On Contango, Backwardation, and Seasonality in Index Futures

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Contango and backwardation refer to a pattern of prices between the spot and futures contracts. Contango formation means (i) futures prices are higher than spot prices, or (ii) the distant future prices have higher prices than nearby futures contracts. This is the usual and frequent interpretation of contango by futures traders, i.e., the specific upward sloping of futures prices given increasing delivery maturity. This, however, is not the academic interpretation of contango, which is more related to the futures price being above the future expected spot price.

Linguistically, the earliest use of the term contango harkens back to the mid-1800s in England, where it is presumed to be a corrupt derivation of continuation, contingent, or continuing (Mitchell 1908). In its earliest industrial use, in the London Stock Exchange, it referred to a financial charge borne by a purchaser of an instrument in case the buyer wished to defer the trade settlement and it had been approved consensually. The fee's total amount would be based on interest not enjoyed by the seller. Normally, the intent of delaying trade settlement occurs for speculation, where the buyer isn't obligated to take possession of the commodity and paid for the stock, since s/he could carry the position over to next business day (for settlement); a right earned by paying a premium (known as contango charge). This charge is similar to modern day connotation of contango, whereby future delivery is dearer than immediate settlement (and delivery), and the charge represents the possessor's cost of carry.

Similar to the history of contango, in the London Stock Exchange, a premium charged to the seller for postponement of physical delivery of stock that has been sold already is called backwardation. Again, the objective is speculative in nature; i.e., to allow for short selling.[1] The seller could carry over his/her short position until the following settlement day through paying the forestated fee of backwardation.

In contrast, normal backwardation entails a phenomenon where futures price is beneath the expected future spot price. If current futures price is less than expected future spot price ($400 vs. $420), it can be called normal backwardation. Moving forward from the day one entered into the futures contract, the futures price will move upwards and subsequently merge with expected spot price on the delivery date, similar to convergence of normal contango phenomena. This also implies a positive yield on the futures position. Kolb (1992) mentions that for a normal backwardation to occur, three things must happen. First, the futures returns should be positive. Second, the futures prices

[1] The fee could be paid either to the buyer or to a third party who lent the stock to the seller.

prior to maturity should be below the terminal futures price, which is the future expected spot price. Third, the futures prices should be lower, the longer the time remaining until expiration.

In understanding contango and backwardation, one needs to understand how futures prices are being established. Since any derivative obtains its value from the underlying asset, the starting point in futures pricing is the spot price of the underlying asset. The spot price needs to be adjusted by the carrying cost in order to arrive to the futures price for forward delivery (Bacha 2006). Here, the carrying cost refers to any additional costs incurred by the seller from keeping the underlying asset in the inventory from day one until the future delivery date. The cost, while mainly referring to the storage cost, can also include handling cost, transportation cost, and so forth. In addition, since the seller is only being paid sometime in the future, an opportunity cost of later payment is incurred by the seller. Both storage and opportunity costs need to be compensated by the buyer of futures to the seller. Hence, we start with the underlying asset spot price, and then we will add:

i. Storage cost (transportation, handling, spoilage, and shrinkage inclusive) and
ii. Cost representing forgone enjoyment of the payment that will be tendered upon maturity of the futures contract.

It would be remiss to omit the concept of convenience yield, which refers to any usufruct that could accrue to the futures seller from holding onto the cash instrument until maturity. According to Brennan and Schwartz (1985),

> "The convenience yield is the flow of services that accrues to an owner of the physical commodity but not to the owner of a contract for future delivery of the commodity."

RELATED LITERATURE

Keynes's novel theory of normal backwardation hinged upon an assumption that on average, hedging predominantly entails a short bias in the futures market (Keynes 1930). Specifically, since commodity producers want to secure their selling price for future deliveries, they will be selling in the future market. Hence, selling pressures will build up, causing these hedgers to pay a risk premium in order to attract buyers. Consequently, the price of a futures contact will be downwardly biased when compared to the future expected spot price, i.e., normal backwardation. This theory enjoyed relative generalizability later, on seeing that futures prices have the potential to convey either a positive or a negative risk premium contingent on the net position of hedgers. This is based on Cootner (1960) proposition, since the supposition of hedgers being overall net short may not reflect reality.

