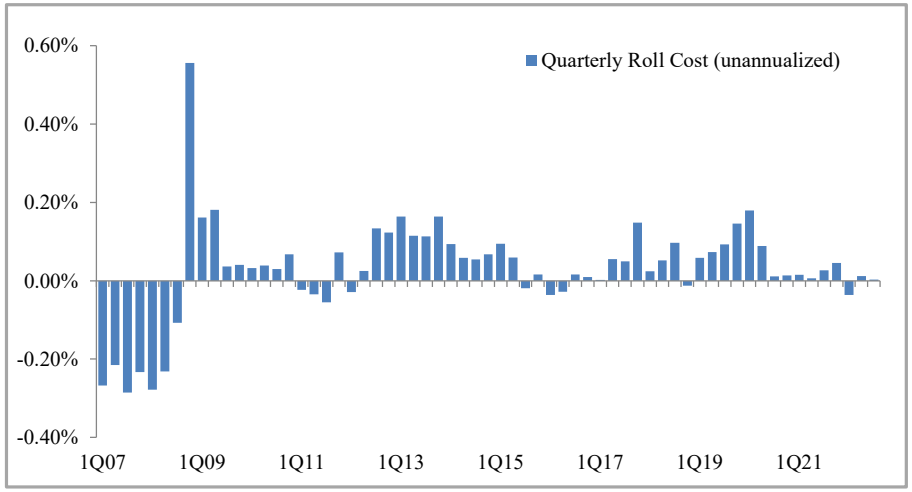
JPX-Nikkei 400

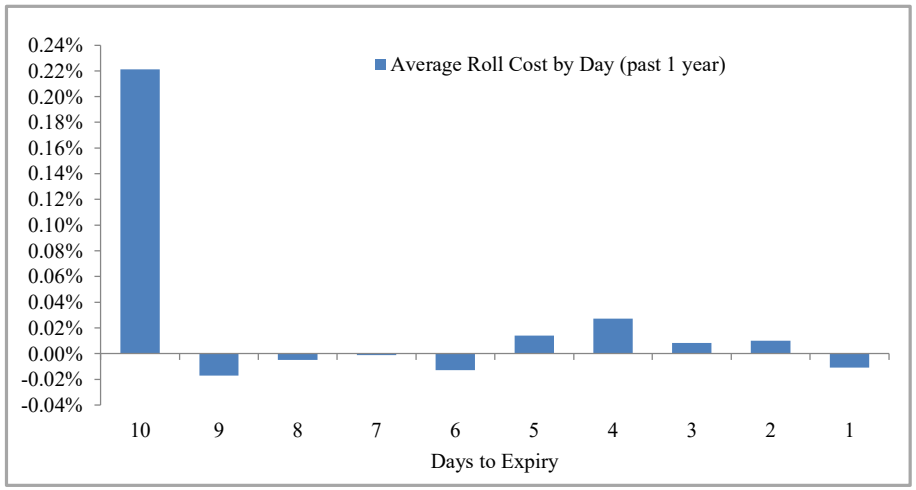




Interest rate: JPY swap rates (Bloomberg ticker: JY0003M <Index>) / Cash withholdings tax rate: 15.315%

S&P ASX 200





Interest rate: Australian bank bill rates (Bloomberg ticker: BBSW3M <Index>) / Net dividends excluding franking credits

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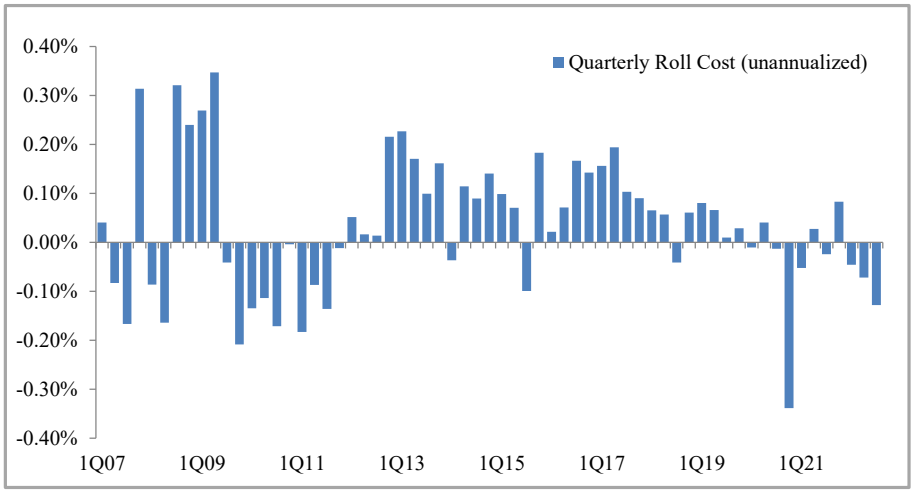
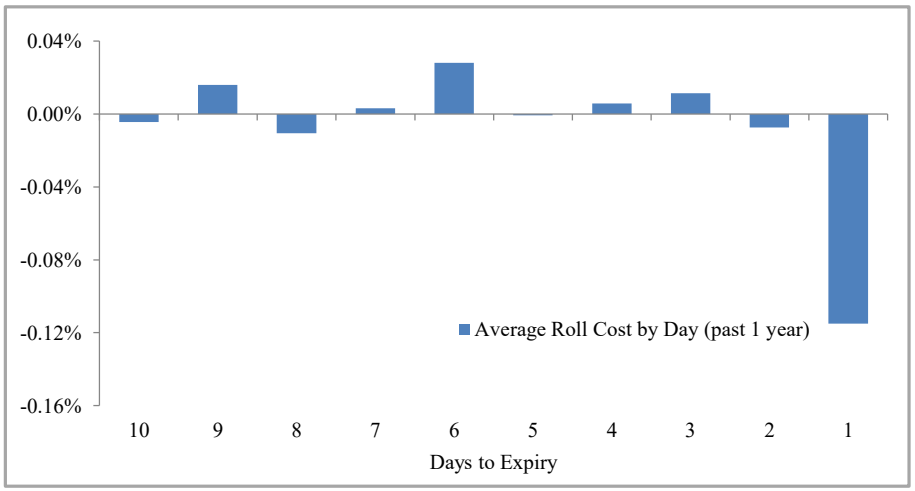
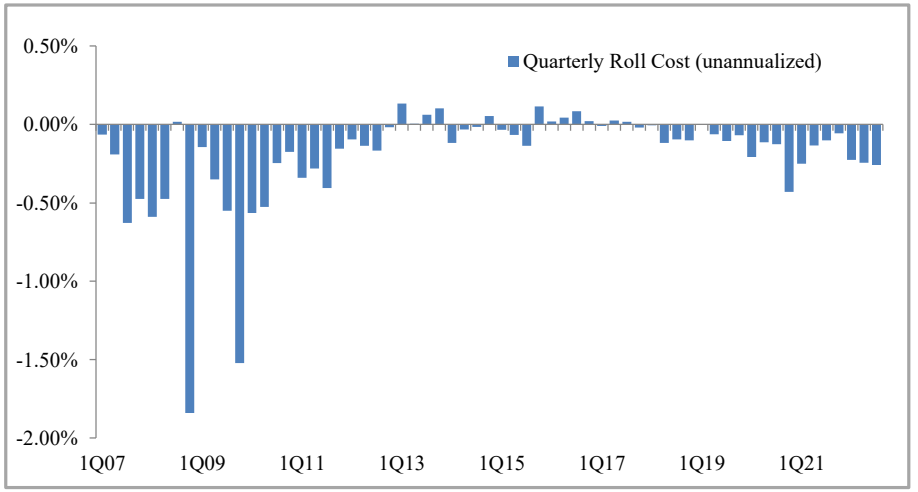
KOSPI 200 - Offshore

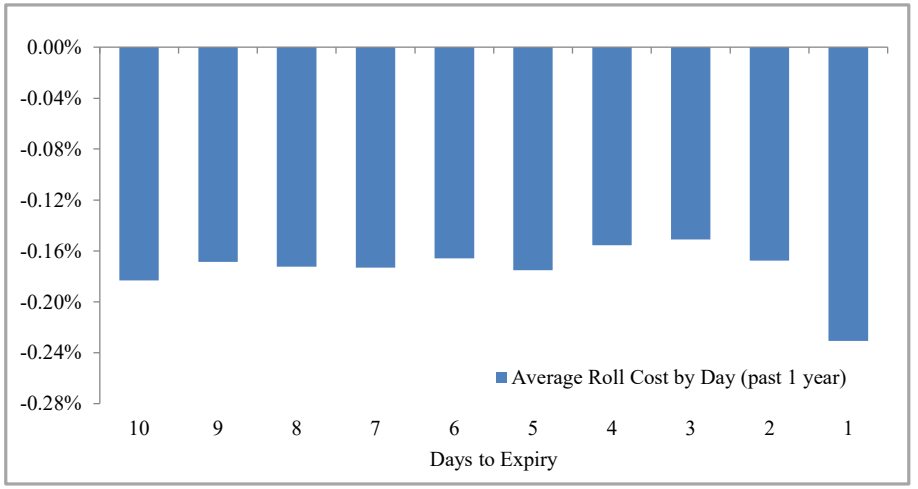




Interest rate: Offshore KRW NDF (Bloomberg ticker: KWNI3M <Curncy>) / Cash withholdings tax rate: 15%

KOSPI 200 - Onshore





Interest rate: KRW 3M CD rate (Bloomberg ticker: KWCDC <Curncy>) / Cash withholdings tax rate: 15%

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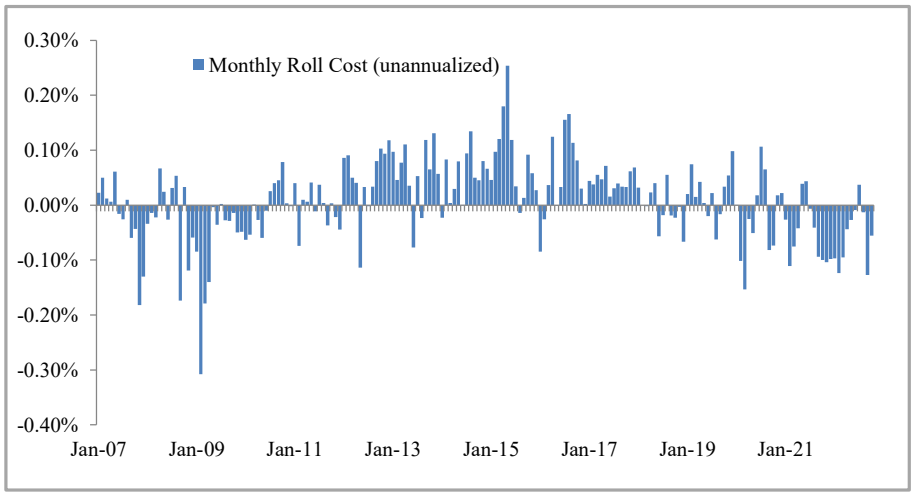
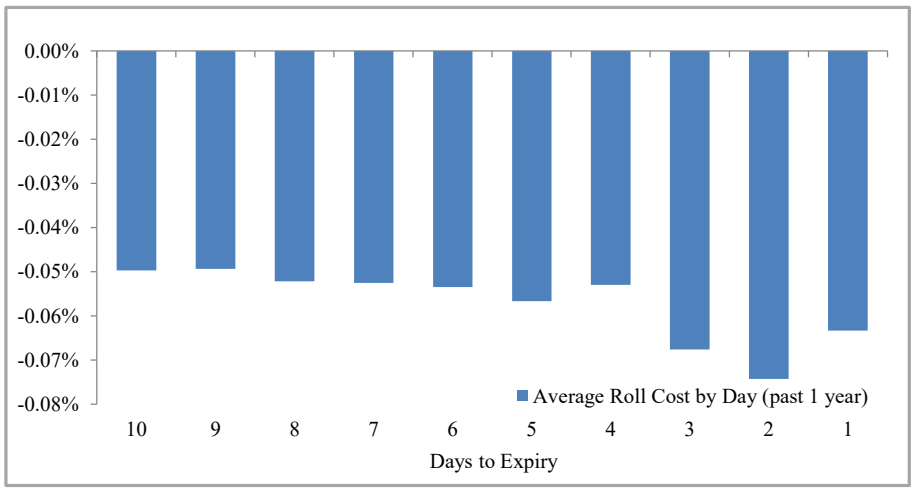
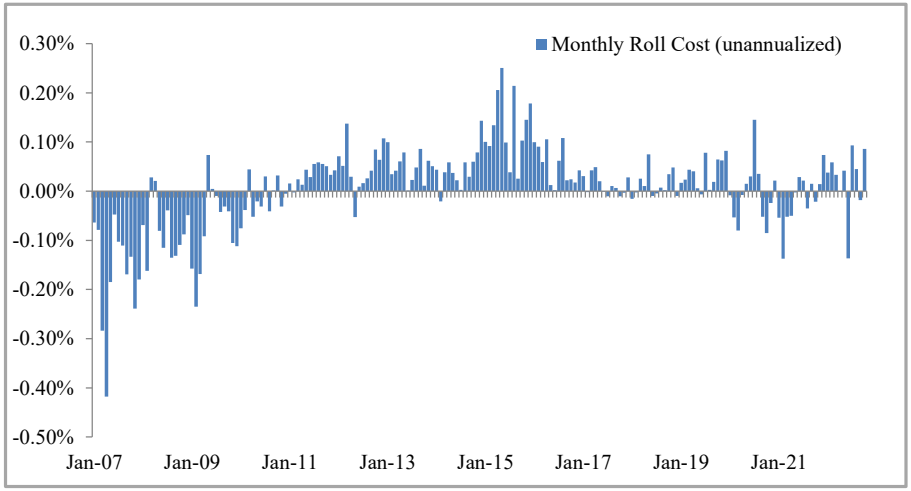
Hang Seng

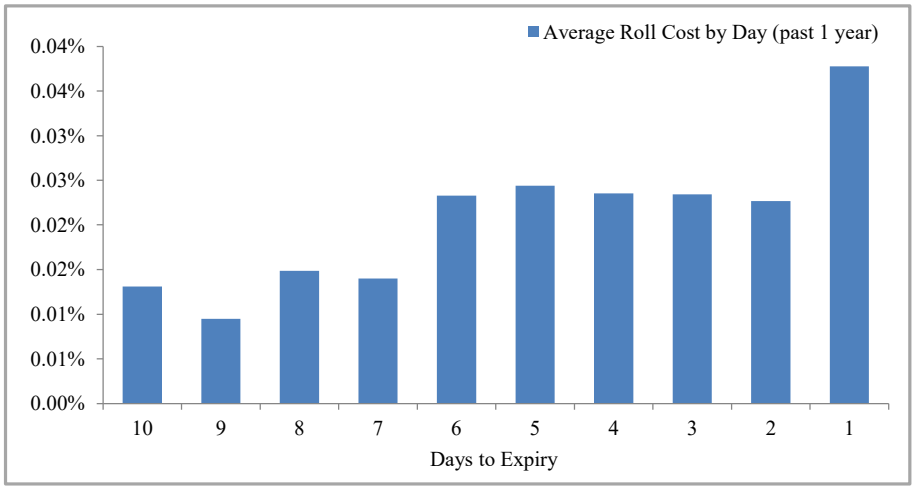




Interest rate: HIBOR (Bloomberg ticker: HIHD01M <Index>) / Cash withhodlings tax rate: 10% for H-shares and Red chips

Hang Seng China Enterprises (H-shares)





Interest rate: HIBOR (Bloomberg ticker: HIHD01M <Index>) / Cash withholdings tax rate: 10%

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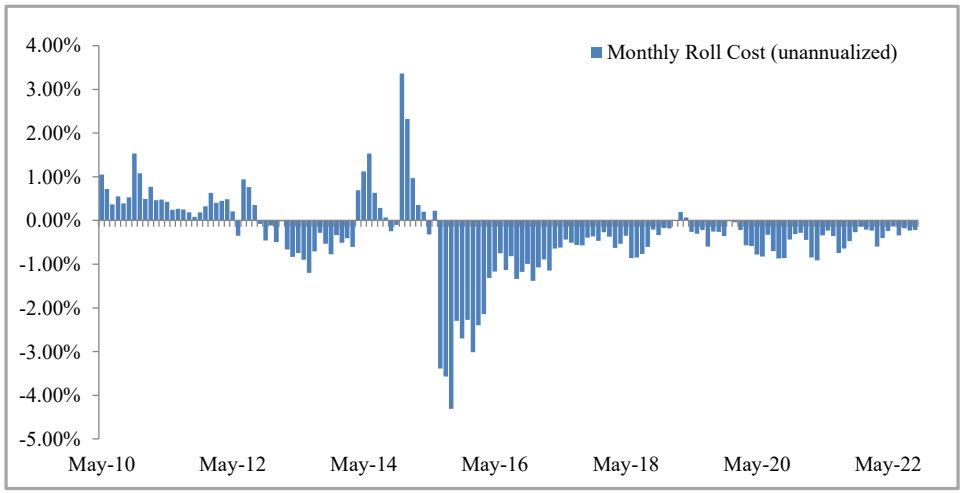
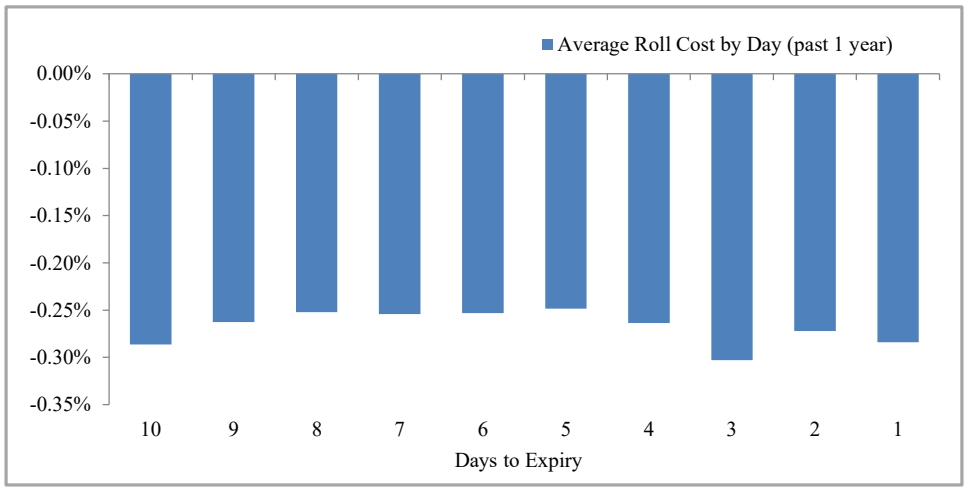
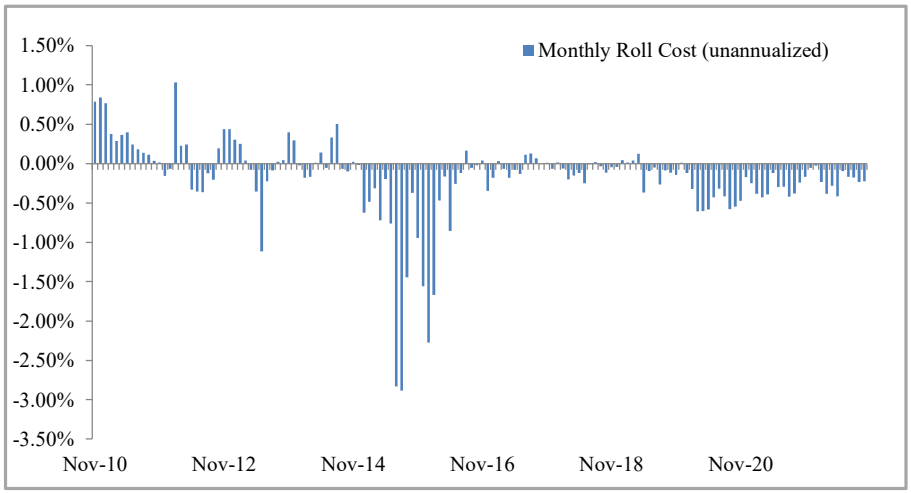
CSI 300 (SHSZ300) - Offshore