In theory and early empirical works, a lack of consensus was observed by Park (1985), who highlighted the inadequate understanding of the underlying processes of futures prices, which in turn led to haphazard scholarly positions on models of futures. O'Brien and Schwarz documented downward biases in futures prices of gold, although Wilson (1982) lamented the lack of explanatory commentary for the downward bias. In general, literature in the 1980s and 1990s was content attributing futures price biases to market inefficiencies, though some dissidents existed (Jarrow and Oldfield 1981; Margrabe 1978). Citing mark-to-market as a singular distinguishing feature of futures from forwards, French (1983) helped develop a general pricing equation for futures and forward contracts based on relations between the derivatives and spot price expectations. Later, Park and Sears (1985) developed two hypotheses and tested them for commodity futures, paving the way of greater acceptance of the contango/backwardation theory—previously attributed to market idiosyncrasies. In recent times, Prince (2014) tested the lead-lag relationship between spot and futures in crude oil, heating oil, natural gas, and gasoline from 1979 to 2013 through different scenarios (including oil shocks, business cycles, and transaction costs) using a VECM model. The findings strongly suggest a leadership of futures prices toward price discovery, though results were less robust for business cycles during recessions compared to expansions. In the agriculture commodities market, backwardation is usually visible due to the seasonal factors associated with these markets. At the near-end of the season of an agriculture-commodity, for instance, the near-month contract will trade at a premium over the next subsequent contracts as the current demand outweighs the available. One can imagine if there is futures market for Durian and now is the ending season of Durian (say in

September–October), the spot prices will definitely be much higher than distant futures month price simply because demand outstrips supply; presently, hence backwardation. Nevertheless, when the peak month arrives (June–August), the futures market may gradually move to contango. This happens as the spot price moves lower due to more supply from producers. Therefore, for an agricultural commodity futures market, we can see that the market may move from backwardation to contango and vice versa in a single year.

During the inception of the futures market, promoters highlighted price insurance as one of its distinguishing feature; it was a trait with the potential to attract firms and investors desirous of avoiding unsavory price fluctuations (Kaldor 1940). Later scholars proffered an alternative explanation grounded in the view that speculators must receive compensation for enduring the hedgers' price risk; why else would they participate? (Working 1962). Later on, Telser (1981) countered this by stating that futures markets thrive as a cheaper transaction cost alternative compared to forward markets. Modern day motivations for futures market participation include speculation, hedging, and arbitrage. Researchers became interested in unraveling a relationship between the spot and futures prices to evaluate which determines the direction of the other. Thus, a flurry of studies ensued investigating the predictive capacity of one price series for the future direction of the other. Jackline and Deo (2011) highlight that understanding which market's price formation precedes the other can aid in risk minimization for investors and serve as an indicator for how the markets are linked and how new information is digested in each arena. Among the advanced economies, evidence of the futures market leading the spot market include studies by Stoll and Whaley (1990) on MMI and S&P 500, Chan (1992) on MMI, Ryoo and Smith (2004) on KOSPI 200, Zhong, Darrat, and Otero (2004) on IPC (Mexico), and Floros and Vougas (2007) on ASE-20 in Greece. Bi-directional evidence includes Pizzi, Economopoulos, and O'Neill (1998) on S&P 500, Abhyankar (1998) on FTSE 100, Both (1999) on DAX in Germany, Turkington and Walsh (1999) on SPI (Australia), Green and Joujon (2000) on CAC-40 (France), and Mukherjee and Mishra (2005) on India (NIFTY). Meanwhile, for emerging markets, Thongtip (2010), Chooudhury and Bajaj (2012), and Songyoo (2013) investigated such relationships in futures and spot markets in Thailand and India.

Having introduced contango and backwardation theories, we shift to the empirical aspect of the article. Our laboratory is Bursa Malaysia (previously, Kuala Lumpur Stock Exchange—KLSE), where the index prime composite index is KLCI and the derivative associated with it is FKLI. The article is organized the following way. A conventional review of prior research is omitted due to dearth of empirical works on contango and backwardation for Malaysian (and nearby ASEAN) markets. Thus, we begin with the empirical setting. First, we introduce FKLI and furnish a brief history on it. Then we outline our data sources and describe them. Thereafter, we present graphical observations and statistical tests carried out to answer the key questions of the research: unravelling contango/backwardation patterns in FKLI, seasonality traits, directional causality relations, and whether cash leads the futures, or otherwise. The presentation of results is accompanied by topical discussion and possible explanations. Lastly, we recap our findings, acknowledge limitations of the study, and suggest paths for furthering the research on this topic.

DATA DESCRIPTION

Data for this study are sourced from Thomson Reuters Datastream and Bursa Malaysia. There is a total of 5,259 daily closing level observation data from December 15, 1995 until April 5, 2017 for both Kuala Lumpur Composite Index (KLCI) and spot month Kuala Lumpur Composite Index Futures (FKLI). FKLI contract specifications are provided in Exhibit 1 and descriptive statistics for both KLCI and FKLI is shown in Exhibit 2. Average daily return for both FKLI and KLCI are 0.02% for the period, though FKLI daily volatility is slightly higher than KLCI (1.6% vs. 1.3%). Movement trajectories of the two are similar (Exhibit 3). Basis, meanwhile, is defined as FKLI minus KLCI; hence, a positive figure represents contango, and a negative number shows backwardation occurring. During the period, on average, the market was in backwardation evidenced by the basis average of −1.2 points or −0.1%.