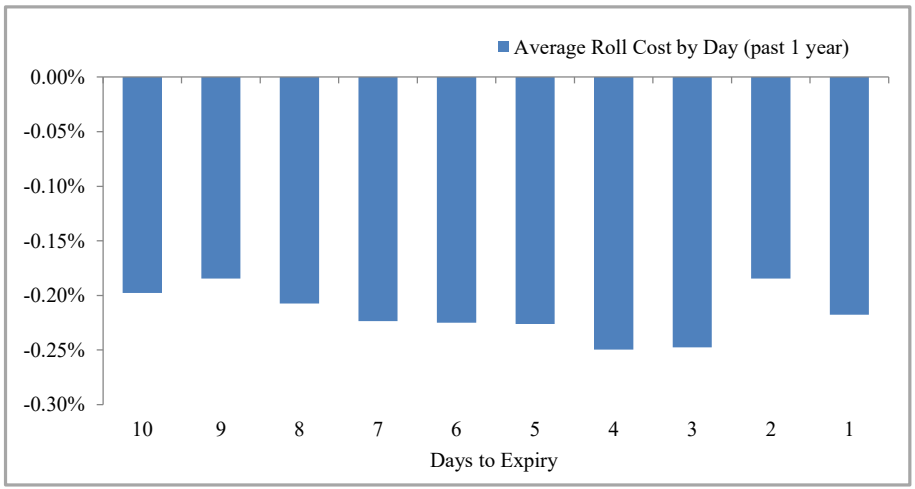




Interest rate: Offshore CNH Rate (Bloomberg ticker: CNHI1M <Curncy>) / Cash withholdings tax rate: 10%

SGX FTSE China A50 (XIN9I) - Offshore





Interest rate: Offshore CNH Rate (Bloomberg ticker: CNHI1M <Curncy>) / Cash withholdings tax rate: 10%

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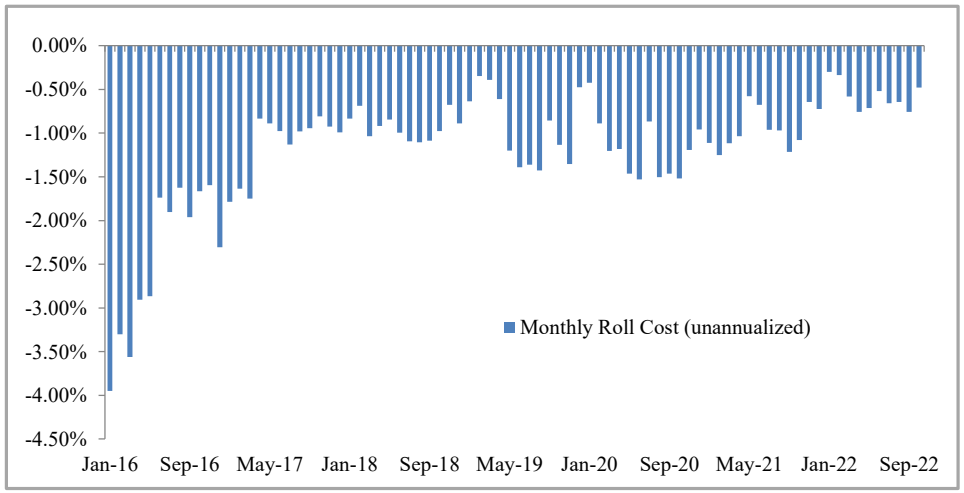
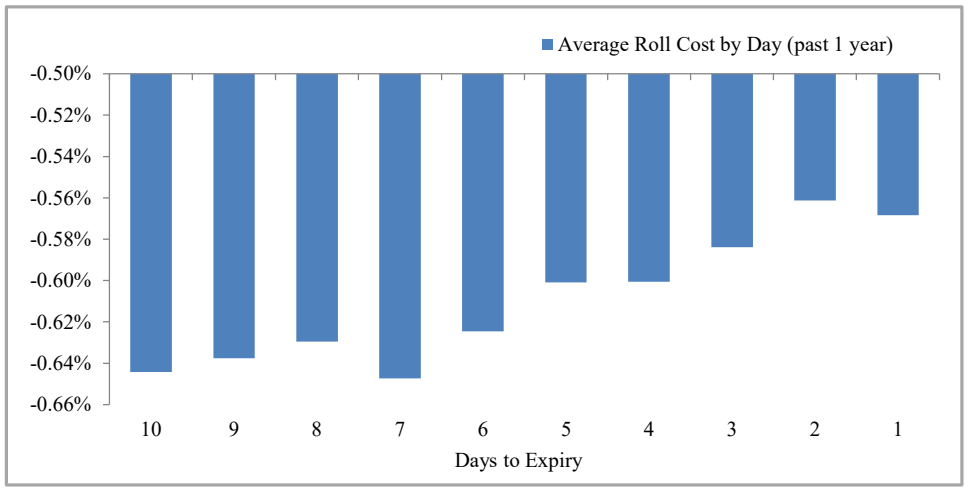
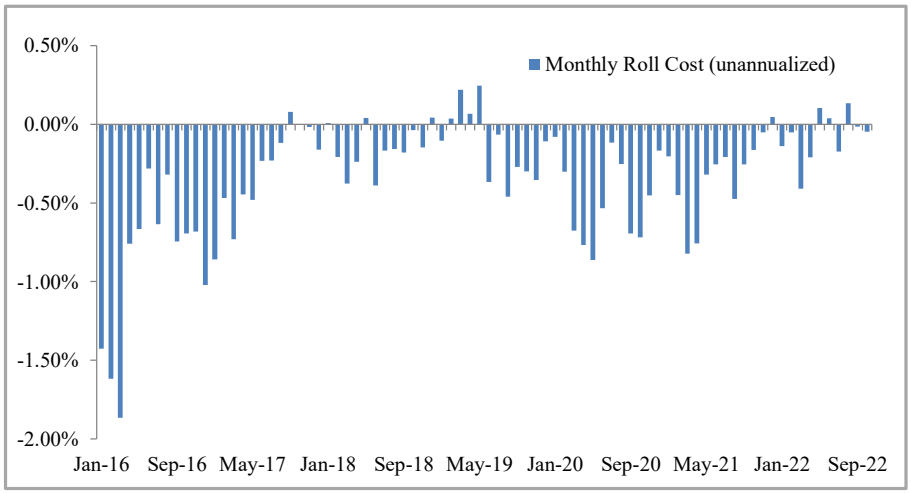
CSI 500 (SH000905) - Offshore

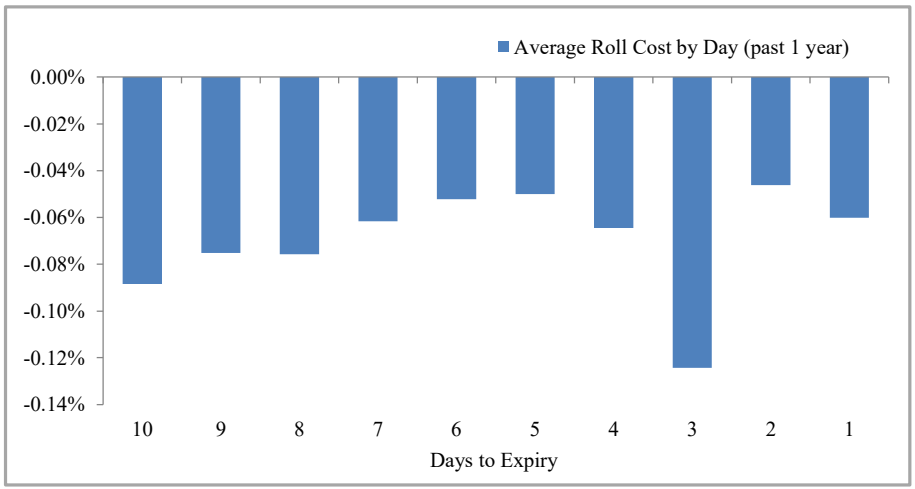




Interest rate: Offshore CNH Rate (Bloomberg ticker: CNHI1M <Curncy>) / Cash withholdings tax rate: 10%

SSE50 - Offshore





Interest rate: Offshore CNH Rate (Bloomberg ticker: CNHI1M <Curncy>) / Cash withholdings tax rate: 10%

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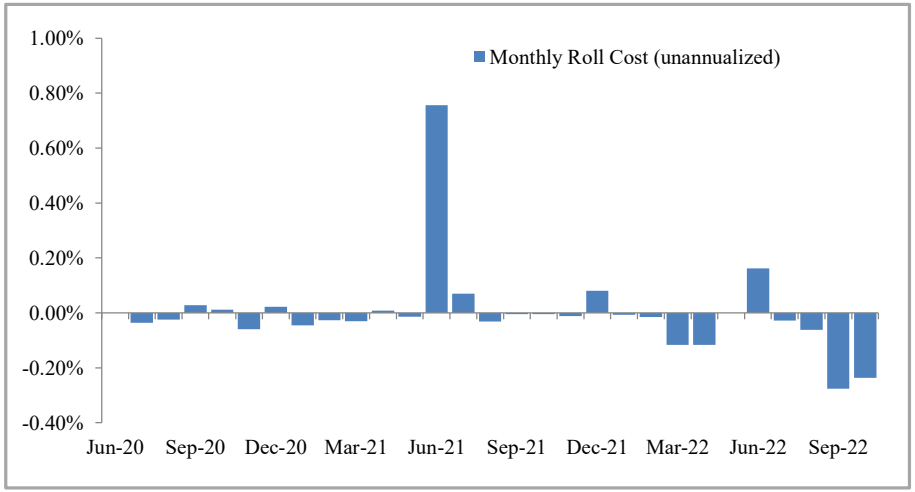
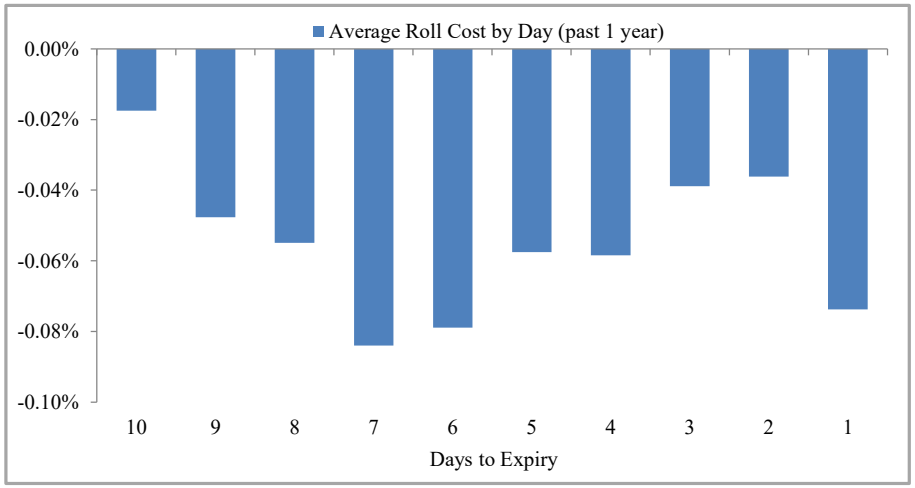
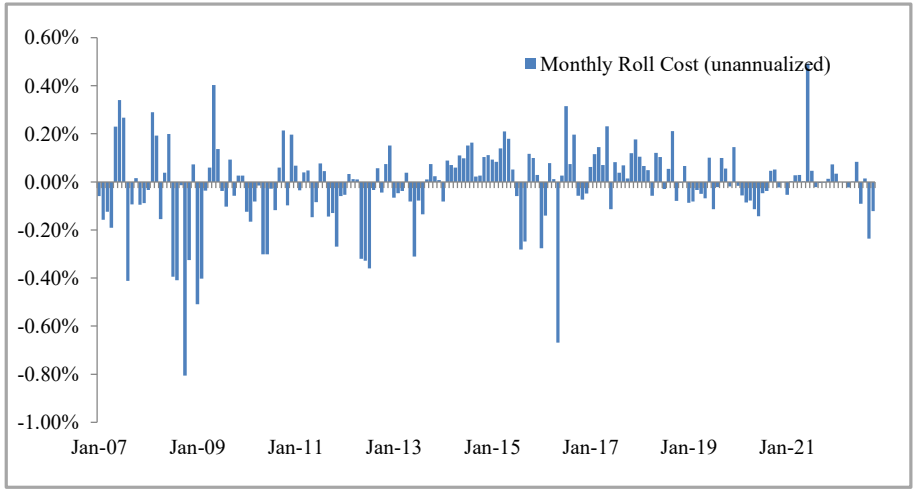
FTSE Taiwan

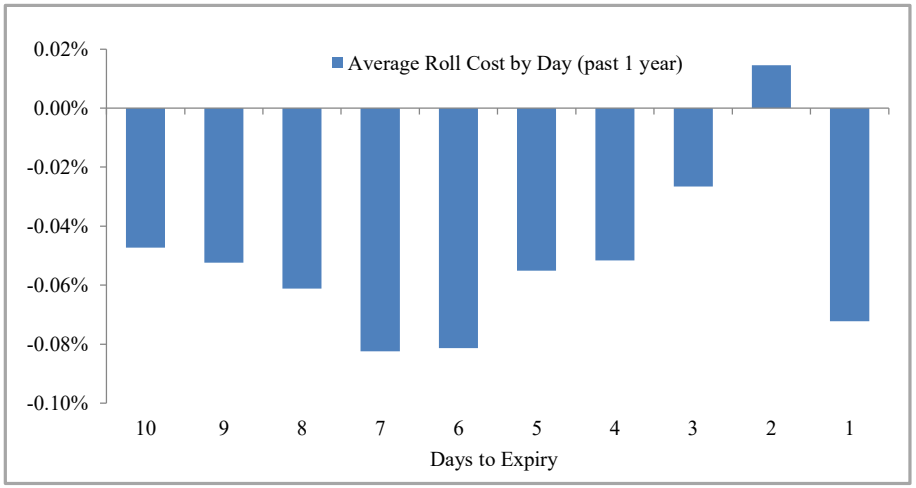




Interest rate: Offshore TWD NDF (Bloomberg ticker: NTNI1M <Curncy>) / Withholdings tax rate on cash/stock dividends: 10%

MSCI Taiwan - Offshore





Interest rate: Offshore TWD NDF (Bloomberg ticker: NTNI1M <Curncy>) / Withholdings tax rate on cash/stock dividends: 10%

Global Equity Index Futures Roll Chartbook - Asia Pacific

Global Quantitative & Derivatives Strategy

Source for data: J.P.Morgan Quantitative and Derivatives Strategy, Bloomberg Finance L.P.

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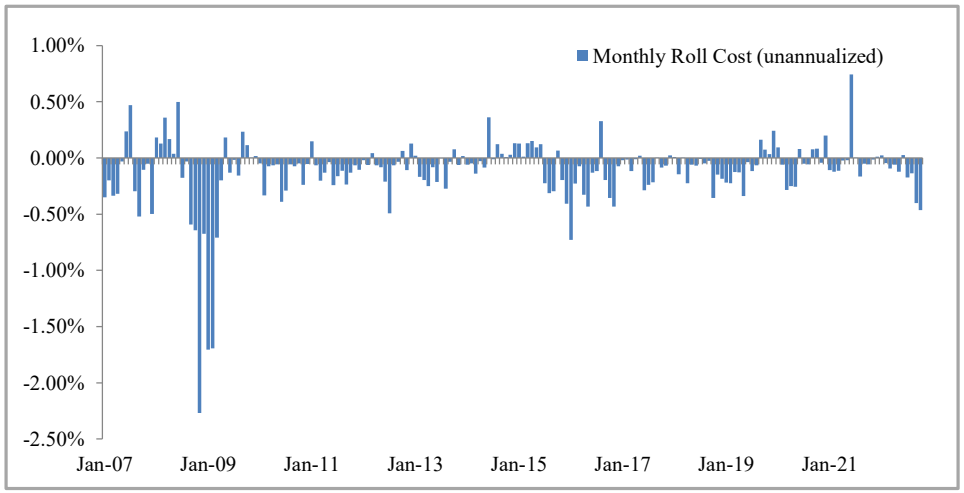
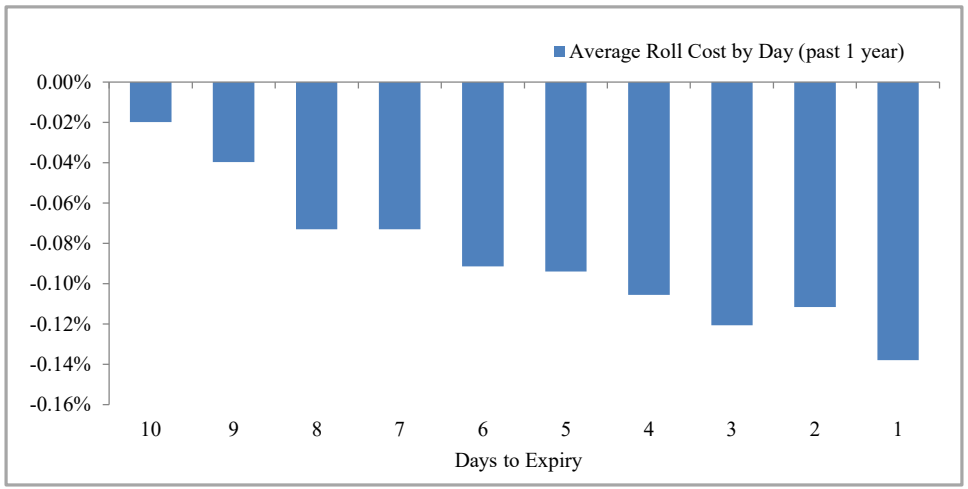
Twinkle Mehta[AC] + 91 (22) 6157-3324 twinkle.mehta@jpmchase.com

See Pages 32-35 for a full team list, contact details and legal affiliations.

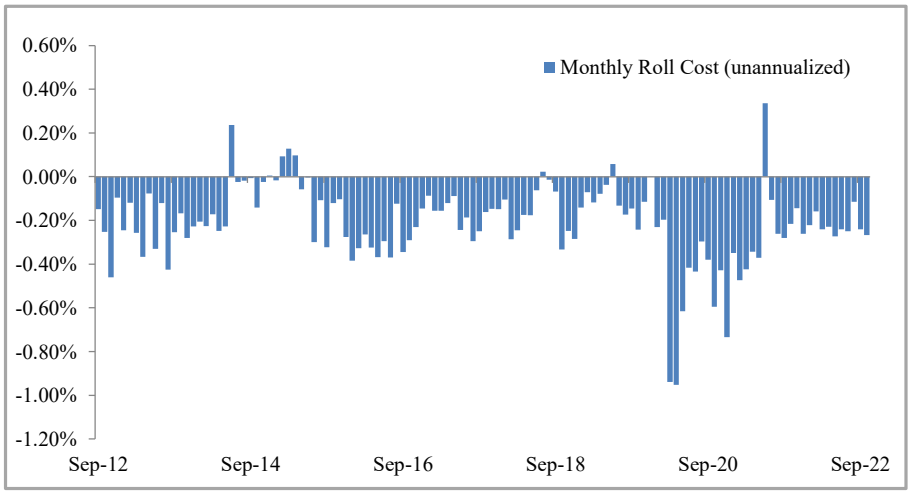
Taiwan TAIEX - Offshore

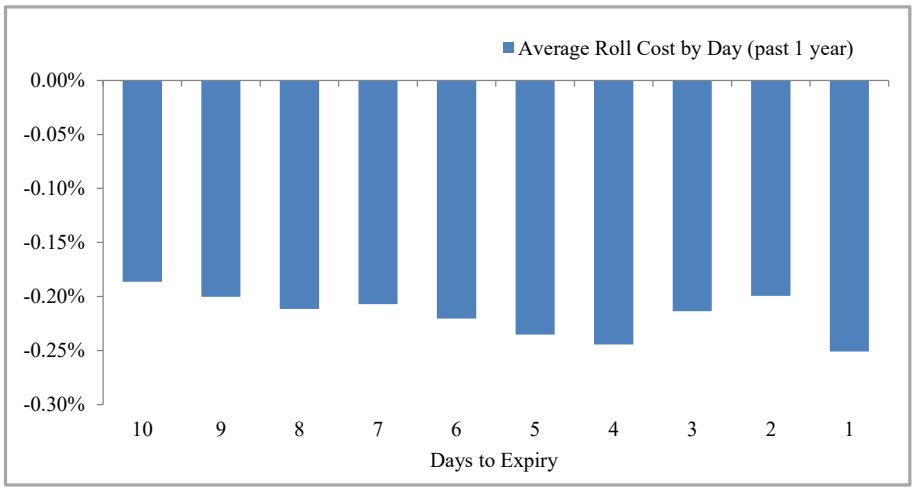




Interest rate: Offshore TWD NDF (Bloomberg ticker: NTNI1M <Curncy>) / Withholdings tax rate: 10%

Taiwan TAIEX - Onshore





Interest rate: TDCC Secondary (Bloomberg ticker: TDSF30D <Index>) / Withholdings tax rate: 10%

Global Equity Index Futures Roll Chartbook - Asia Pacific

Global Quantitative & Derivatives Strategy

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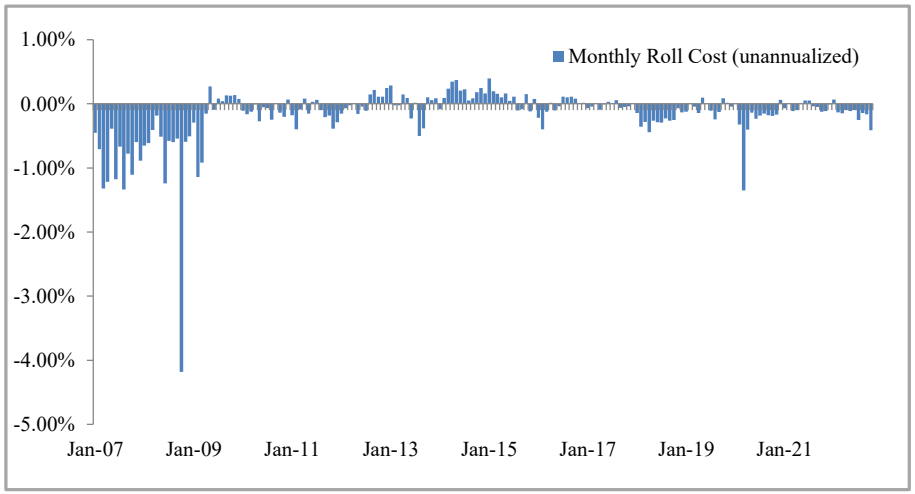
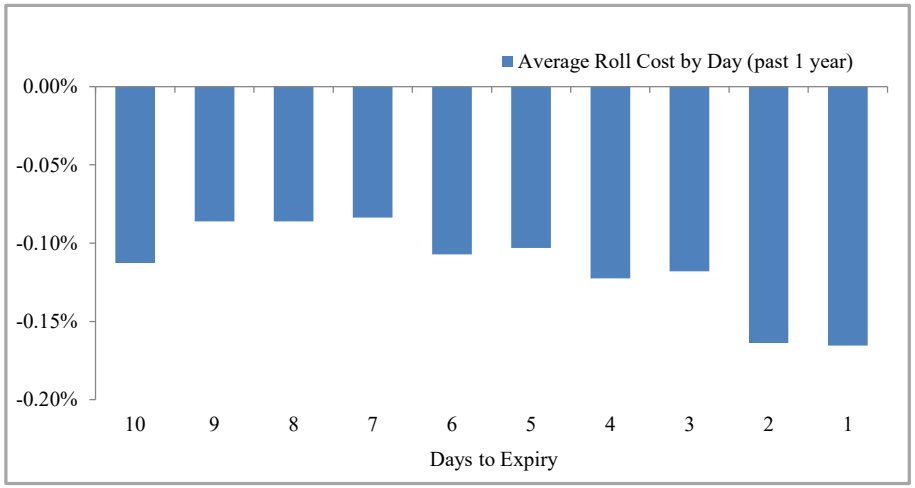
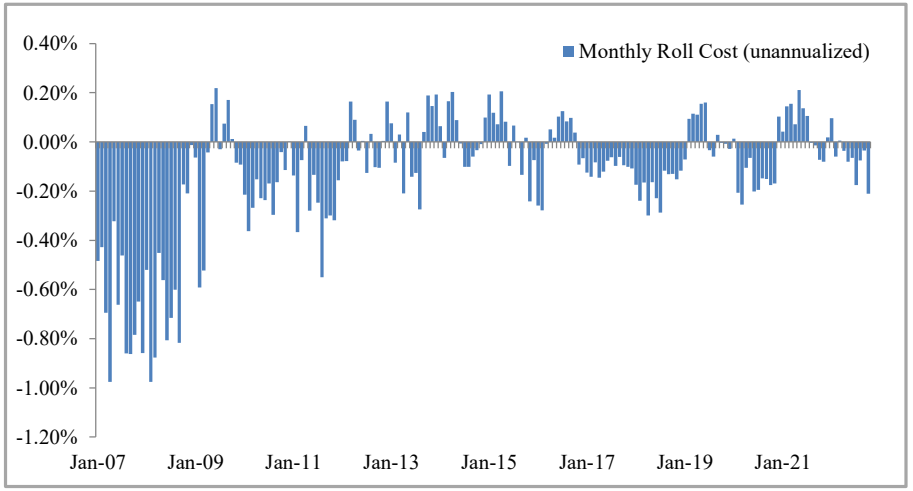
S&P CNX NIFTY (NSE) - Offshore

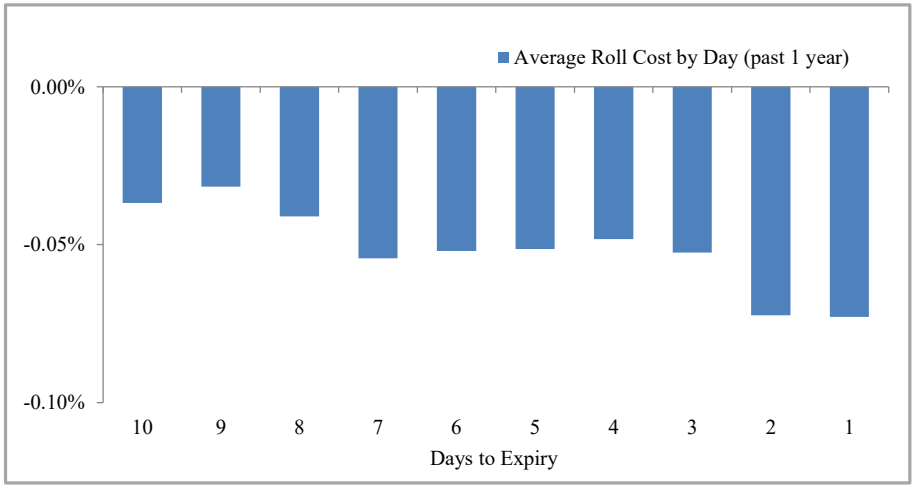




Interest rate: Offshore INR NDF (Bloomberg ticker: IRNI1M <Index>) / Cash withholdings tax rate: 0%

S&P CNX NIFTY (NSE) - Onshore





Interest rate: INR Swap Onshore (Bloomberg ticker: IRSWOA <Curncy>) / Cash withholdings tax rate: 0%

Global Equity Index Futures Roll Chartbook - Asia Pacific

Global Quantitative & Derivatives Strategy

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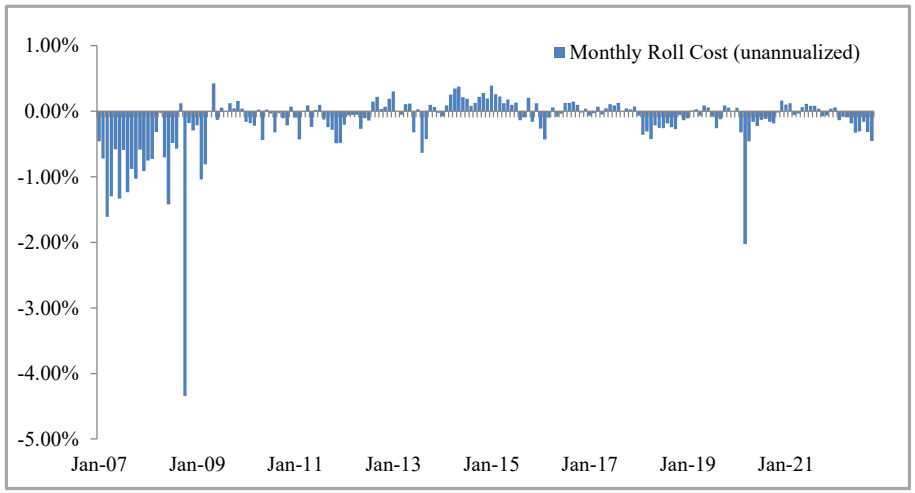
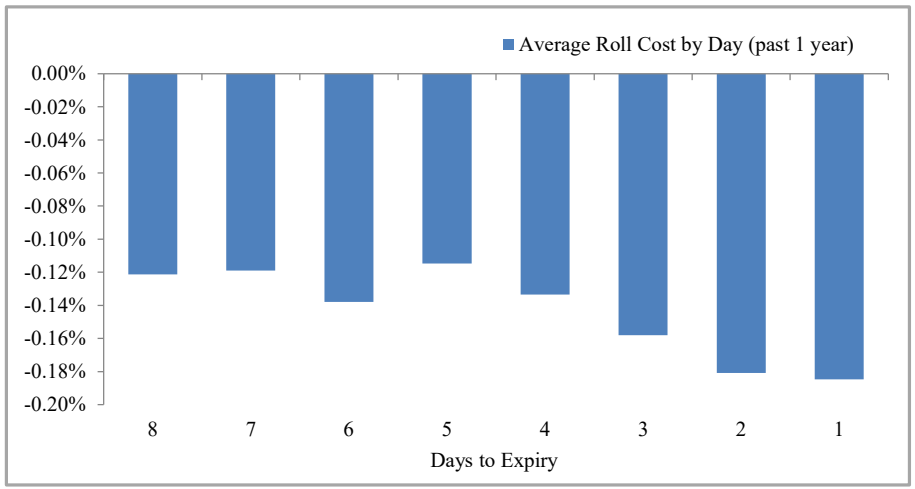
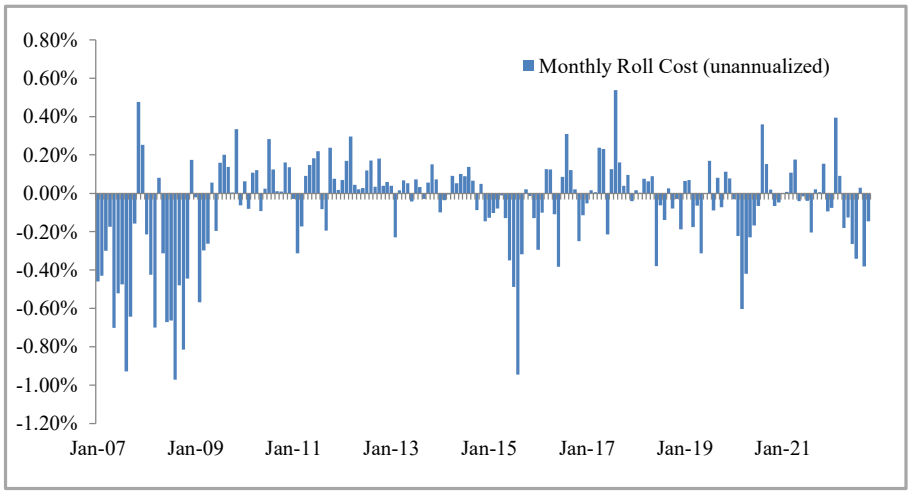
S&P CNX NIFTY (SGX) - Offshore

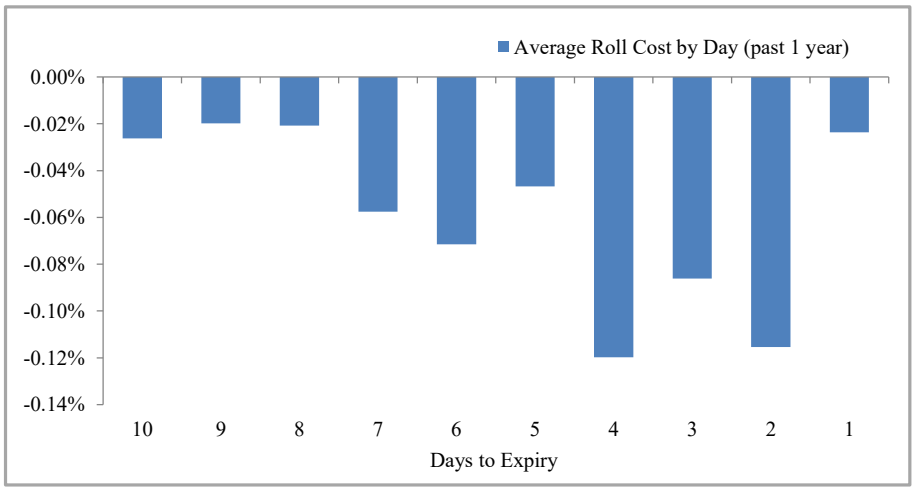




Interest rate: Offshore INR NDF (Bloomberg ticker: IRNI1M <Index>) / Cash withholdings tax rate: 0%

FTSE Bursa Malaysia KLCI - Offshore





Interest rate: Offshore MYR NDF (Bloomberg ticker: MRNI1M <Curncy>) / Cash withholdings tax rate: 0%

Global Equity Index Futures Roll Chartbook - Asia Pacific

Global Quantitative & Derivatives Strategy

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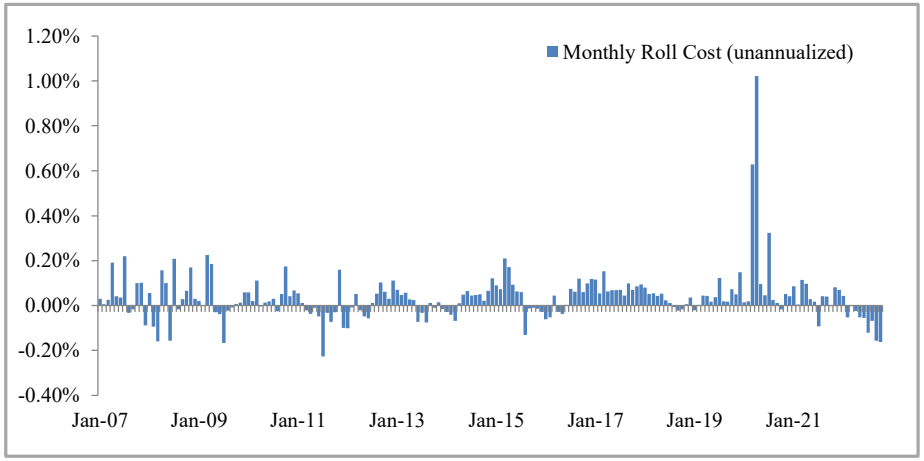
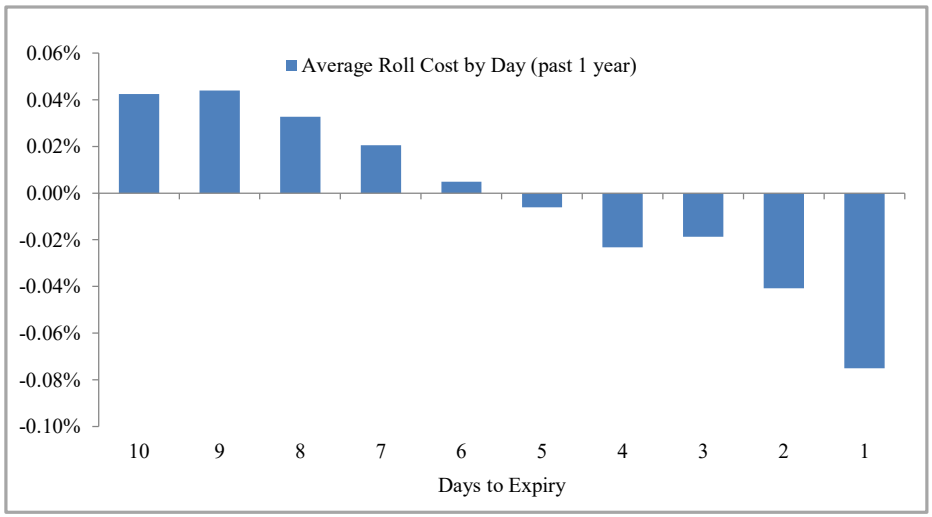
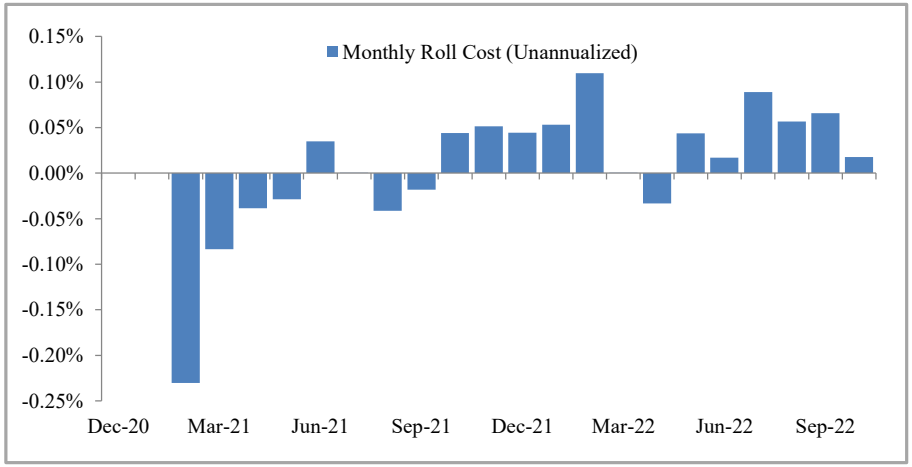
MSCI Singapore

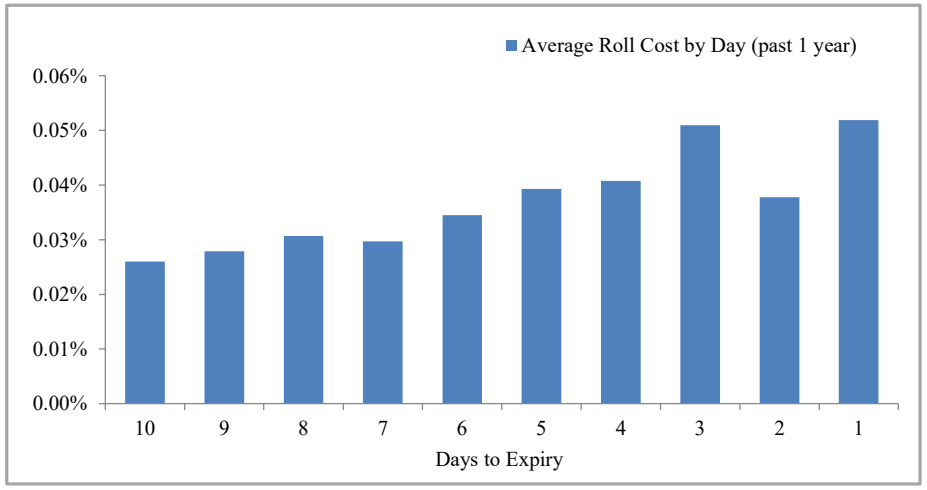




Interest rate: SGD swap rates (Bloomberg ticker: SORF1M <Index>) / Cash withholdings tax rate: 0%

HANG SENG TECH





Interest rate: HIBOR (Bloomberg ticker: HIHD01M <Index>) / Cash withholdings tax rate: 10%

Global Equity Index Futures Roll Chartbook - Asia Pacific

Global Quantitative & Derivatives Strategy

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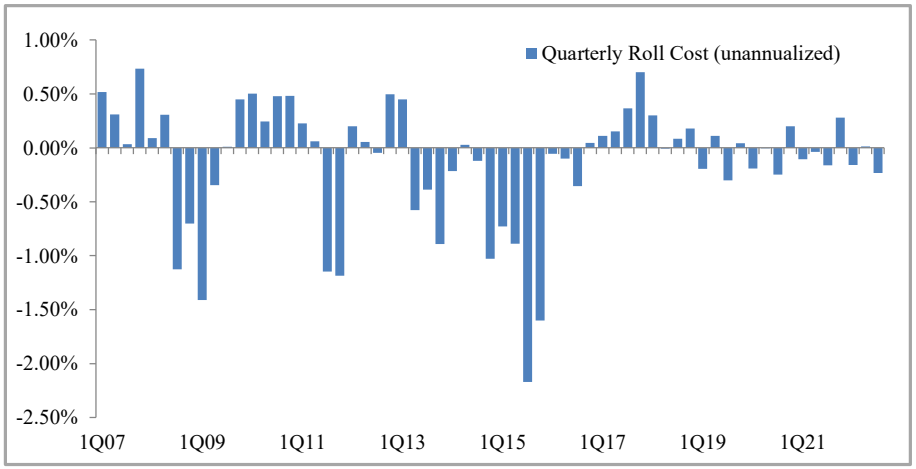
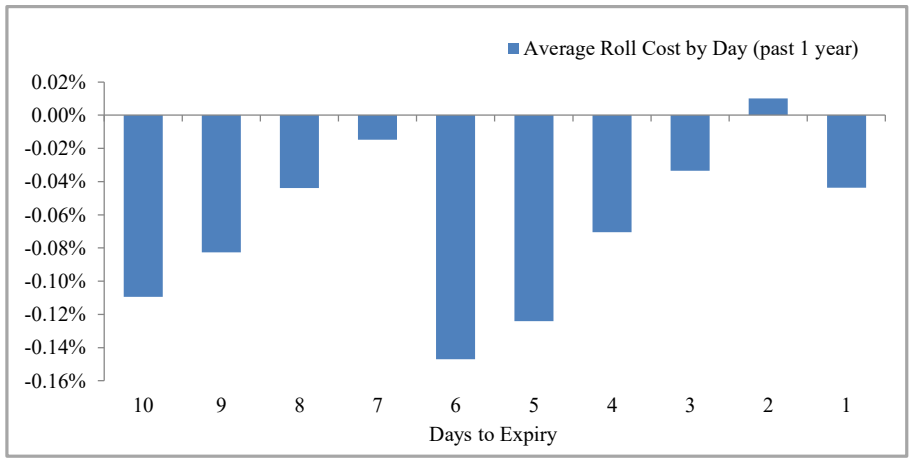
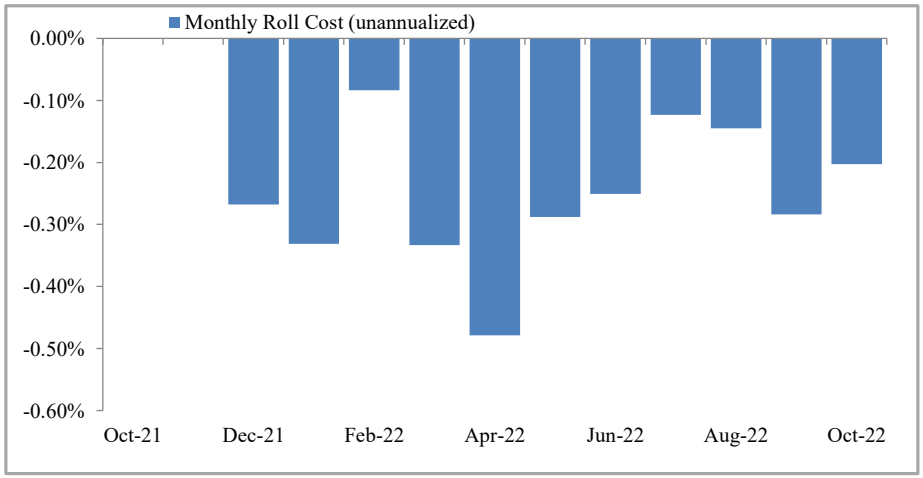
Thai SET 50