EMPIRICAL FINDING

Market Expectation

Our first observation from Exhibit 3 is that contango occurs whenever KLCI is on the uptrend, while

EXHIBIT 1
Specifications of a Standardized FKLI Contract

Particulars	Details
Underlying Instrument	FBM KLCI (FTSE Bursa Malaysia Kuala Lumpur Composite Index, the premier index of Bursa Malaysia)
Size of Contract	FBM KLCI multiplied by RM50
Fluctuation Tick	0.5 index point valued at RM25
Circuit Breakers	20% per trading session for the respective contract months. Only exception is for spot-month contract, for which no circuit breakers apply. Moreover, no circuit breaker applies for the 2nd month contract for last 5 working days prior to expiry.
Contract Months	Spot month, the following month, and the next 2 calendar quarterly months.[a]
Trade Sessions	Morning trading session: 0845–1245 (Kuala Lumpur Time). Post-lunch trading session: 1430–1715 (Kuala Lumpur Time).
Last Trading Day	The last Business Day of the contract month.
Settlement	Cash Settlement based on the Final Settlement Value.
Settlement Value	Mean value (rounded to the nearest 0.5 of an index point) retrieved every 15 seconds or at such intervals as deemed appropriate by Bursa Malaysia; periodically from 154530 hours to 164515 hours. An extra value is added after 1700 hours on the Final Trading Day (the 3 highest and lowest values excepted).
Limit Imposed on Speculation	Highest 10,000 contracts (all months combined).

Notes: This exhibit provides detail on FKLI product specification. If FBM KLCI presently is at 1,738.00, one FKLI contract will amount to 1,738.00 x RM 50 = RM 86,900 per contract. At any point of time, there will be four (4) different FKLI contracts. For example, if today is April 11, the four (4) contracts will be for April, May, June, and September 2017. April 28, 2017 (Friday), which corresponds to the last business day for this month, will be the final trading day for spot month contract; i.e., the April contract. Since 10,000 contracts are the maximum net long or short positions one can hold at any point of time, the maximum net open position per entity is therefore 10,000 x RM 86,900 = RM 869.00 million.

[a] *The calendar quarterly months are March, June, September, and December.*

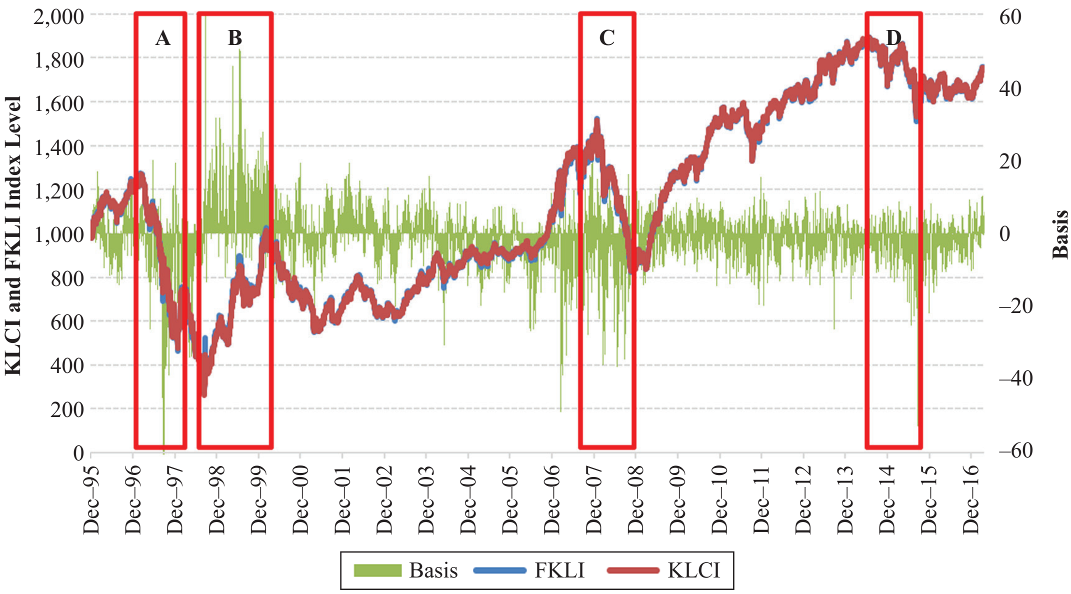
EXHIBIT 2
Descriptive Statistics

	FKLI Return	KLCI Return	Basis (points)	Basis (in %)
Total # of Data	5,258	5,258	5,259	5,259
Average	0.02%	0.02%	–1.2	–0.1%
Std. Dev	1.6%	1.3%	8.4	1.1%
Max	33.4%	23.1%	80.3	18.1%
Min	–32.2%	–21.5%	–62.1	–8.1%
# of Data Above 0	2,623 (50%)	2,725 (52%)	2,317 (44%)	2,317 (44%)
# of Data = 0	112 (2%)	12 (0%)	3 (0%)	3 (0%)
# of Data Below 0	2,523 (48%)	2,521 (48%)	2,939 (56%)	2,939 (56%)

Notes: This exhibit shows the descriptive statistics for FKLI and KLCI returns, as well as basis in points and percentage. Both FKLI and KLCI returns are daily return changes in percentage ($P_t/P_{t-1} - 1$). The number of data above 0 indicates positive daily performance and vice versa. Basis is defined as FKLI spot month minus KLCI. A positive figure reflects a contango formation, while a negative figure indicates backwardation. Data are collected from December 15, 1995 to April 5, 2017.