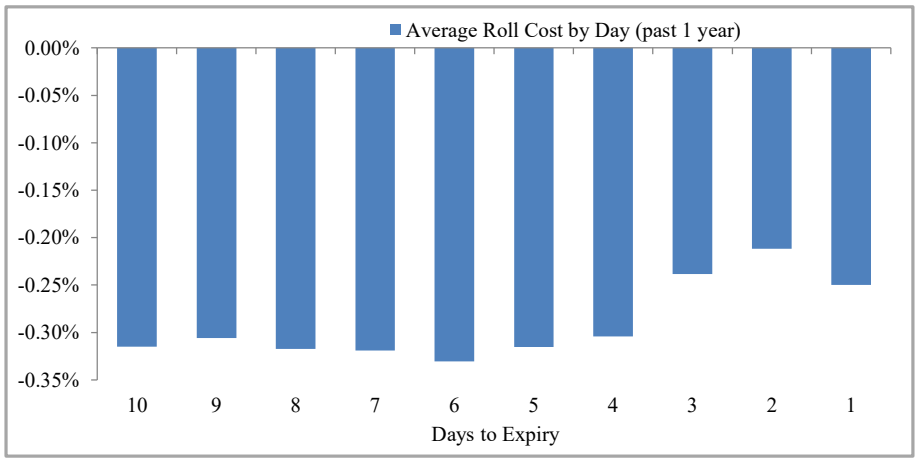




Interest rate: THB offshore forward (Bloomberg ticker: THB13M <Curncy>) / Cash withholdings tax rate: 10%

MSCI China A50





Interest rate: Offshore CNH Rate (Bloomberg ticker: CNHI1M <Curncy) / Cash withholdings tax rate: 10%

Global Equity Index Futures Roll Chartbook - Europe

Global Quantitative & Derivatives Strategy

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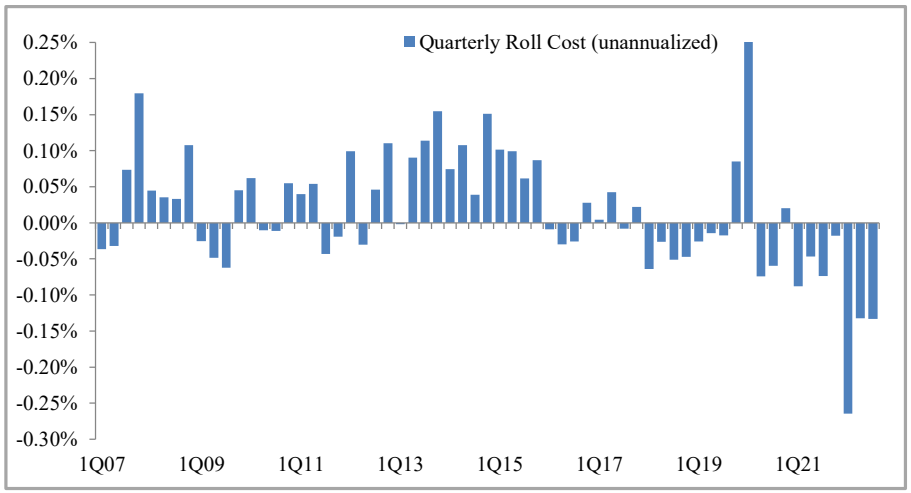
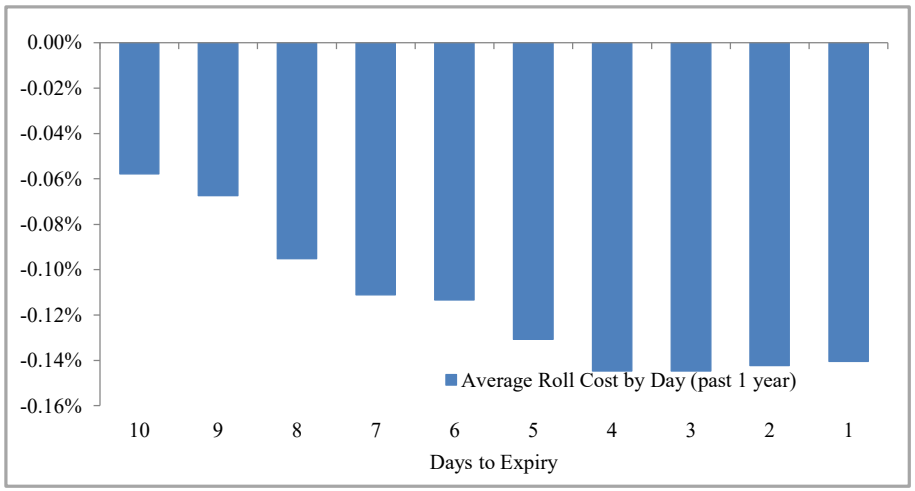
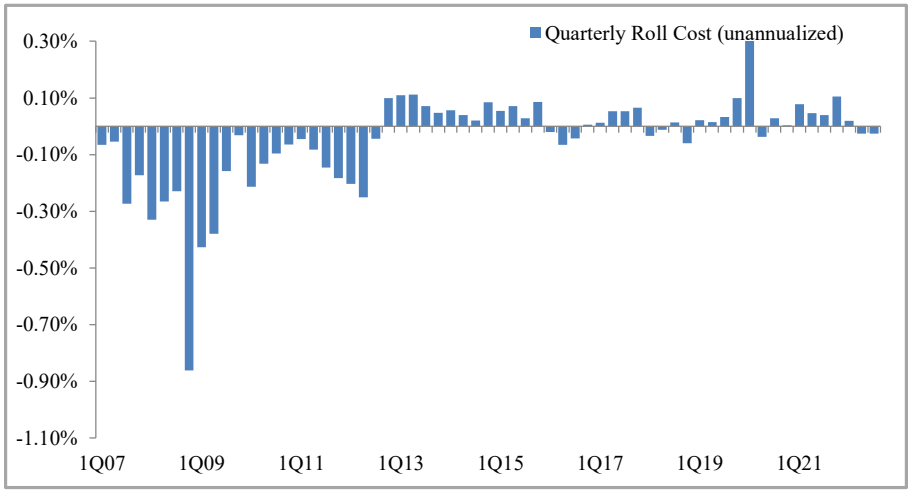
Euro Stoxx 50

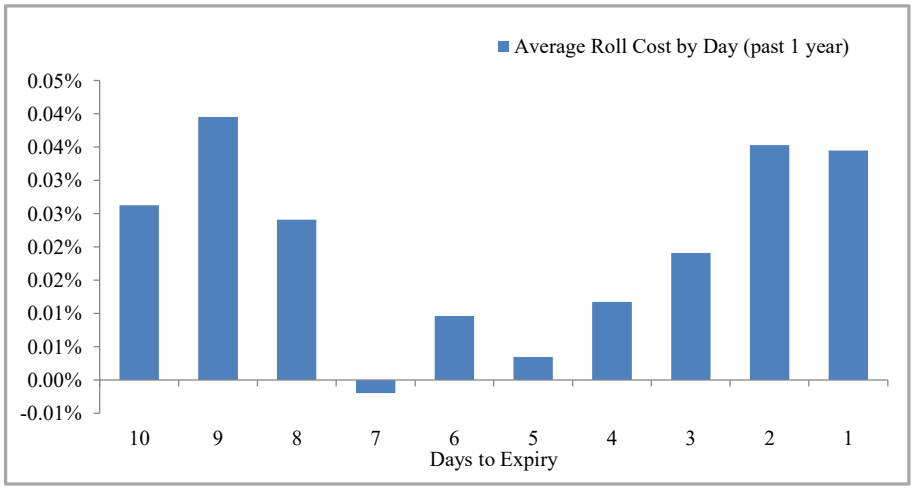




Interest rate: ESTR rates (Bloomberg ticker: EESWEC <Curncy>)

FTSE 100





Interest rate: SONIA rates (Bloomberg ticker: BP0003M <Index>)

Global Equity Index Futures Roll Chartbook - Europe

Global Quantitative & Derivatives Strategy

Source for data: J.P.Morgan Quantitative and Derivatives Strategy, Bloomberg Finance L.P.

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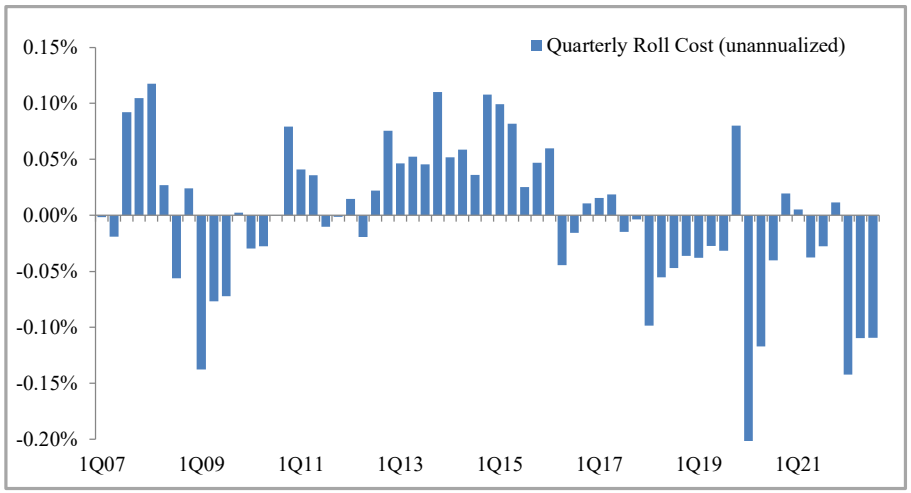
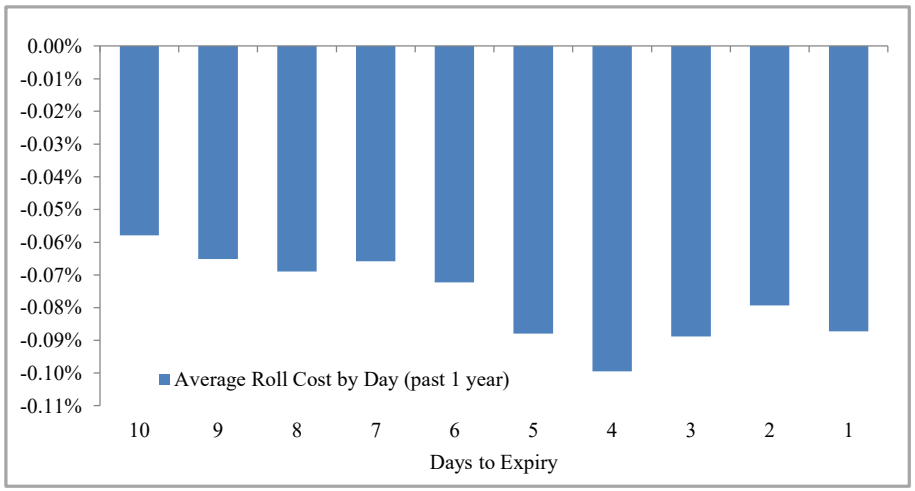
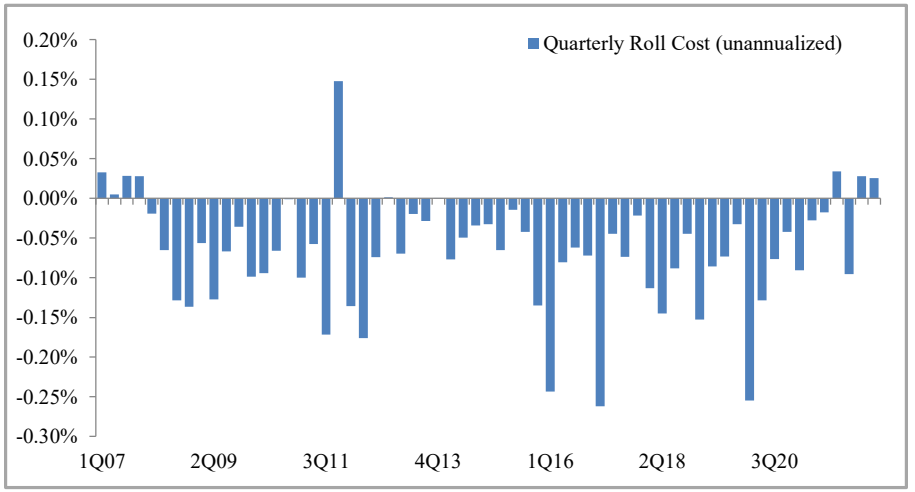
DAX

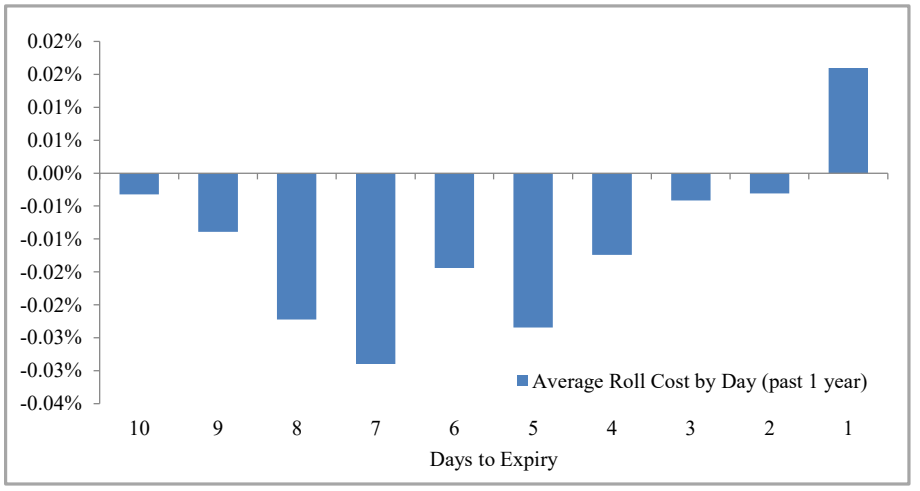




Interest rate: ESTR rates (Bloomberg ticker: EESWEC <Curncy>)

SMI





Interest rate: SARON rates (Bloomberg ticker: SFSNTC <Index>)

Global Equity Index Futures Roll Chartbook - Europe

Global Quantitative & Derivatives Strategy

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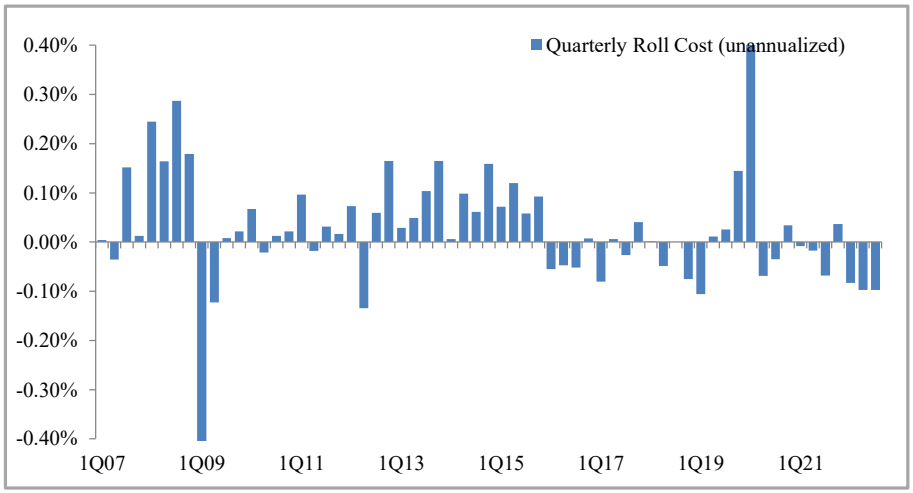
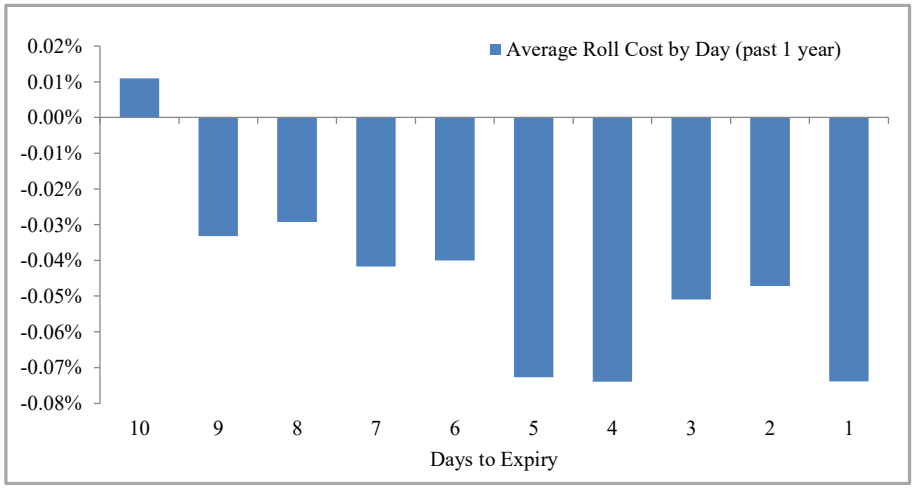
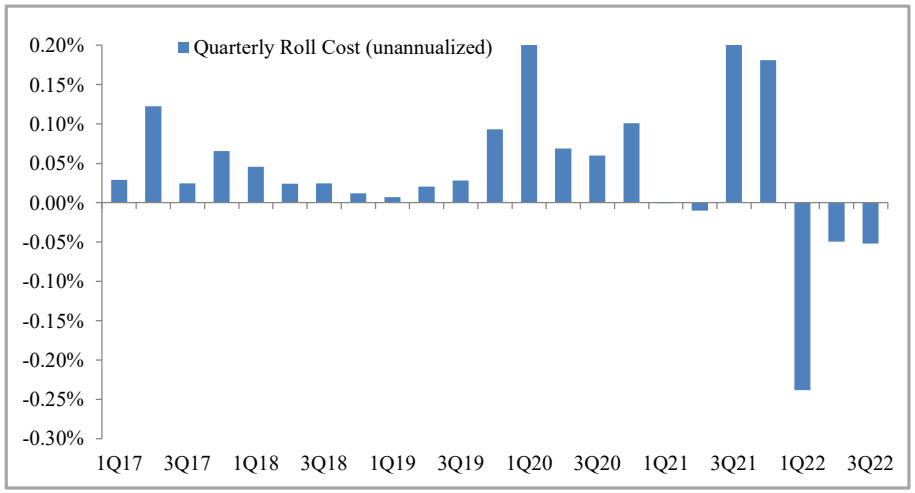
FTSE MIB

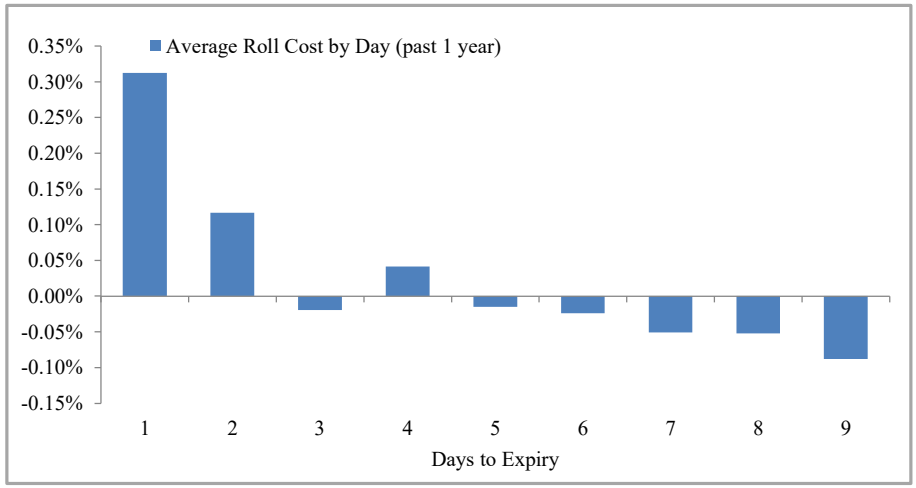




Interest rate: ESTR rates (Bloomberg ticker: EESWEC <Curncy>)

SX7E





Interest rate: ESTR rates (Bloomberg ticker: EESWEC <Curncy>)

Global Equity Index Futures Roll Chartbook - Europe

Global Quantitative & Derivatives Strategy

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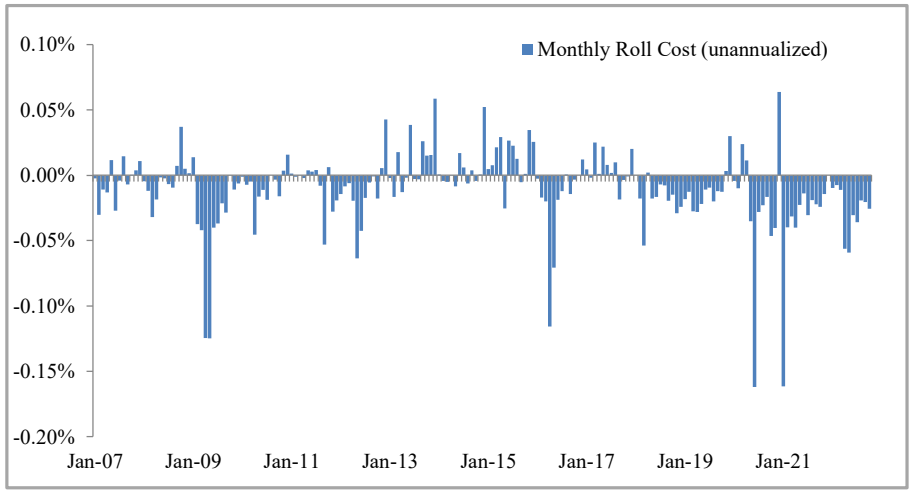
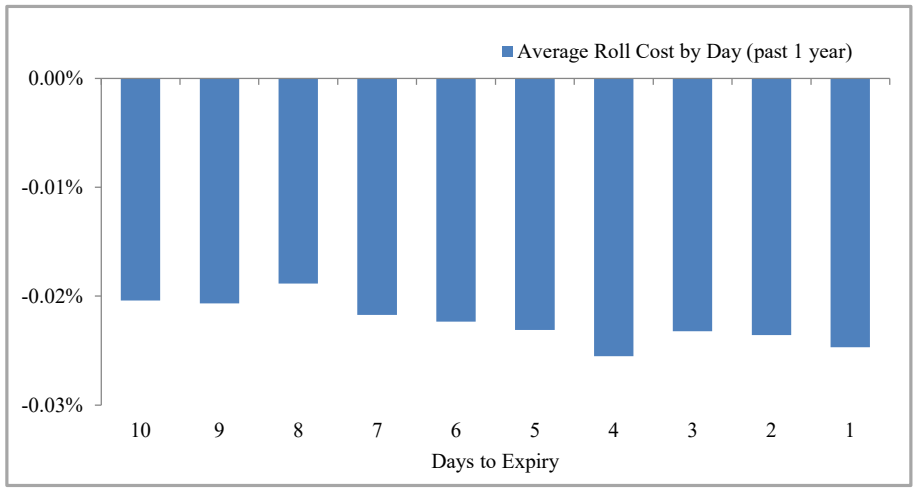
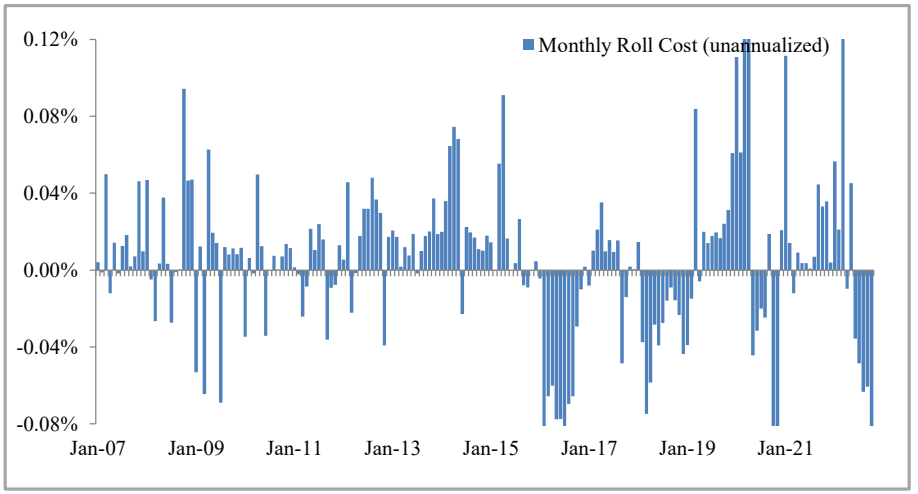
CAC

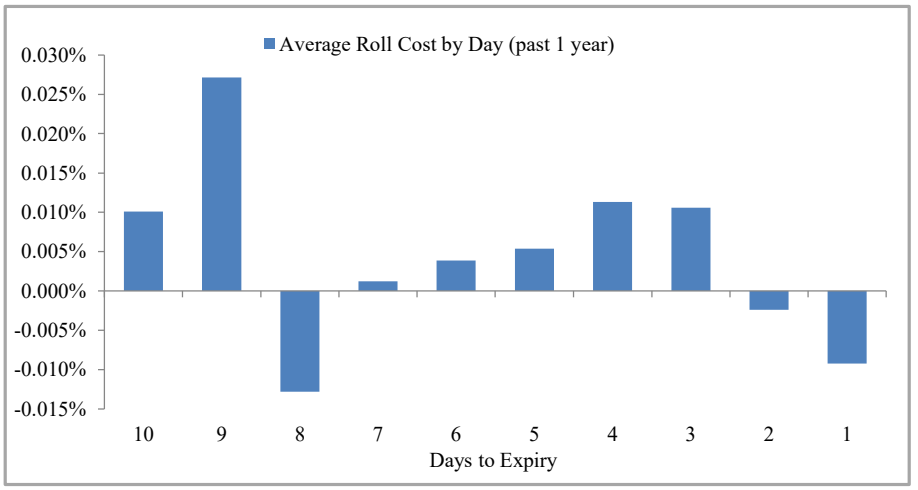




Interest rate: ESTR rates (Bloomberg ticker: EESWEC <Curncy>)

OMX





Interest rate: SEK swap rates (Bloomberg ticker: SKSWTNA <Curncy>)

Global Equity Index Futures Roll Chartbook - Europe

Global Quantitative & Derivatives Strategy

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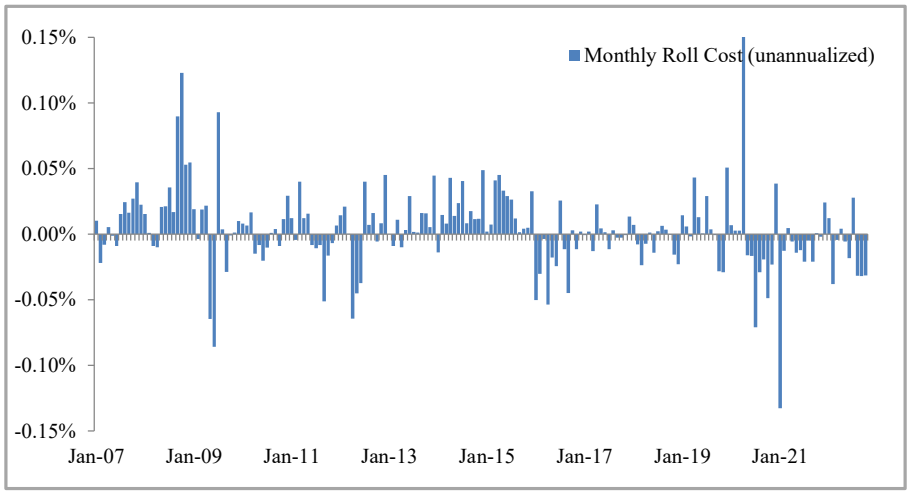
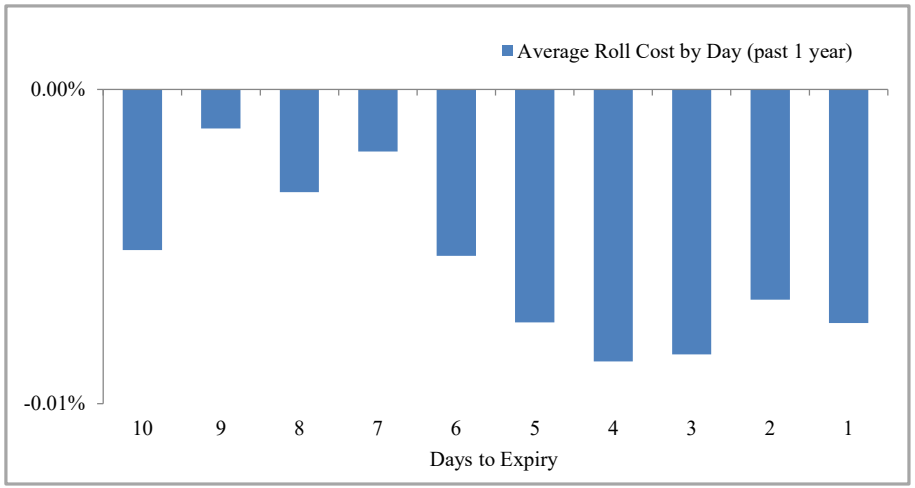
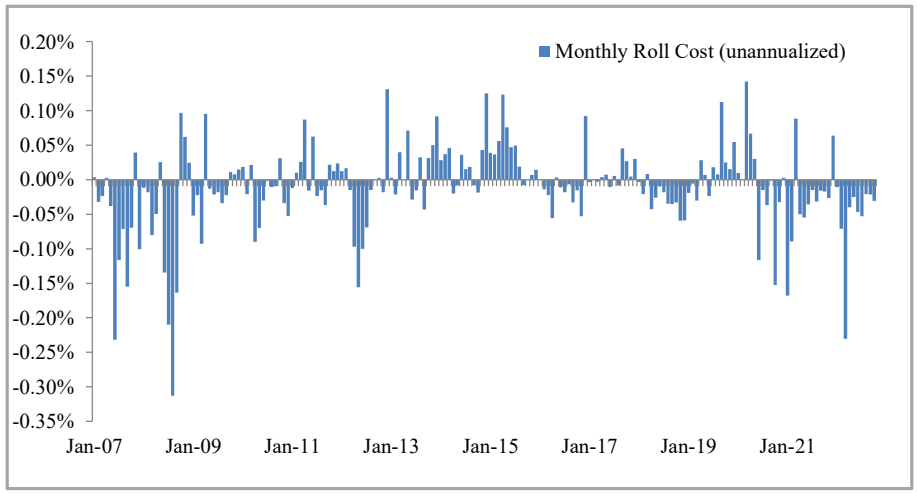
AEX

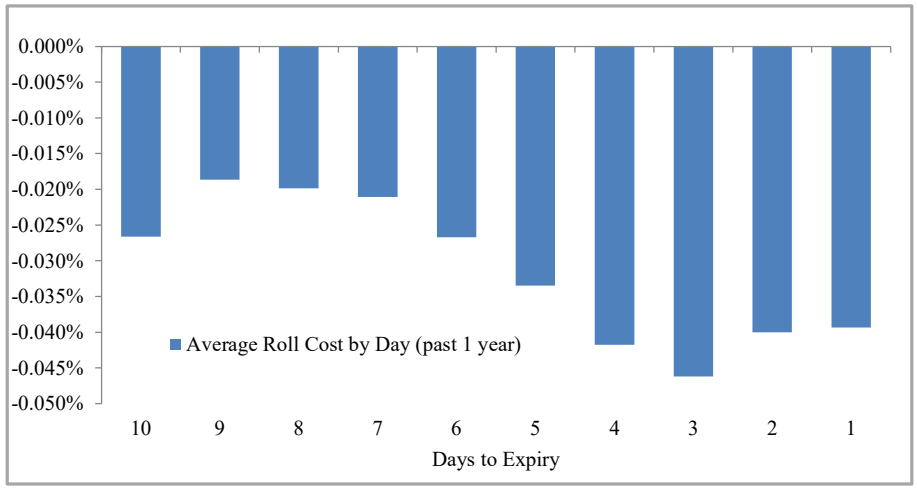




Interest rate: ESTR rates (Bloomberg ticker: EESWEC <Curncy>)

IBEX





Interest rate: ESTR rates (Bloomberg ticker: EESWEC <Curncy>)

Global Equity Index Futures Roll Chartbook - Americas

Global Quantitative & Derivatives Strategy

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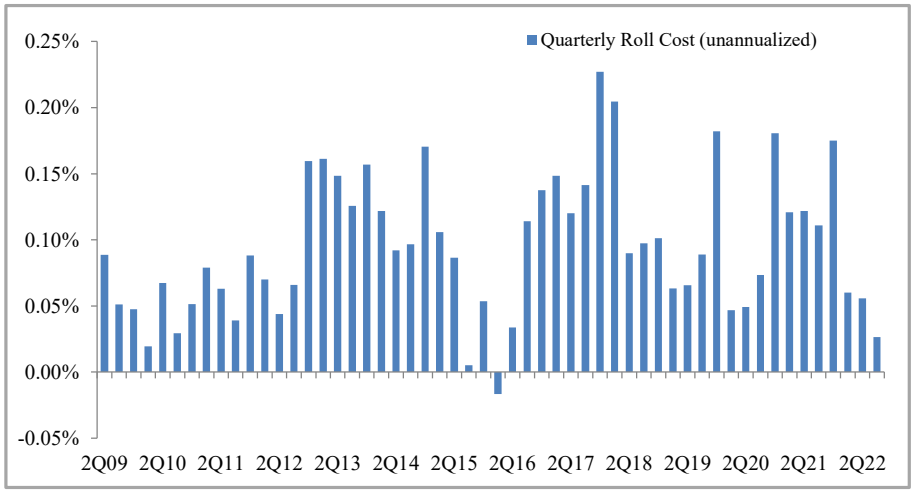
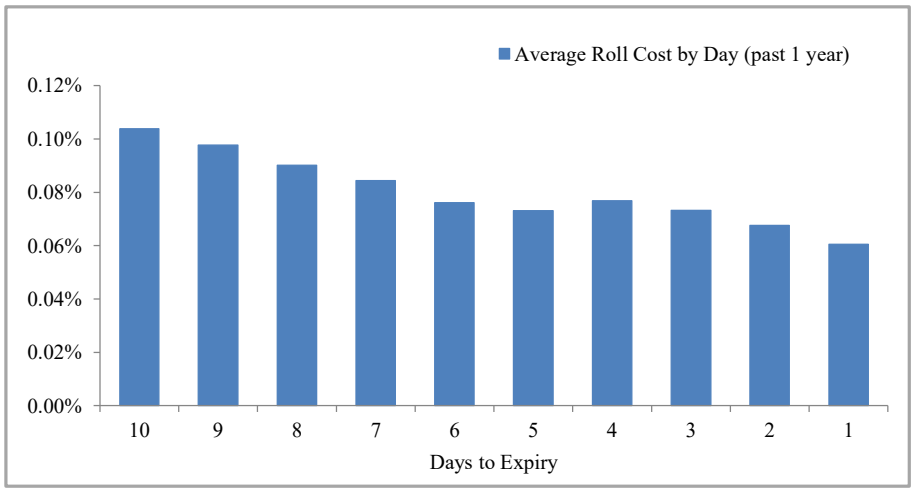
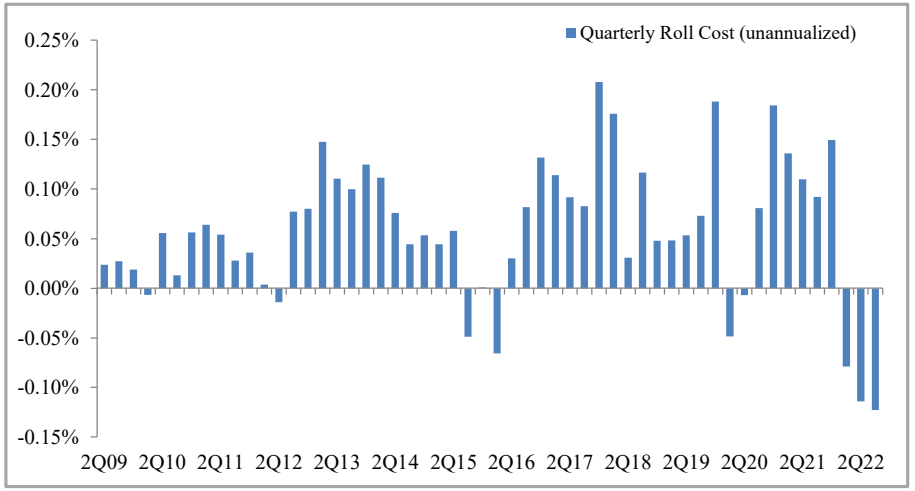
S&P 500

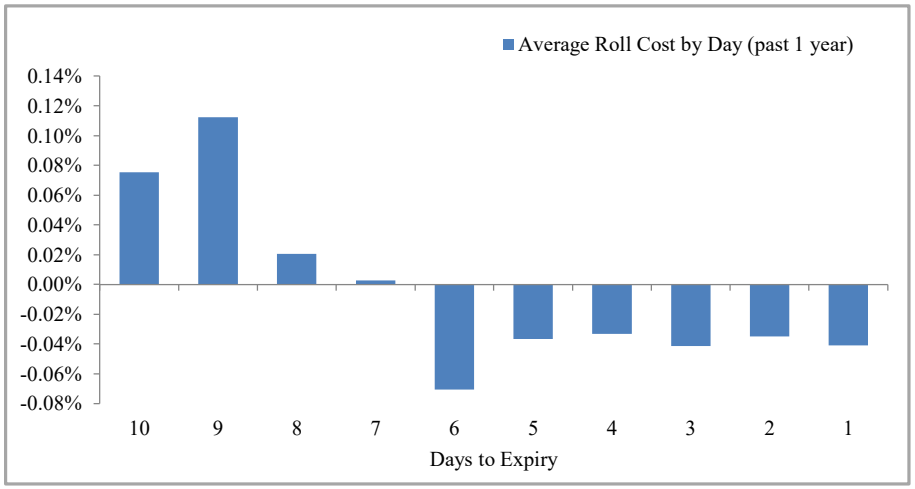




Interest rate: SOFR futures (Bloomberg ticker: SFRA <Comdty>) / Cash withholdings tax rate: 0%

S&P Mid 400





Interest rate: SOFR futures (Bloomberg ticker: SFRA <Comdty>) / Cash withholdings tax rate: 0%

Global Equity Index Futures Roll Chartbook - Americas

Global Quantitative & Derivatives Strategy

Source for data: J.P.Morgan Quantitative and Derivatives Strategy, Bloomberg Finance L.P.