Exhibit 3

Contango and Backwardation Behavior Given Market Expectation



Notes: Contango formation is observed when KLCI is on the uptrend; that is period B. Backwardation occurs when KLCI is on a downtrend: periods A, C, and D. Period A coincides with the Asian Financial Crisis. During period B, Malaysia enforced capital controls and pegged MYR to USD. Period C was during the 2007–2008 global financial crisis. Period D surrounded impending policy normalization in the US and a persistent drop in oil prices that diminished Malaysian government revenue.

backwardation occurs when index is in a downtrend. Periods A, C, and D are examples of persistent negative returns in KLCI and corresponding backwardation phenomena. Period A refers to the Asian Financial Crisis, which started in 1997. Period C corresponds to 2007–2008 Global Financial Crisis. Period D reflects concern on policy normalization in the US, falling oil prices, and the impact towards Malaysian government budget balance. On the other hand, the contango in Period B corresponds to the recovery period after September 2, 1998 during which Malaysia imposed a 12-month capital flight ban; i.e., no outward movement of capital. Bank Negara Malaysia (the central bank) also pegged USDMYR at 3.80. These four phenomena represent market expectation on the movement of both KLCI and FKLI. For example, when KLCI rebounded due to measures taken by the government in September 1998, it was expected that KLCI would recover its earlier losses and one of the ways investors could make money from this upward movement expectation is via KLCI futures or FKLI. One could buy FKLI, maximize the leverage opportunity via the small initial margin, and wait for the profit to accumulate as the index rises. Similarly, one could also profit from actual stock holdings, but can earn more via leverage and reduced transaction cost (e.g., brokerage, commission) via FKLI. This act of buying FKLI increases the futures level for forward deliveries much more, compared to the increase in cash price such that contango is formed.

On the flip side, during the downward trend of A, C, and D, both retail and institutional investors could express their views in trading positions by shorting FKLI. Thus, futures deliveries prices will be lower than cash price and backwardation occurs. This low futures price reflects the market expectation that KLCI will be experiencing further losses in the forthcoming months amidst anticipated market turbulence. While one can easily short futures, it is quite impossible to do so from the cash market without possessing the underlying asset. Furthermore, short selling was prohibited for a long period after a brief introduction in the 1990s. It was later reintroduced through regulated short selling program in January 2007, and, even then, it was limited to 100 eligible stocks. When short selling in the cash market is not allowed (or is not allowed fully), selling KLCI constituents becomes impossible except through FKLI.

Our next observation with regard to market expectation is that whenever FKLI is in deep backwardation (large negative basis), it is a telling sign that KLCI is in a trough and due to recover imminently. Exhibit 4 shows eight such scenarios (refer to the arrows). The explanation for this relates to the first observation. Whenever the market is on a downward trend and index futures turn into backwardation and further backwardation, there will be a time where KLCI will rebound, either a dead-cat-bounce (short-term) or strong trend reversal (mid-to long-term). When this happens, futures traders will quickly close their position to avoid reduction in mark-to-market profits or to prevent losses if they were shorting futures quite late near the trough. As soon as there are signs of recovery, futures price formation will change from deep backwardation into light backwardation or even contango, depending to the magnitude of the composite index recovery. This, however, contradicts findings from crude oil markets, where it is observed that large contango is indicative of market bottoms (Bouchouev 2012). This could be attributed to investors in crude oil futures being more sophisticated. In other words, when crude oil hits the bottom, market participants know the situation will not last and recovery is in the cards, given that there could be intervention from OPEC or other oil producing countries; hence, higher prices are expected for future deliveries. This contrasts with FKLI, where participants are passive and only react once the sign is obvious.

Seasonality

To identify seasonality traits, we analyze average basis for each month in a year for the 23-year period. Based on Exhibits 5 and 6, two interesting patterns emerge. First, backwardation persistently occurs from April–June and in August of any given year. May, especially, is the month of backwardation, whereby 81% of the time backwardation occurs. April and August are at 76%, while June is at 67%. This means there is a greater than 67% chance that these four months will experience backwardation. This could be due to the fact that investors are selling or closing their futures positions ahead of the summer holiday and also there were several negative global events surrounding those months over the past 23 years; for example, heightening portfolio outflows and ringgit weakening in 1998 prior to the pegging of MYR in September; the credit crunch in 2008 around Lehman Brothers bankruptcy; and the significant fall of crude oil prices beginning in August 2014. Contrarily, December shows a relatively persistent contango—being in that mode 64% of the time. In fact, for nine years in a row since 1995 until 2003, December has always been in contango.