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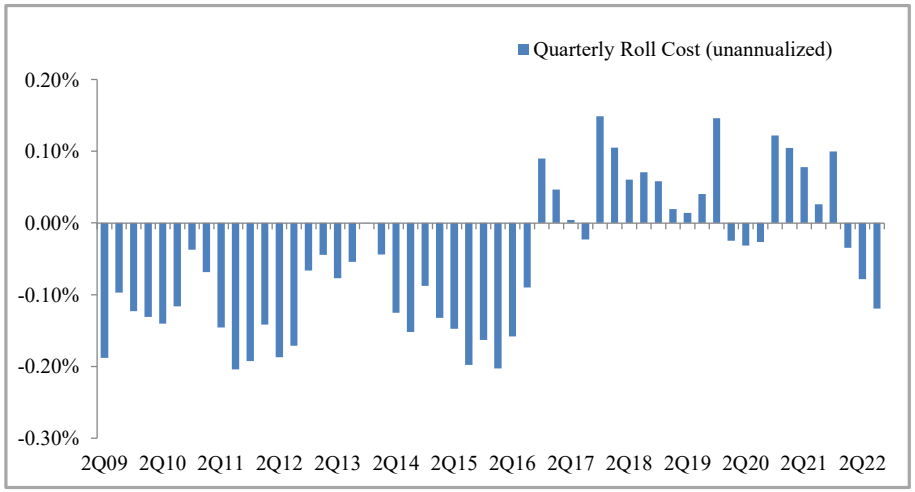
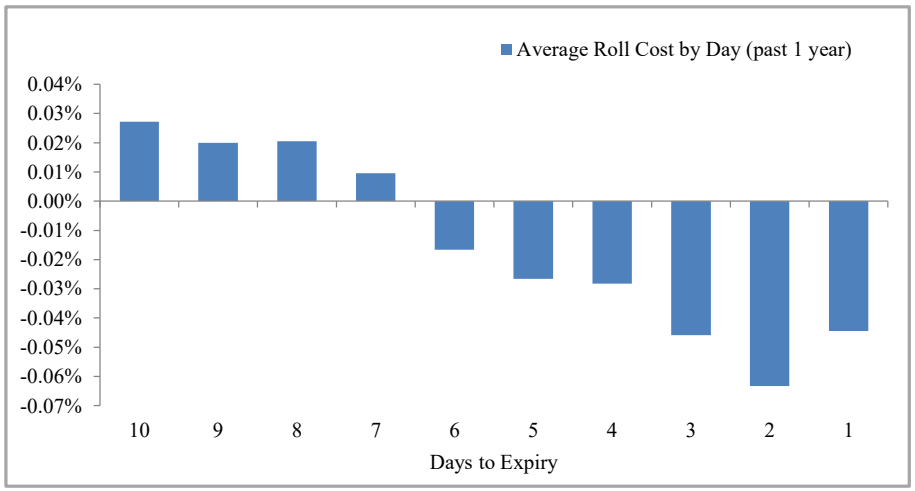
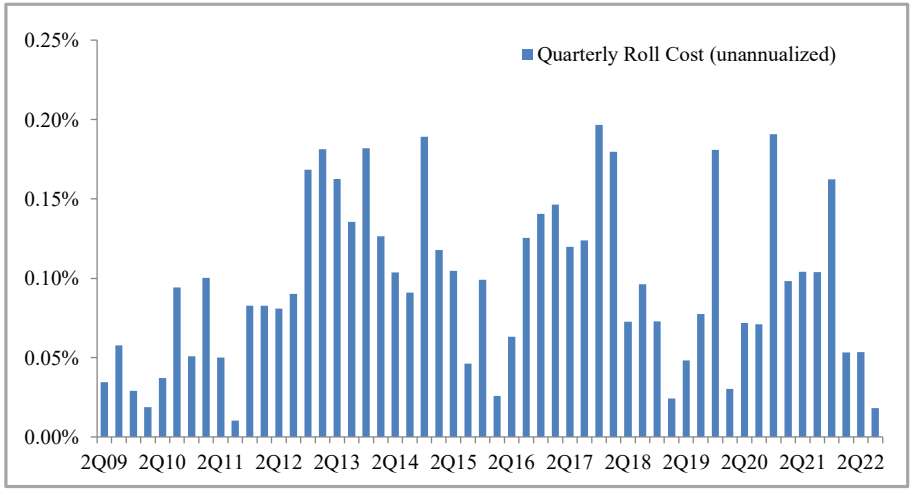
Russell 2000

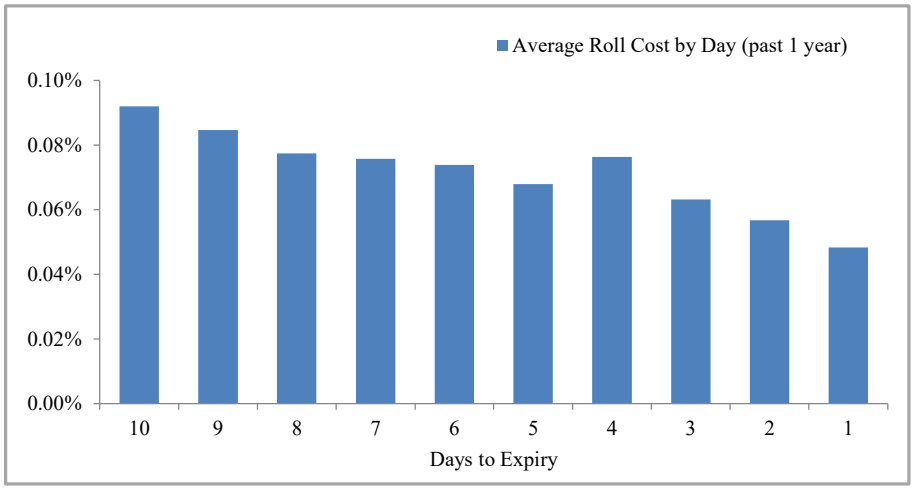




Interest rate: SOFR futures (Bloomberg ticker: SFRA <Comdty>) / Cash withholdings tax rate: 0%

NASDAQ 100





Interest rate: SOFR futures (Bloomberg ticker: SFRA <Comdty>) / Cash withholdings tax rate: 0%

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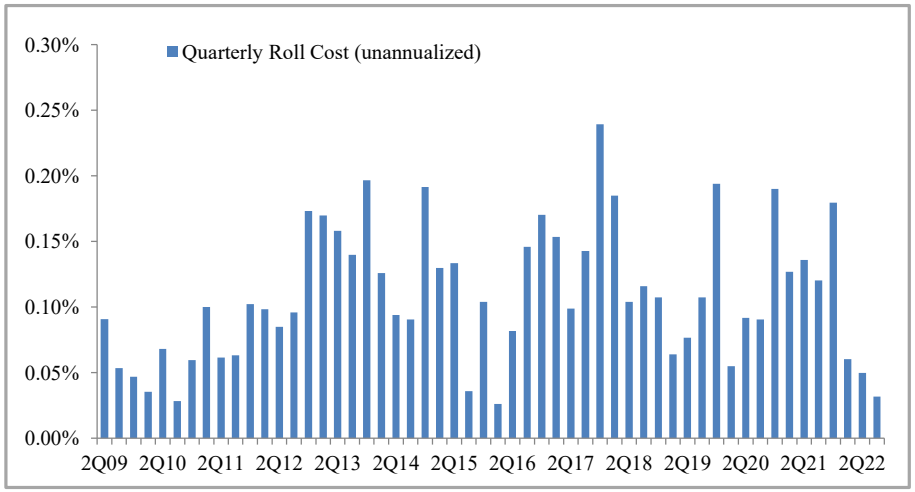
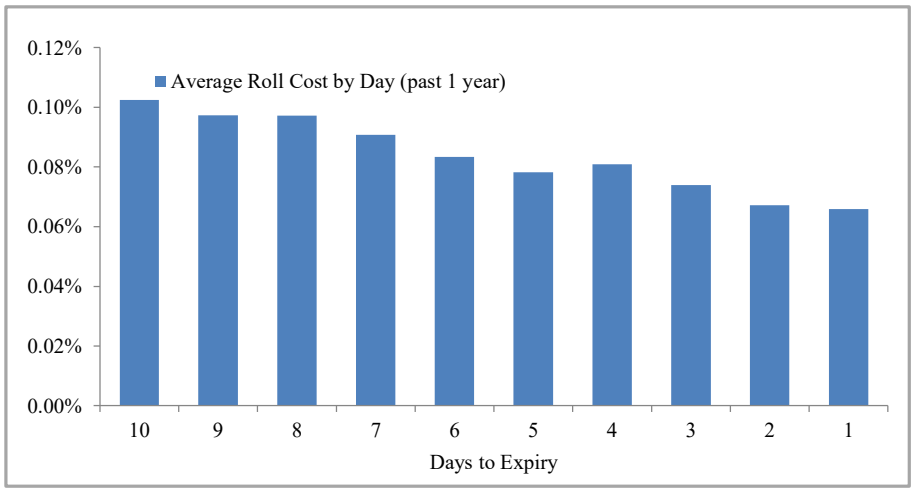
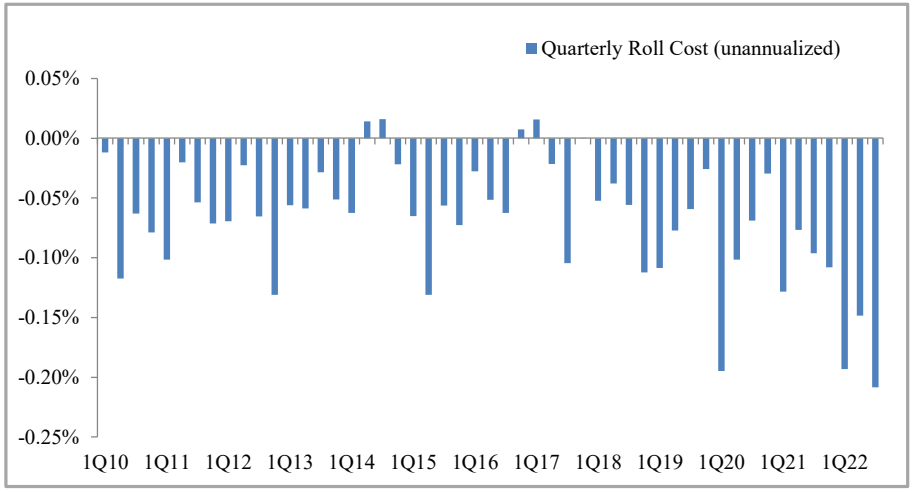
Dow Jones Industrial Average

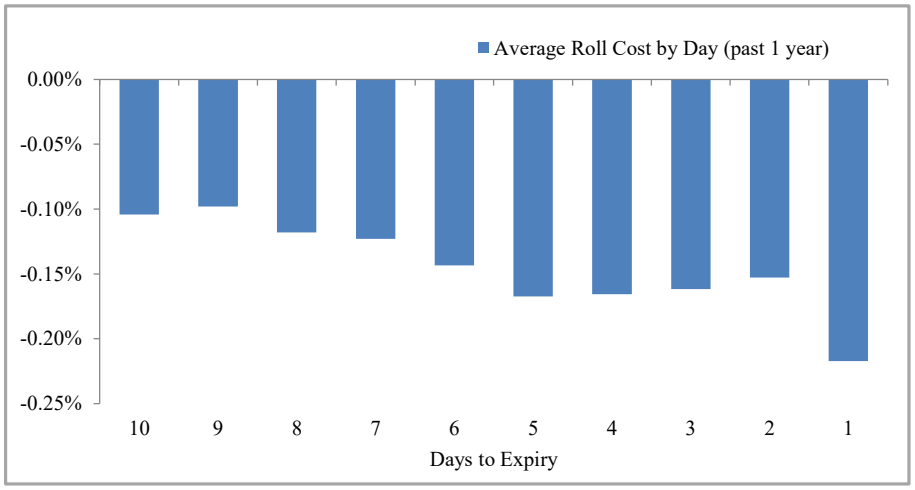




Interest rate: SOFR futures (Bloomberg ticker: SFRA <Comdty>) / Cash withholdings tax rate: 0%

S&P/TSX 60





Interest rate: Canadian bank bill (Bloomberg ticker: BAA <Comdty>) / Cash withholdings tax rate: 0%

Global Equity Index Futures Roll Chartbook - Americas

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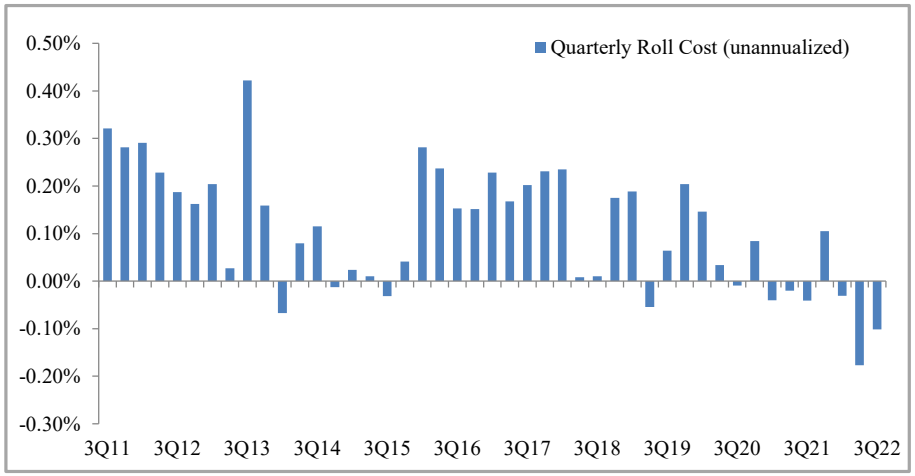
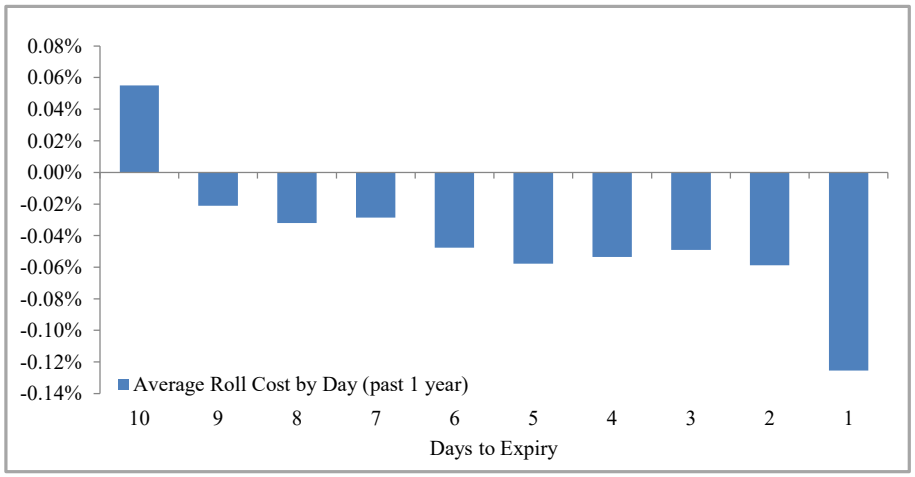
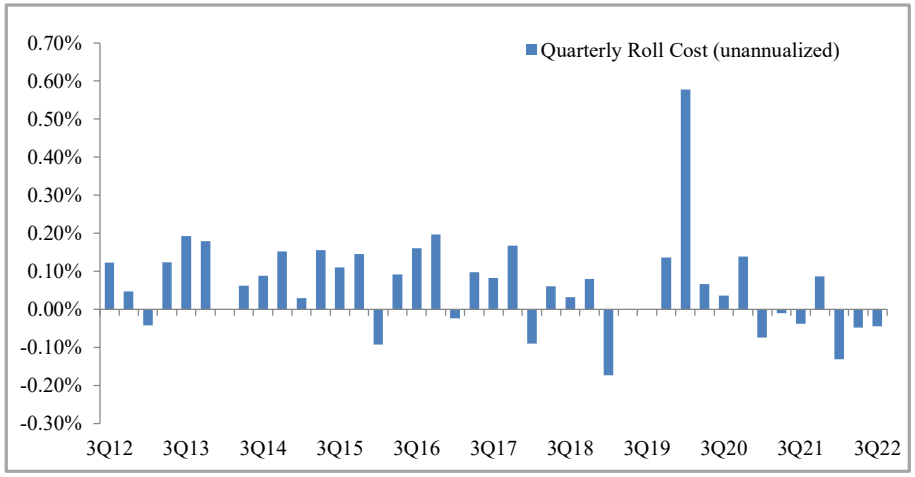
MSCI Emerging Markets

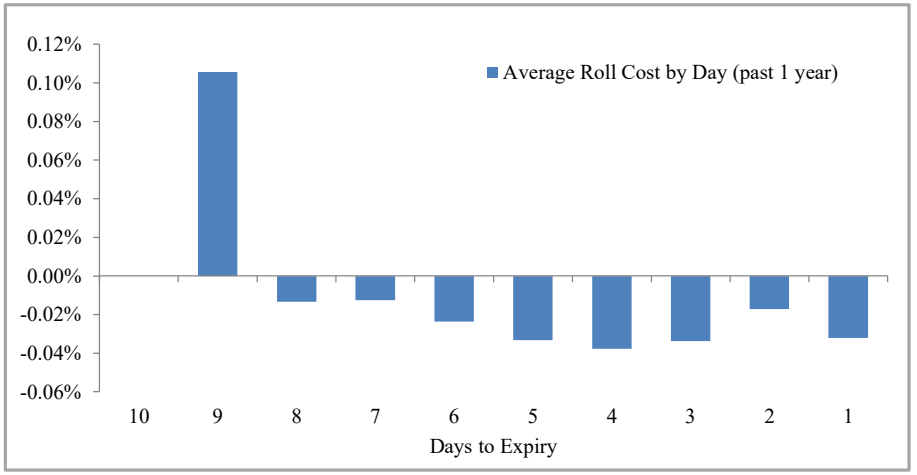




Interest rate: SOFR futures (Bloomberg ticker: SFRA <Comdty>) / Cash withholdings tax rate: 0%
Historical roll costs in 3Q11-4Q13 are calculated based on realized dividends

MSCI EAFE





Interest rate: SOFR futures (Bloomberg ticker: SFRA <Comdty>) / Cash withholdings tax rate: 0%
Historical roll costs in 3Q12-2Q15 are calculated based on realized dividends

Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

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Equity Index Futures Contract Specifications

	Contract Name	Front-month Contract Ticker	Underlier Ticker	Exch	Curncy	Cont Size	Tick Size (Value)	Trading Hours (Local Time)	Roll Freqency	Last Trading Day	Final Settlement Price Calculation (LTD = Last trading day)	Notional Open Int (USD Mn)	Notional Daily Vol* (USD Mn)	CFTC Approved?
Americas	S&P 500 Emini	ESA	SPX	CME	USD	50	0.25 (USD12.5)	08:30-07:30	Quarterly	16-Dec-22	Based on component stocks' opening prices on the third Friday of the expiration months	447,051	433,735	Y
	S&P Mid 400 Emini	FAA	MID	CME	USD	100	0.1 (USD10)	18:00-17:00	Quarterly	16-Dec-22		11,744	3,696	Y
	Russell 2000 Mini	RTYA	RTY	CME	USD	50	0.1 (USD5)	20:00-18:00	Quarterly	16-Dec-22		45,697	22,492	Y
	NASDAQ 100 E-Mini	NQA	NDX	CME	USD	20	0.25 (USD5)	18:00-17:00	Quarterly	16-Dec-22		62,614	163,474	Y
	DJIA Mini E-CBOT	DMA	INDU	CBT	USD	5	1 (USD5)	18:00-17:00	Quarterly	16-Dec-22		12,906	31,396	Y
	S&P/TSX 60	PTA	SPTSX60	MSE	CAD	200	0.1 (CAD20)	06:00-09:15 & 09:30-16:15	Quarterly	15-Dec-22	Underlier's opening price on LTD+1	56,388	5,899	Y
	MSCI EM Mini	MESA	MXEF	NYF	USD	50	0.1 (USD5)	20:00-18:00	Quarterly	16-Dec-22	Underlier's closing price on LTD	53,535	7,151	Y
	MSCI EAFE	MFSA	MXEA	NYF	USD	50	0.1 (USD5)	20:00-18:00	Quarterly	16-Dec-22	Underlier's closing price on LTD	35,235	4,940	Y
Europe	Euro Stoxx 50	VGA	SX5E	EUX	EUR	10	1 (EUR10)	07:50-22:00	Quarterly	16-Dec-22	Arithmetic average of underlier's price in 11:50-12:00 CET on LTD	170,505	42,515	Y
	FTSE 100	Z A	UKX	ICF	GBP	10	0.5 (GBP5)	01:00-21:00	Quarterly	16-Dec-22	Based on component stocks' auction prices on LTD	47,146	11,490	Y
	DAX	GXA	DAX	EUX	EUR	25	1 (EUR25)	07:50-22:00	Quarterly	16-Dec-22	Based on component stocks' Xetra auction prices on LTD	31,493	25,959	Y
	SMI	SMA	SMI	EUX	CHF	10	1 (CHF10)	07:50-22:00	Quarterly	16-Dec-22	Based on component stocks' opening prices on LTD	20,210	4,483	Y
	CAC	CFA	CAC	EOP	EUR	10	0.5 (EUR5)	08:00-22:00	Monthly	18-Nov-22	Arithmetic average of underlier's price in 15:40-16:00 CET on LTD	16,211	6,397	Y
	OMX	QCA	OMX	SSE	SEK	100	0.25 (SEK25)	09:00-17:25	Monthly	18-Nov-22	VWAP of underlier on LTD	8,493	2,744	Y
	AEX	EOA	AEX	EOE	EUR	200	0.05 (EUR10)	08:00-22:00	Monthly	18-Nov-22	Arithmetic average of underlier's price in 15:30-16:00 CET on LTD	5,825	3,740	Y
	IBEX	IBA	IBEX	MFM	EUR	10	1 (EUR10)	08:00-20:00	Monthly	18-Nov-22	Arithmetic average of underlier's price in 16:15-16:45 CET on LTD	5,367	1,596	Y
	FTSE MIB	STA	FTSEMIB	MIL	EUR	5	5 (EUR25)	09:00-17:50	Quarterly	16-Dec-22	Based on component stocks' opening prices on LTD	16,075	2,733	Y
	SX7E	CAA	SX7E	EUX	EUR	50	0.05 (EUR2.5)	08:00-17:00	Quarterly	16-Dec-22	Arithmetic average of underlier's price in 11:50-12:00 CET on LTD	7,704	1,355	Y

* Average aggregate daily volume for the past 3 months

Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

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Equity Index Futures Contract Specifications

	Contract Name	Front-month Contract Ticker	Underlying Index Ticker	Exch	Curncy	Cont Size	Tick Size (Value)	Trading Hours (Local Time)	Roll Freqency	Last Trading Day	Final Settlement Price Calculation (LTD = Last trading day)	Notional Open Int (USD Mn)	Notional Daily Vol* (USD Mn)	CFTC Approved?
Asia Pacific	TOPIX	TPA	TPX	OSE	JPY	10000	0.5 (JPY5000)	08:45-15:15 & 16:30-05:30	Quarterly	08-Dec-22	Based on component stocks' opening prices on LTD+1	65,240	11,093	Y
	Nikkei 225	NKA	NKY	OSE	JPY	1000	10 (JPY10000)	08:45-15:15 & 16:30-05:30	Quarterly	08-Dec-22		54,884	13,265	Y
	JPX-Nikkei 400	JPWA	JPNK400	OSE	JPY	100	5 (JPY500)	08:45-15:15 & 16:30-05:30	Quarterly	08-Dec-22		960	109	Y
	S&P ASX 200	XPA	AS51	SFE	AUD	25	1 (AUD25)	09:50-16:30 & 17:10-07:00	Quarterly	15-Dec-22	Based on component stocks' opening prices on LTD	27,216	7,127	Y
	KOSPI 200	KMA	KOSPI2	KFE	KRW	250000	0.05 (KRW12500)	09:00-15:45 & 18:00-05:00	Quarterly	08-Dec-22	Underlier's closing price on LTD	22,798	16,841	Y
	Hang Seng	HIA	HSI	HKG	HKD	50	1 (HKD50)	09:15-16:30 & 17:15-23:45	Monthly	29-Nov-22	Arithmetic average of quotations taken at 5-min intervals of the continuous trading session and at the close on LTD	16,405	15,745	Y
	H-shares	HCA	HSCEI	HKG	HKD	50	1 (HKD50)	09:15-16:30 & 17:15-23:45	Monthly	29-Nov-22		17,613	6,358	Y
	MSCI EM Asia	ANSA	M1MS	NYF	USD	100	0.05 (USD5)	09:00-18:15 & 18:40-04:45	Quarterly	16-Dec-22	Underlier's closing price on LTD	3,113	81	Y
	FTSE China A50	XUA	XIN9I	SGX	USD	1	1 (USD1)	09:00-16:35 & 17:00-04:45	Monthly	29-Nov-22	Underlier's closing price on LTD	9,707	4,741	Y
	CSI 300	IFBA	SHSZ300	CFF	CNY	300	0.2 (CNY60)	09:30-11:30 & 13:00-15:00	Monthly	18-Nov-22	Arithmetic average of underlier's price for last 2 hours on LTD	30,750	14,505	N
	CSI 500	FFDA	SH000905	CFF	CNY	200	0.2 (CNY40)	09:30-11:30 & 13:00-15:00	Monthly	18-Nov-22	Arithmetic average of underlier's price for last 2 hours on LTD	52,904	16,375	N
	SSE50	FFBA	SSE50	CFF	CNY	300	0.2 (CNY60)	09:30-11:30 & 13:00-15:00	Monthly	18-Nov-22	Arithmetic average of underlier's price for last 2 hours on LTD	12,333	6,098	N
	MSCI Taiwan	HJAA	TAMSCI	HKG	USD	100	0.1 (USD10)	08:45-13:50 & 14:15-04:45	Monthly	29-Nov-22	Underlier's closing price on LTD	880	428	Y
	Taiwan TAIEX	FTA	TWSE	FTX	TWD	200	1 (TWD200)	08:45-13:45 & 15:00-05:00	Monthly	16-Nov-22	Arithmetic average of underlier's price for last 30 mins on LTD	6,882	14,152	Y
	S&P CNX NIFTY (NSE)	NZA	NIFTY	NSE	INR	50	0.05 (INR2.5)	09:15-15:30	Monthly	24-Nov-22	Underlier's closing price on LTD, i.e. VWAP of component stocks for last 30 mins	2,952	2,637	Y
	S&P CNX NIFTY (SGX)	IHA	NIFTY	SGX	USD	2	0.5 (USD1)	09:00-18:15 & 18:40-04:45	Monthly	24-Nov-22		9,613	4,470	Y
	MSCI Singapore	QZA	SIMSCI	SGX	SGD	100	0.05 (SGD5)	08:30-17:10 & 17:40-04:45	Monthly	29-Nov-22	Based on component stocks' opening prices on LTD + 1	4,514	1,230	Y
	FTSE Taiwan	TWTA	FTCRTWRP	SGX	USD	40	0.25 (USD10)	08:30-17:10 & 17:40-04:45	Monthly	29-Nov-22		4,763	3,062	Y
	Thai SET 50	BCA	SET50	TEF	THB	200	0.1 (THB20)	9:45-12:30 & 14:15-16:55	Monthly^	29-Dec-22	Arithmetic average of quotations taken at 1-min intervals for last 15 mins and closing price on LTD (ex. 3 highest and lowest values)	2,717	1,366	Y
	Hang Seng Tech	HCTA	HSTECH	HKG	HKD	50	1 (HKD50)	08:30-17:10 & 17:40-04:45	Monthly	29-Nov-22		3,327	1,720	Y
	KLCI	IKA	FBMKLCI	MDE	MYR	50	0.5 (MYR25)	08:45-12:45 & 14:30-17:15	Monthly	30-Nov-22	Arithmetic average of unlderlier's price for last 30 mins on LTD	517	187	Y
	MSCI China A50	MCYA	MXCNA50C	HKG	USD	25	0.2 (USD5)	09:30-11:30 & 13:00-15:00	Monthly	18-Nov-22	Arithmetic average of underlier's price for last 2 hours on LTD	1,150	782	N

* Average aggregate daily volume for the past 3 months. ^ Thai SET 50 futures now have monthy contracts while their liquidity has yet to pick up.

J.P.Morgan

November 8, 2022

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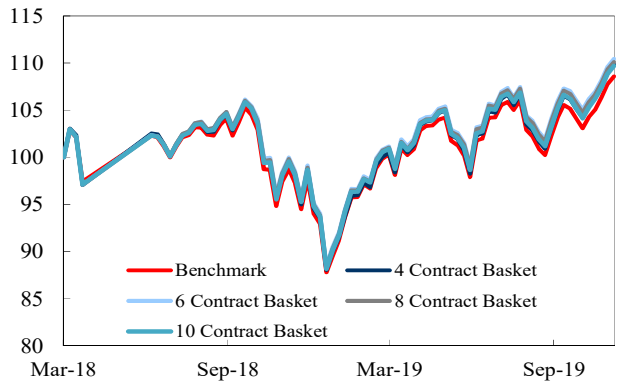
MSCI World (DM) Index Replication via Index Futures

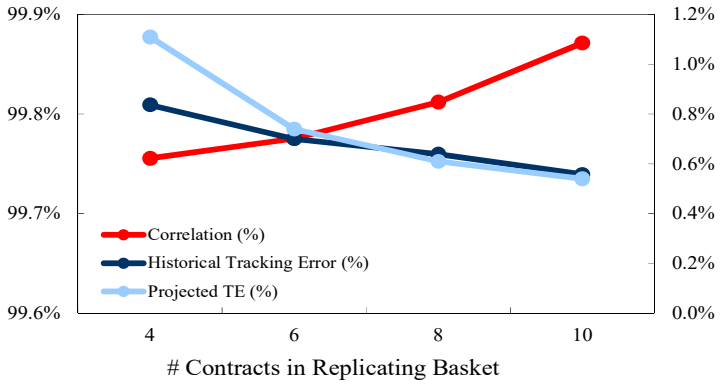
Generic Future	Index Name	Ticker	Country	Exchange	Crncy.	Contract Size	ADV ($M)	# of Contracts in Portfolio 4	6	8	10
			MXWO Replication								
ES1	S&P 500 Index	SPX	United Stat	Chicago M	USD	50	$ 304,474	71.3%	68.0%	65.2%	64.2%
VG1	Euro Stoxx 50 Pr	SX5E	Germany	Eurex	EUR	10	$ 36,979	15.1%	8.7%	8.8%	7.9%
TP1	Topix Index (Tokyo)	TPX	Japan	Osaka Exch	JPY	10,000	$ 11,048	8.5%	8.3%	8.0%	7.8%
Z 1	Ftse 100 Index	UKX	Britain	ICE Futures	GBP	10	$ 9,871	5.0%	4.9%	3.7%	3.5%
SM1	Swiss Market Index	SMI	Switzerland	Eurex	CHF	10	$ 3,884	-	5.1%	5.6%	4.8%
PT1	S&P/Tsx 60 Index	SPTSX60	Canada	Montreal E	CAD	200	$ 3,020	-	5.0%	3.2%	3.2%
XP1	S&P/Asx 200 Index	AS51	Australia	ASX Trade	AUD	25	$ 5,497	-		3.1%	2.5%
RTYA	Russell 2000 Index	RTY	United Stat	Chicago M	USD	50	$ 21,733	-	-	2.4%	2.8%
QC1	Omx Stockholm 30 Index	OMX	Sweden	OMX Nord	SEK	100	$ 2,134	-	-	-	1.6%
HI1	Hang Seng Index	HSI	Hong Kong	Hong Kong	HKD	50	$ 26,168	-	-	-	1.7%
Correlation (%)								99.8%	99.8%	99.8%	99.9%
Historical Tracking Error (%)								0.8%	0.7%	0.6%	0.6%
Projected TE (%)								1.1%	0.7%	0.6%	0.5%
Basket Average Notional Volume ($M)								$ 224,208	$ 211,977	$ 204,119	$ 201,105

* Correlation and historical tracking error calculated using the past three years of weekly US dollar returns. Basket average notional volume calculated based on the past 20D average volume of individual futures. Based on data as of Feb 26, 2021.

Performance of Benchmark and Replicating Futures Portfolios



Correlation & Tracking Error of Replication Futures Portfolios



MSCI global indices cover all the major global equity indices. They comprise all investable large- and mid-cap securities and include ~85% of each market's free float-adjusted market capitalization. Many passively managed funds and ETFs use MSCI indices as a benchmark while active and enhanced funds, and hedge funds have significant exposure to these indices.

There are actively traded listed futures on the MSCI EAFE and MSCI EM indices, but not other MSCI global indices, and liquidity of the former can sometimes be enhanced by trading replicating baskets of country futures. In addition to buying the constituent cash basket, market participants can invest in these global benchmarks through: ETFs, swaps, or replicating baskets of listed futures.

Replicating these indices through futures allows investors to use liquid exchange-traded instruments with low transaction costs, i.e. tight bid-ask spreads, low commissions, and low market impact for large transactions due to the high liquidity. However, futures require investors to trade in a minimum block size (and thus may be inefficient for small portfolios), to roll the futures monthly/quarterly potentially at a premium or discount, and to manage the FX and operational risk associated with transacting across multiple currencies and exchanges. Futures also expose investors to tracking risk since the replicating portfolios do not exactly match the benchmark.

An example of futures replicating portfolios for MSCI World (Developed) Index is shown on the left. We construct replicating portfolios comprising four, six, eight, and ten individual futures. Each replicating portfolio is constructed with the objective of minimizing the projected tracking error of the basket relative to the benchmark. We show these optimized futures basket compositions and weights, along with country and exchange information. We also present the historical and projected tracking error, correlation, and liquidity for each of these baskets vs the benchmark.

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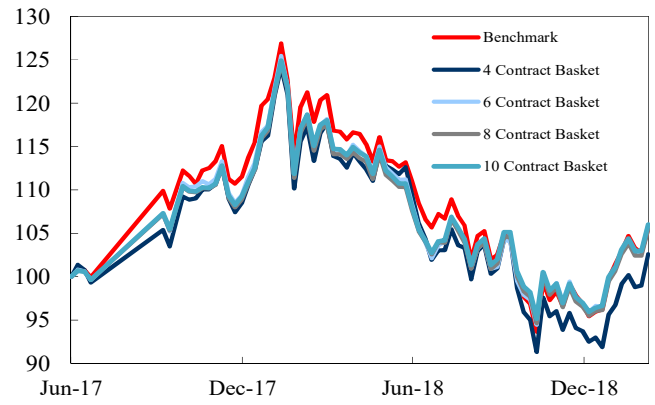
MSCI EM Index Replication via Index Futures

MXEF Replication								# of Contracts in Portfolio			
Generic Future	Index Name	Ticker	Country	Exchange	Crncy.	Contract Size	ADV ($M)	4	6	8	10
HC1	Hang Seng China Ent Ind	HSCEI	Hong Kong	Hong Kong Futures Exchange	HKD	50	$ 8,453	38.8%	33.9%	33.4%	32.8%
KM1	Kospi 200 Index	KOSPI2	South Korea	Korea Exchange	KRW	250,000	$ 15,844	20.5%	17.7%	16.2%	15.8%
FT1	Msci Taiwan	TAMSCI	Taiwan	Taiwan Futures Exchange	TWD	200	$ 8,070	24.3%	17.2%	15.5%	14.7%
AI1	Ftse/Jse Africa Top40 Ix	TOP40	South Africa	South African Futures Exchange	ZAR	10	$ 858	16.5%	10.6%	9.0%	8.8%
NZ1	Nifty 50	NIFTY	India	Natl Stock Exchange of India	INR	75	$ 1,623	-	10.6%	9.2%	8.4%
BZ1	Brazil Ibovespa Index	IBOV	Brazil	B3 Derivatives	BRL	1	$ 3,419	-	10.0%	7.9%	7.8%
MYI1	Msci Malaysia	MXMY	Singapore	Singapore Exchange (was SIMEX)	USD	20	$ 0	-	-	-	0.1%
ZVP1	Msci Mexico	MXMX	Germany	Eurex	USD	50	$ 10	-	-	4.4%	4.1%
SST1	Msci Thailand	MXTH	Singapore	Singapore Exchange (was SIMEX)	USD	20	$ 0	-	-	-	3.6%
FXP1	Msci Russia	MXRU	Russia	Eurex	USD	10	$ 1	-	-	4.6%	3.9%
Correlation (%)								96.6%	97.6%	97.7%	97.8%
Historical Tracking Error (%)								3.6%	2.7%	2.6%	2.5%
Projected TE (%)								4.2%	2.4%	2.1%	2.0%
Basket Average Notional Volume ($M)								$ 8,622	$ 7,661	$ 7,127	$ 6,944

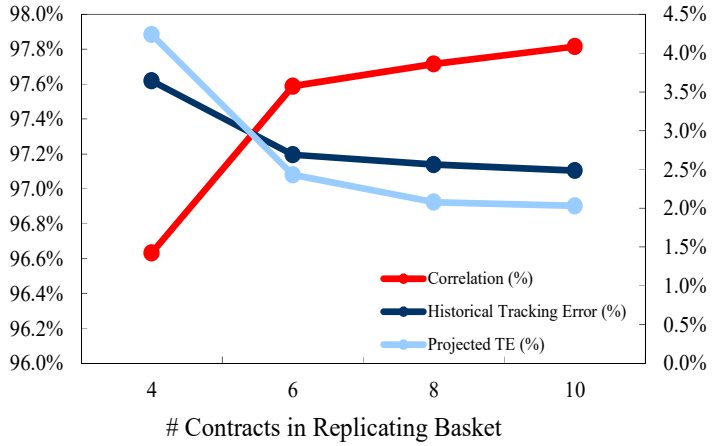
* Correlation and historical tracking error calculated using the past three years of weekly US dollar returns. Basket average notional volume calculated based on the past 20D average volume of individual futures. Based on data as Feb 28, 2019.

The second example is a futures replicationg portfolio for MSCI EM Index. The futures replicating portfolio for MSCI EM tends to show higher tracking error and lower basket liquidity compared to that for MSCI World (DM) Index.

Performance of Benchmark and Replicating Futures Portfolios



Correlation & Tracking Error of Replication Futures Portfolios



Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

Source for data: J.P.Morgan Quantitative and Derivatives Strategy, Bloomberg Finance L.P.

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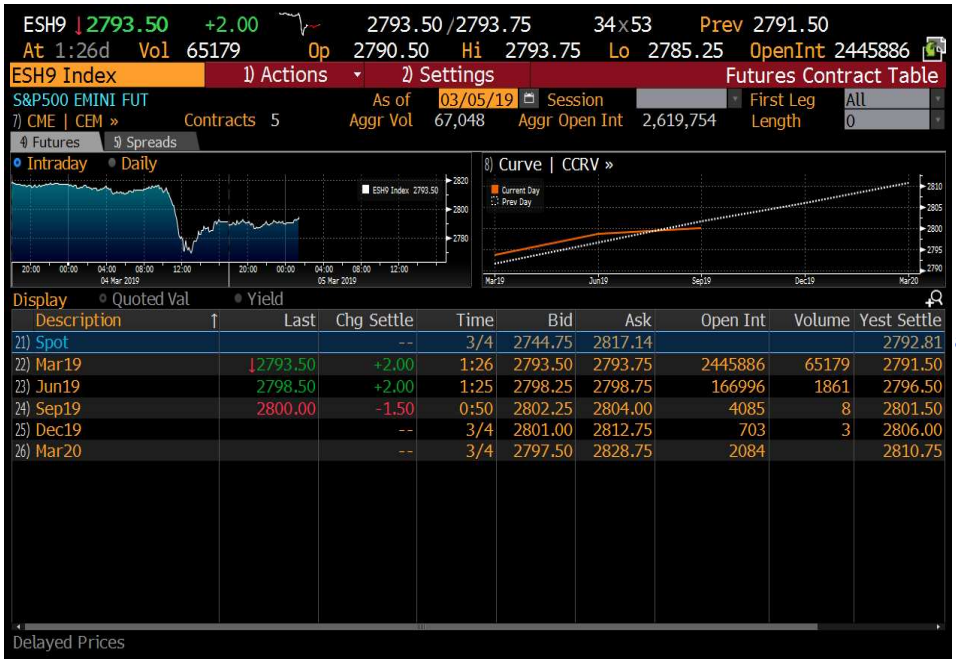
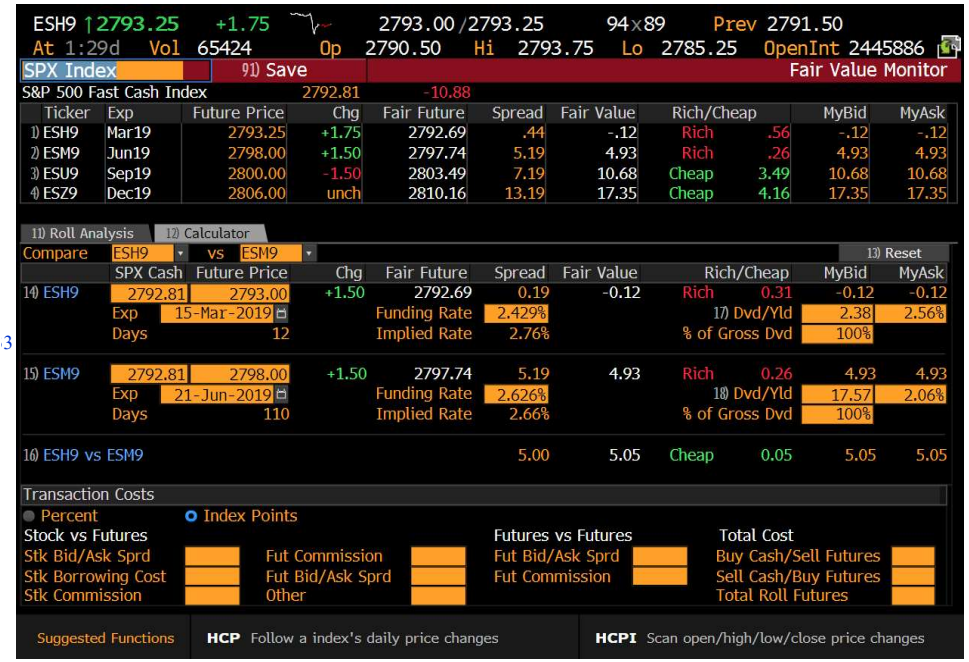
Useful Bloomberg Functions for Index Futures