One possible explanation is that towards year-end, investors are taking profit in the cash market (KLCI) and they prefer to have a light book in the equity market ahead of long holiday. When the spot market is down and the futures market is relatively stable, contango will be formed. This theory, however, proved to be irrelevant, as December is actually the most positive and profitable month of FKLI. The FKLI average daily return is the highest in December at +0.13% since 1995. This could be due to window dressing of positions ahead of the year-end closing period of December 31. Institutional investors, including fund managers, normally would want to boost up their mark-to-market value for the year of interest and hence could be buying intermittent lots of stocks in both KLCI and FKLI. Additionally, the positioning of FKLI could reflect the expectation of normally positive performance returns in January and February, due to capital inflows to rebuild investors' portfolio positions for the new year. Based on Exhibit 7, it can be seen that the earlier theory of investors selling FKLI in the summer holds, as average daily returns in May and June were both negative at −0.02% and −0.03% respectively.

The Cost of Carry Model

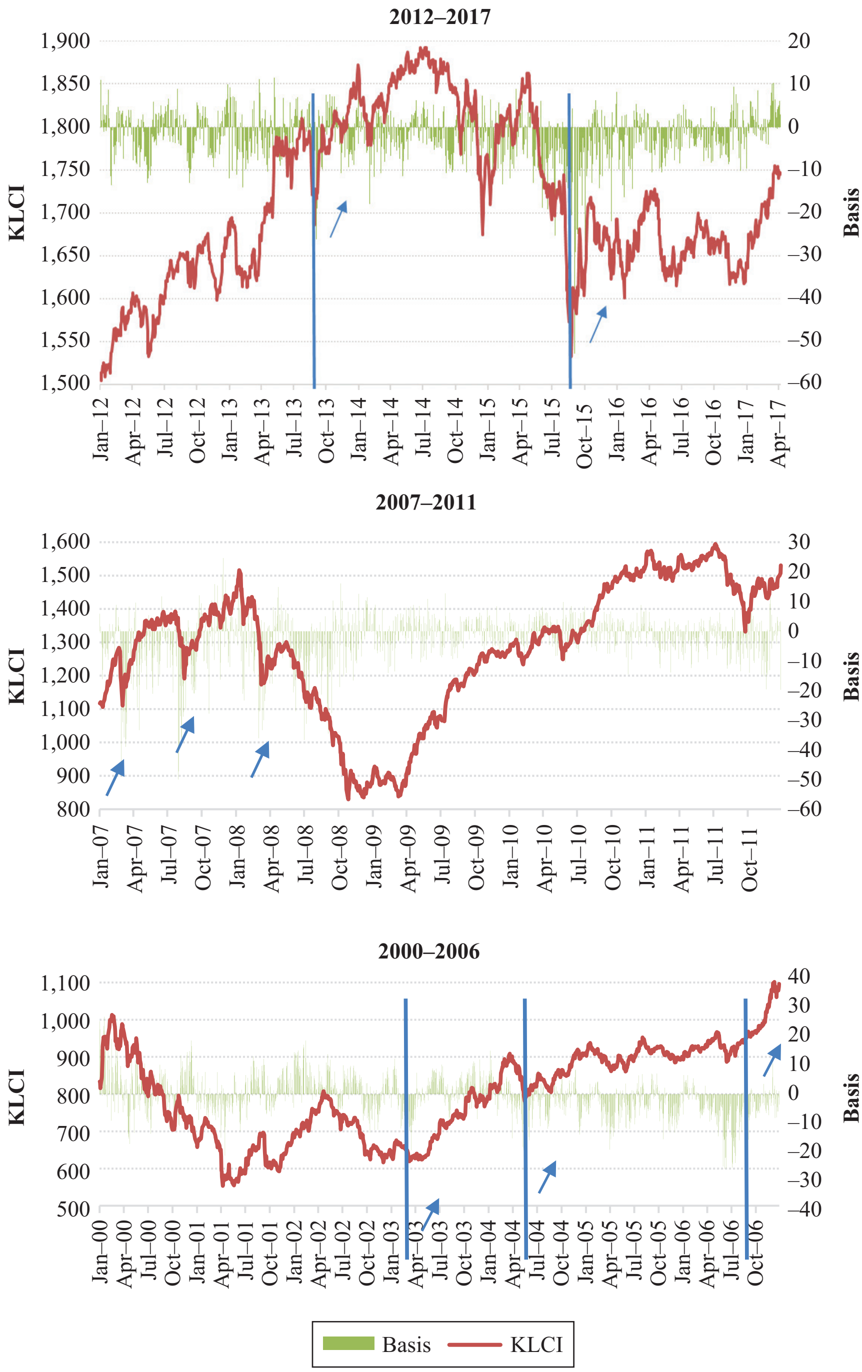
The index futures price can be calculated this way:

$$F_{t,T} = S_o(1 + R_f - D)^{t,T} \tag{1}$$

where

- $F_{t,T}$ = a futures contract's price (here, t = today's date, T = date when contract matures)
- S_o = present spot price of the equity index
- R_f = risk-free interest rate (annualized; used as a proxy for opportunity cost of foregoing spot settlement)
- D = Dividend or convenience yield (in % terms; annualized)