□ **CT <GO>** - Index futures contracts table



□ **FAIR <GO>** - Index futures fair value page



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The index futures ticker is determined as "Index futures generc ticker + Month code + Year code". For example, the ticker for the S&P 500 Emini Mar19 contract is:

ES + H + 9 = **ESH9**

Futures month codes are as follows:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Code	F	G	H	J	K	M	N	Q	U	V	X	Z

Example: ESH9 vs SPX

Theo. Future (2792.69) = Cash (2792.81) + Fair Spread (-0.12)

Fair Spread (-0.12) = Interest (2792.81 × 2.429% × 12/360) - Dividend (2.38)

Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

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BDVD <GO> - Index dividend page (Bloomberg estimates)

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Index dividend is a reflection of the cash dividend drop on ex-day for the constituent companies.
Index dividend = Dividend per share x Index shares / Index divisor
Note that "Index shares" is calculated based on index methodology (including free-float adjustments, capping, etc). An example is shown on the right:

Company	Dividend (p)	Shares (m)	Market Value (£m)	Free Float Factor	xd adjustment (points)
A plc	12.56	61,443	7,717.2	1.00	1.97
B plc	14.00	22,579	3,161.0	1.00	0.81
				Total xd adjustment for Index	2.78
				Index divisor = 3,918.36	

Company A: Dividend drop = 0.1256 x 61,443 / 3918.36 = 1.97 index points

Global Equity Index Futures Roll Chartbook

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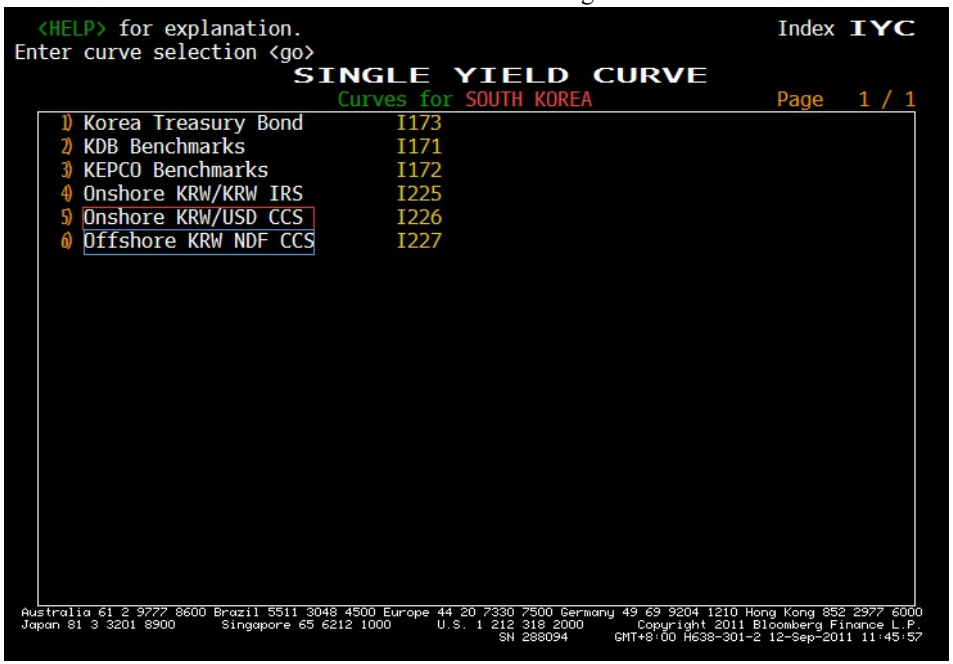
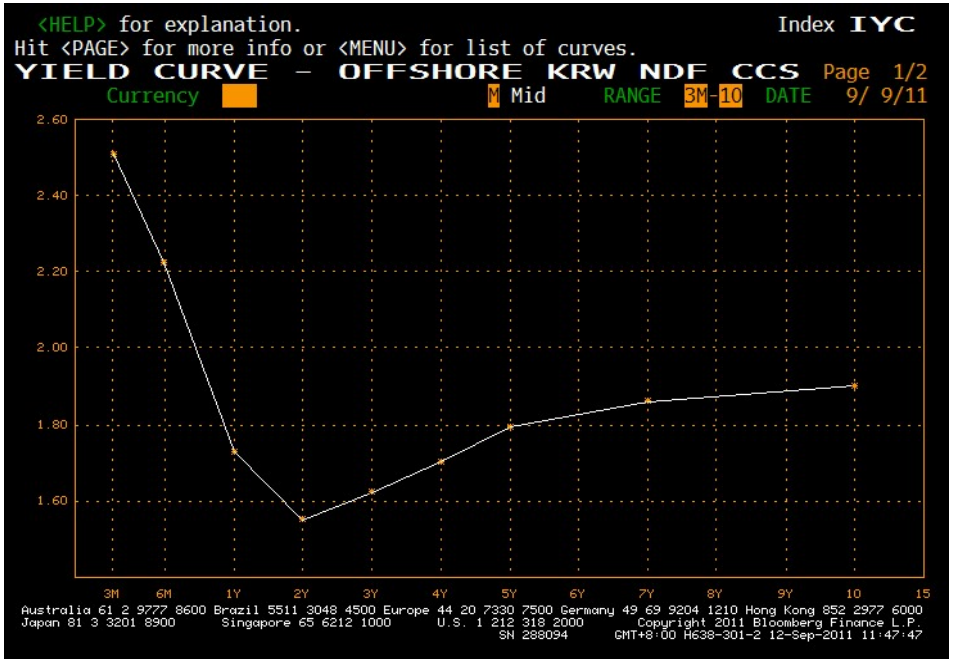
Useful Bloomberg Functions for Index Futures

• **IYC1 <GO>** - Yield curve for Index futures financing cost





J.P.Morgan

November 8, 2022

Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

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J.P. Morgan Equity Index Futures Research Coverage

- **Futures Roll Report (Monthly/Quarterly)**

- Highlights the risk and likely outcomes of the roll into expiry.

- Published quarterly for US indices, Nikkei 225/TOPIX, KOSPI 200, S&P ASX 200 and monthly for European indices and other Asian indices.

J.P.Morgan

North America Quantitative and Derivatives Strategy
05 June 2013

US Equity Futures Outlook
June - Sep 2013

Special Topic: The New Regime for Funding Rates

- The S&P 500 futures roll is trading significantly rich to Libor-based fair value again this quarter as effective financing rates remain elevated. **In our view, the Dec-12 roll marked the beginning of a new regime with structurally higher equity financing costs driven by regulatory and industry changes, which will persist for the foreseeable future.** Thus, futures investors would be ill-served to anchor their expectations for the roll around a mean-reversion to "fair-value." We discuss the drivers of equity financing spreads in the special topic section of this report.
- The tighter and more volatile financing conditions present the main risk for the roll, in our view. The Jun-Sep roll is trading ~43 bps expensive relative to our Eurodollar futures fair value and ~59 bps rich to our Fed Funds based FV, based on our dividend assumptions. However, we see limited dividend risk this quarter as there are few unannounced dividends expected to go ex around the June expiry.
- Last quarter the roll exhibited a sharp reversal, richening initially as long rollers rolled early to avoid getting burned like in December, then falling sharply once buyers began to dry up. The higher financing rates into this roll and positioning likely tilted toward long rollers lead us to **recommend rolling longs early as we again see potential for the roll to richen into expiry.** On the other hand, our roll model suggests a flat trend into expiry.
- The back section of this report contains detailed roll statistics for the Russell 2000, S&P 400, and NASDAQ 100 index futures and an overview of liquidity trends for global equity and equity-linked markets.

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Roll cost progression for the S&P 500 June - Sep 2013 futures roll

Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg

See page 27 for analyst certification and important disclosures.

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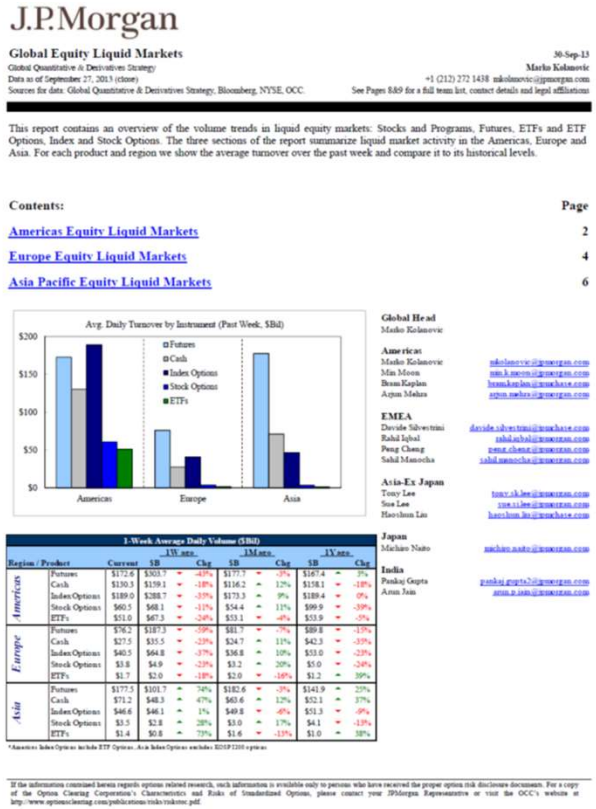
www.jpmorganmarkets.com

- **Global Equity Liquid Markets (Weekly)**

- Contains an overview of volume trends in global liquid equity markets: stocks and programs, futures, ETFs and ETF options, index and stock options.



J.P.Morgan

Global Equity Liquid Markets

Global Quantitative & Derivatives Strategy
Data as of September 27, 2013 (close)
Sources for data: Global Quantitative & Derivatives Strategy, Bloomberg, NYSE, OCC

30-Sep-13
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This report contains an overview of the volume trends in liquid equity markets: Stocks and Programs, Futures, ETFs and ETF Options, Index and Stock Options. The three sections of the report summarize liquid market activity in the Americas, Europe and Asia. For each product and region we show the average turnover over the past week and compare it to its historical levels.

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1-Week Average Daily Volume ($Bil)

Region / Product	Current	1W ago	Chg	1M ago	Chg	1Y ago	Chg
Americas							
Futures	$172.6	$303.7	-43%	$177.7	-3%	$167.4	3%
Cash	$130.3	$159.1	-18%	$116.2	12%	$158.1	-18%
Index Options	$189.0	$288.7	-35%	$173.3	9%	$189.4	0%
Stock Options	$60.5	$68.1	-11%	$54.4	11%	$99.9	-39%
ETFs	$51.0	$67.3	-24%	$53.1	-4%	$53.9	-5%
Europe							
Futures	$76.2	$187.3	-59%	$81.7	-7%	$89.8	-15%
Cash	$27.5	$35.5	-23%	$24.7	11%	$42.3	-35%
Index Options	$40.5	$64.8	-37%	$36.8	10%	$53.0	-23%
Stock Options	$3.8	$4.9	-23%	$3.2	20%	$5.0	-24%
ETFs	$1.7	$2.0	-18%	$2.0	-16%	$1.2	39%
Asia							
Futures	$177.5	$101.7	74%	$182.6	-3%	$141.9	25%
Cash	$71.2	$48.3	47%	$63.6	12%	$52.1	37%
Index Options	$46.6	$46.1	1%	$49.8	-6%	$51.3	-9%
Stock Options	$3.5	$2.8	28%	$3.0	17%	$4.1	-13%
ETFs	$1.4	$0.8	73%	$1.6	-13%	$1.0	38%

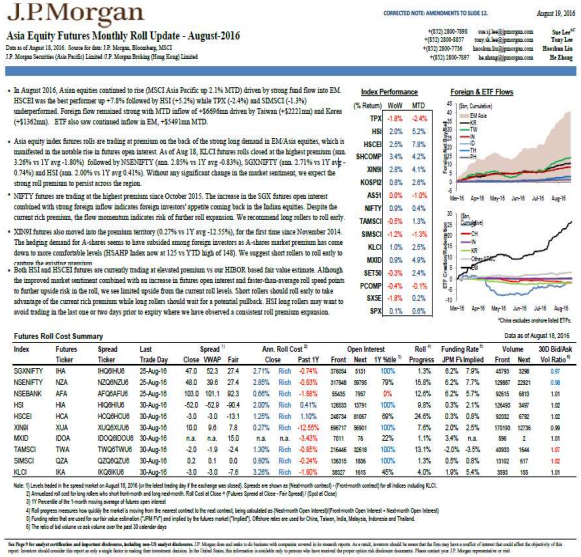
*Americas Index Options include ETF Options. Asia Index Options excludes KOSPI 200 options

If the information contained herein regards options related research, such information is available only to persons who have received the proper option risk disclosure documents. For a copy of the Options Clearing Corporation's Characteristics and Risks of Standardized Options, please contact your JPMorgan Representative or visit the OCC's website at http://www.optionsclearing.com/publications/risks/riskstoc.pdf.

- **Futures Roll Chartbook (Monthly)**

- Contains a roll cost analysis for major global equity index futures

- Published separately on the Indian single stock futures



J.P.Morgan

CORRECTED NOTE: AMENDMENTS TO SLIDE 12. August 10, 2016

Asia Equity Futures Monthly Roll Update - August-2016

Data as of August 10, 2016. Source for data: J.P. Morgan, Bloomberg, MSCI
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- In August 2016, Asian equities continued to rise (MSCI Asia Pacific up 2.1% MTD) driven by strong fund flow into EM. HSCEI was the best performer up +7.8% followed by HSI (+5.2%) while TPX (-2.4%) and SIMSCI (-1.3%) underperformed. Foreign flow remained strong with MTD inflow of +$695mn driven by Taiwan (+$2221mn) and Korea (+$1362mn). ETF also saw continued inflow in EM, +$349.1mn MTD.
- Asia equity index futures rolls are trading at premium on the back of the strong long demand in EM/Asia equities, which is manifested in the notable rise in futures open interest. As of Aug 18, KLCI futures rolls closed at the highest premium (ann. 3.26% vs 1Y avg -1.80%) followed by NSENFITY (ann. 2.85% vs 1Y avg -0.83%), SGXNIFTY (ann. 2.71% vs 1Y avg -0.74%) and HSI (ann. 2.00% vs 1Y avg 0.41%). Without any significant change in the market sentiment, we expect the strong roll premium to persist across the region.
- NIFTY futures are trading at the highest premium since October 2015. The increase in the SGX futures open interest combined with strong foreign inflow indicates foreign investors' appetite coming back in the Indian equities. Despite the current rich premium, the flow momentum indicates risk of further roll expansion. We recommend long rollers to roll early.
- XINHI futures also moved into the premium territory (0.37% vs 1Y avg -12.55%), for the first time since November 2014. The hedging demand for A-shares seems to have subsided among foreign investors as A-shares market premium has come down to more comfortable levels (HSAHP Index now at 125 vs YTD high of 148). We suggest short rollers to roll early to capture the attractive premium
- Both HSI and HSCEI futures are currently trading at elevated premium vs our HIBOR based fair value estimate. Although the improved market sentiment combined with an increase in futures open interest and faster-than-average roll speed pertain to further upside risk in the roll, we see limited upside from the current roll levels. Short rollers should roll early to take advantage of the current rich premium while long rollers should wait for a potential pullback. HSI long rollers may want to avoid trading in the last one or two days prior to expiry where we have observed a consistent roll premium expansion.

Index Performance

(% Return)	WoW	MTD
TPX	-1.8%	-2.4%
HSI	2.0%	5.2%
HSCEI	2.5%	7.8%
SHCOMP	3.4%	4.2%
XINHI	2.8%	4.1%
KOSPI2	0.8%	2.6%
AS51	0.0%	-1.0%
NIFTY	0.9%	0.4%
TAMSCI	-0.6%	1.3%
SIMSCI	-1.2%	-1.3%
KLCI	1.0%	2.5%
MXID	0.9%	4.9%
SETSI	-0.3%	2.4%
PCOMP	-0.4%	-0.1%
SXXE	-1.8%	0.2%
SPX	0.1%	0.6%

Foreign & ETF Flows

*China excludes onshore listed ETFs.

Futures Roll Cost Summary

Data as of August 10, 2016

Index	Futures Ticker	Spread Ticker	Last Trade Day	Spread[1] Close	VWAP	Fair	Ann. Roll Cost[2] Close	Past 1Y	Open Interest Front	Next	1Y %ile[3]	Roll[4] Progress	Funding Rate[5] JPM FV Implied	Volume Front	Next	30D Bid/Ask Vol Ratio[6]
SGXNIFTY	IHA	IHQ8HU6	25-Aug-16	47.0	52.3	27.4	2.71%	Rich -0.74%	376854	5131	100%	1.3%	6.2% 7.9%	45783	3296	0.97
NSENIFTY	NZA	NZQ6NZU6	25-Aug-16	48.0	39.6	27.4	2.85%	Rich -0.83%	317348	89795	79%	15.0%	6.2% 7.7%	129887	23921	0.98
NSEBANK	AFA	AFQ8AFU6	25-Aug-16	103.0	101.1	92.3	0.66%	Rich -1.98%	35455	7957	0%	12.0%	6.2% 5.7%	92615	6810	1.01
HSI	HIA	HIQ8HIU6	30-Aug-16	-52.0	-52.9	-90.4	2.00%	Rich 0.41%	126535	15791	100%	9.6%	0.3% 2.1%	126483	3497	1.02
HSCEI	HCA	HCQ8HCU6	30-Aug-16	-3.0	-3.0	-13.1	1.25%	Rich 1.10%	248734	81067	69%	24.6%	0.3% 0.8%	92032	6782	1.02
XINHI	XUA	XUQ6XUU6	30-Aug-16	10.0	9.6	7.8	0.27%	Rich -12.55%	696717	96901	100%	7.6%	2.0% 2.5%	170193	12736	0.99
MXID	IDOA	IDOQ6DOU6	30-Aug-16	n.a.	n.a.	15.0	n.a.	n.a. -3.43%	7011	76	22%	1.1%	3.4% n.a.	556	2	1.01
TAMSCI	TWA	TWQ6TWU6	30-Aug-16	-2.0	-1.9	-2.4	1.30%	Rich -0.65%	216446	32616	100%	13.1%	-2.0% -3.5%	43933	1644	1.07
SIMSCI	GZA	GZQ6NZU6	30-Aug-16	0.2	0.1	0.0	0.80%	Rich -0.24%	126315	1606	100%	1.3%	0.5% 0.8%	13162	617	1.02
KLCI	IKA	IKQ8IKU6	30-Aug-16	-3.0	-3.0	-7.6	3.28%	Rich -1.80%	38327	1615	45%	4.0%	1.9% 5.4%	3593	155	1.01

Note: [1] Levels traded in the spread market on August 10, 2016 (or the latest trading day if the exchange was closed). Spreads are shown as (Next-month contract) - (Front-month contract) for all indices including KLCI.
[2] Annualized roll cost for long rollers who short front-month and long next-month. Roll Cost at Close = (Futures Spread at Close - Fair Spread) / (Spot at Close)
[3] 1Y Percentile of the 1-month moving average of futures open interest
[4] Roll progress measures how quickly the market is moving from the nearest contract to the next contract, being calculated as (Next-month Open Interest)/(Front-month Open Interest + Next-month Open Interest)
[5] Funding rates that are used for our fair value estimation ("JPM FV") and implied by the futures market ("Implied"). Offshore rates are used for China, Taiwan, India, Malaysia, Indonesia and Thailand.
[6] The ratio of bid volume vs ask volume over the past 30 calendar days

Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy
Source for data: J.P.Morgan Quantitative and Derivatives Strategy, Bloomberg Finance L.P.

Global Quantitative and Derivatives Strategy

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Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

Source for data: J.P.Morgan Quantitative and Derivatives Strategy, Bloomberg Finance L.P.

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Global Equity Index Futures Roll Chartbook

Global Quantitative & Derivatives Strategy

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