EXHIBIT 4
FKLI Backwardation as a Signal of KLCI Recovery



Note: This exhibit shows that whenever KLCI is in deep backwardation, it is a sign of KLCI recovery.

EXHIBIT 5
Average Basis by Month from 1995 to 2017

Average Basis	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Jan		3	1	–6	16	12	–1	10	3	5	–2	2	–5	–2	0	0	0	2	0	–2	–3	–4	2
Feb		8	1	–6	7	5	–3	9	–6	1	1	1	–1	–4	–4	–2	–4	–2	–6	–2	–4	–3	0
Mar		1	3	–2	1	5	–4	3	–10	0	–7	–4	–18	–13	0	2	–2	1	–1	–2	–3	0	4
Apr		–2	–4	–17	12	–4	–5	3	–1	–3	–9	–5	–9	–1	2	2	–3	–4	–3	–2	0	–4	
May		–1	–9	–13	9	3	–1	7	1	–11	–4	–7	–7	0	–1	–2	–3	–6	–3	–3	–4	–4	
Jun		–6	2	–3	12	0	–4	–1	6	–3	–5	–13	–4	–10	1	1	–1	0	–2	1	–8	–2	
Jul		–3	–4	0	22	–2	1	3	4	–1	–2	–14	–5	–12	–1	2	–1	1	2	0	–6	1	
Aug		–8	–6	–1	9	3	5	5	–2	–6	–2	–4	–19	–7	–3	0	–4	0	–3	–2	–11	–2	
Sep		–2	–28	11	5	0	3	0	3	–1	2	–4	–8	–9	2	0	–5	–6	–6	–6	–16	–3	
Oct		4	–16	10	5	–5	–2	–4	3	–1	–4	–5	–2	–2	1	0	–2	2	3	–2	–5	–3	
Nov		5	–5	10	12	6	5	–4	3	2	–7	–2	3	–3	1	–1	–8	–4	–2	2	–3	–1	
Dec	2	2	1	13	12	9	4	4	3	–6	–6	–1	0	3	–2	1	1	1	–3	–2	–3	–2	

Notes: This exhibit reports monthly mean values of daily basis for every month between December 1995 and March 2017. The intent is to determine persistent positive or negative mean basis for that particular month.

EXHIBIT 6
Description of Average Negative Basis by Month from 1995 to 2017

	Backwardation (negative basis)			
	Average Basis	Frequency	Total Data	%
Jan	1	11	22	50%
Feb	–1	14	22	64%
Mar	–2	13	22	59%
Apr	–3	16	21	76%
May	–3	17	21	81%
Jun	–2	14	21	67%
Jul	–1	11	21	52%
Aug	–3	16	21	76%
Sep	–3	13	21	62%
Oct	–1	13	21	62%
Nov	0	11	21	52%
Dec	1	8	22	36%

Notes: This exhibit summarizes the monthly average basis and the frequency of monthly average basis as a negative figure (backwardation) occurring in the past 22 years. The later data is more useful in deducing whether a particular month is prone to backwardation or contango. It is observed that there is at least a 2/3 probability that it will be in backwardation in the months of April, May, June, and August. Only December exhibits candidacy traits for contango.

EXHIBIT 7
Mean Daily Returns by Month from 1995 to 2017

Month	KLCI	FKLI
Jan	0.08%	0.09%
Feb	0.11%	0.11%
Mar	–0.01%	–0.01%
Apr	0.02%	0.03%
May	–0.03%	–0.02%
Jun	–0.02%	–0.03%
Jul	0.01%	0.00%
Aug	–0.14%	–0.14%
Sep	–0.02%	0.01%
Oct	0.07%	0.07%
Nov	0.01%	0.01%
Dec	0.14%	0.13%

Note: This exhibit reports the month-wise mean daily returns of KLCI and FKLI.

The equation is a manifestation of the cost of carry (COC) model. Since there is no storage cost for equity, there is no storage term, C, in the equation as compared to commodity futures. From Eq. 3, one can conclude that when the advantages of possessing the tangible asset or equity index (dividend yield) are greater than risk-free interest rate (i.e., the financing costs), the negative term is greater than positive term. Hence, the futures curve enters a backwardation stage. Conversely, the futures curve enters the contango zone when the cost of financing (R_f) exceeds the dividend yield.

We collect the FBM KLCI dividend yield from Bloomberg, where data is available since 2006. The risk-free rate is taken as 12-month Malaysian Treasury bills, with data obtained from the Bank Negara Malaysia website. We then calculate the difference between the

Exhibit 8

The Cost of Carry Model Prediction of Contango and Backwardation in FKLI

Year	Basis	Actual Status Based on Basis	12m T-Bills Rate, RF (%)	Dividend Yield, D (%)	RF–D	RF–D Implied Status
2006	–5.0	Backwardation	3.58	3.30	0.3	*Contango*
2007	–6.3	Backwardation	3.43	3.53	–0.1	Backwardation
2008	–5.0	Backwardation	3.35	6.40	–3.0	Backwardation
2009	–0.3	Backwardation	2.03	2.77	–0.7	Backwardation
2010	0.4	*Contango*	2.62	3.67	–1.1	Backwardation
2011	–2.6	Backwardation	2.94	3.43	–0.5	Backwardation
2012	–1.2	Backwardation	3.01	3.52	–0.5	Backwardation
2013	–1.7	Backwardation	3.00	3.27	–0.3	Backwardation
2014	–1.6	Backwardation	3.18	3.24	–0.1	Backwardation
2015	–5.5	Backwardation	3.06	3.05	0.01	*Contango*
2016	–2.2	Backwardation	2.51	3.20	–0.7	Backwardation
2017	2.0	*Contango*	3.01	3.17	–0.2	Backwardation

Notes: This exhibit compares actual average basis in the given year versus the expected basis from the cost of carry model. The average 12-month Treasury bill yield is used as the risk-free rate (obtained from Bank Negara Malaysia), while the dividend yield is the FBM KLCI index dividend yield sourced from Bloomberg.

risk-free rate and dividend yield. A positive figure will imply a contango and vice versa. Based on Exhibit 8, out of 12-year data, the COC model manages to predict eight contango and backwardation phenomena correctly. This is a success rate of 67%. Historically, it seems that dividend yield is almost always higher than the risk-free rate. This implies that one could enjoy excess returns over the risk-free rate (even before taking into consideration any capital gain), when he or she invests in Malaysian stocks. Notice that dividend yield in 2008 was the highest, at 6.40%, which coincides with the Global Financial Crisis (GFC). This could be due to companies trying to restrain shareholders from liquidating their shares by tendering attractive dividends.

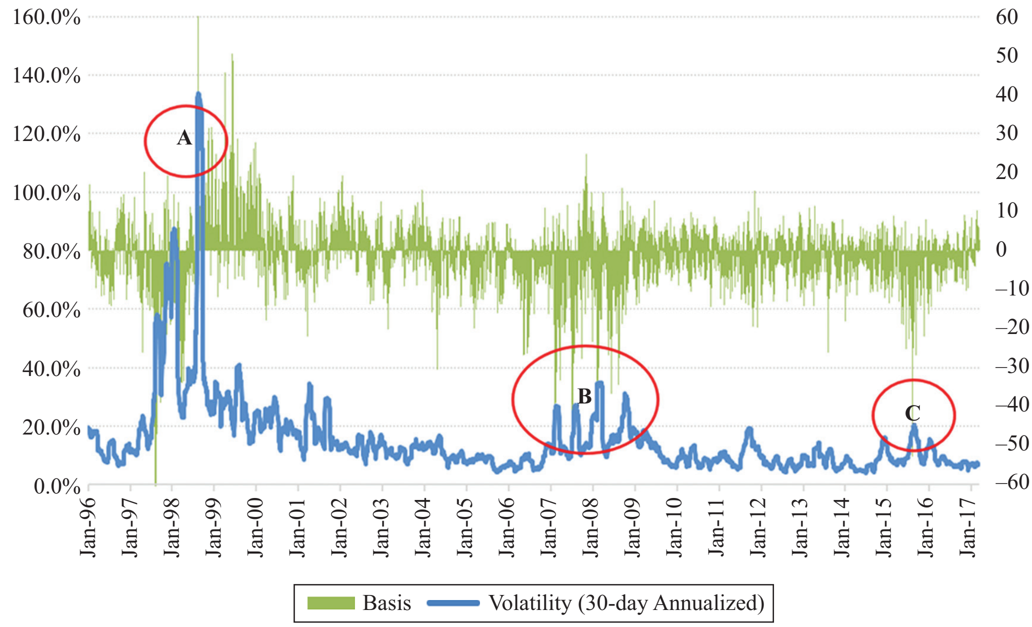
Meanwhile, in the two years that the COC model predicted a contango, the RF–D difference was relatively small, at 0.3 (2006) and 0.01 (2015). Any slight deviation in the risk-free rate or the dividend yield would have turned the RF–D term into a negative number and hence backwardation. On the other hand, in 2010 where the COC model predicts strong backwardation (RF–D of −1.1%), the market was in contango because this period corresponds to the recovery period of KLCI post-GFC and Malaysia was also benefitting from portfolio inflows from the US due to the quantitative easing program undertaken by the Federal Reserve. This had improved investors' optimism and influenced FKLI into contango mode, as compared to the model's prediction of backwardation. All in all, the COC model provides a quick and fairly accurate prediction of whether the FKLI market will be in contango or backwardation, although it must be analyzed together with other factors such as trends in KLCI and impact of global economic events.

Volatility

Based on Exhibit 9, one can see that there is a relationship between KLCI volatility and FKLI formation. At any peak of KLCI volatilities, it will correspond either to a strong contango or a strong backwardation in the FKLI spot month contract. Three periods were highlighted as such (Period A, B, and C). The first period was around 7th September 1998 onwards, where basis was in strong contango at more than 60 points, while KLCI annualized volatility hit a high of 133.7% compared to normal period average of below 20.0%. Strong contango and high volatility were experienced as KLCI witnessed a sharp 69% rebound within 6 days from 1st September to 7th September 1998 following measures taken by the government to prevent further portfolio outflows from the country. Meanwhile, from March 2007 until September 2008 (period B), there were four peaks of high KLCI volatilities and these

Exhibit 9

Comparison between Basis and KLCI Volatility



Note: This exhibit shows a comparison: a time series of daily basis vs. KLCI daily return volatility, which is defined as a standard deviation of a rolling 30-day period, annualized.

peaks coincidentally correspond to four different spikes of strong backwardation formation. These intermittent bursts of volatility could be imputed to spillover effects of subprime mortgage crisis in the US, which impacted stock markets and further negatively affected Malaysian equities. Similarly, sharp backwardation in period C (September 2015) matches that year's peak volatility of 20.5% during the month.

Causality and Direction

Next, we examine the empirical relationship and connections between the cash market (KLCI index) and the FKLI (futures price index). We are interested to find out if the spot market foretells the futures market or *vice versa,* in addition to exploring existence of any bi-directional causality/feedback among the two markets. This is performed via a Granger causality test. The test requires variables employed in an econometric model to be stationary. In other words, the time invariance of the variables' stochastic properties is a prerequisite. Moreover, the time series cannot be co-integrated. Therefore, the time series analysis suitable for this research contains unit root tests to inspect the stationary properties of the series, and co-integration, and causality tests, the results of which are provided in Exhibits 10, 11, and 12.

Firstly, Augmented Dickey-Fuller (ADF) tests were conducted to determine whether or not stationarity properties of the time series exist. The presence of unit roots in a variable signifies the non-stationarity of a time-series. Data was input for both FKLI and KLCI closing prices from December 15, 1995 until April 5, 2017 (5,259 data points). All index series are transformed to logarithm. In the ADF tests, the null hypothesis, H_o is comprised of testing to determine if the series comprises a unit root and is thus non-stationary. If the *t*-statistic is larger than the critical values, the null hypothesis of a unit root is rejected owing to stationarity. The results obtained are tabulated above in Exhibit 10. As demonstrated, all calculated values of ADF for both KLCI and FKLI at level are not significant at 5%. Therefore, it is not possible to reject H_o. This implies that all of the series under scrutiny are not I (0). Afterward, the unit root test was employed for the first difference of the series, after which the ADF-statistics are found to be significant at

EXHIBIT 10

Unit Root Test Results

	ADF			
Series	**Level (*t*-statistic)**	**Probability***	**1st Difference (*t*-statistic)**	**Probability**
KLCI	–0.988557	0.7595	–31.94923	0.0000
FKLI	–0.991938	0.7583	–39.80392	0.0000

Notes: This exhibit reports the results of Augmented Dicky-Fuller tests to establish the stationarity of the time series. H_o rejected if less than 5%. At 5%, the test critical value = −2.861895.

EXHIBIT 11

Co-Integration Rank Test (Trace) between KLCI and FKLI

Futures Index	Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	Critical Value (5%)	Prob.	Conclusion
FKLI	None*	0.054415	294.8898	15.49471	0.0001	1 Cointegrating
	At most 1	0.000175	0.921367	3.841466	0.3371	Equation

*Notes: This exhibit reports the Co-Integration Rank Test (Trace) results between KLCI and FKLI. Here, an *(asterisk) denotes rejection of the hypothesis at the 0.05 level.*

EXHIBIT 12

Pairwise Granger Causality Test between KLCI and FKLI

Null Hypothesis	*F*-statistic	Probability
KLCI does not Granger-cause FKLI	27.3733*	1.E-12
FKLI does not Granger-cause KLCI	65.4097*	9.E-29

*Note: A pairwise Granger Causality representation between KLCI and FKLI. An *(asterisk) denotes significance at 5%.*

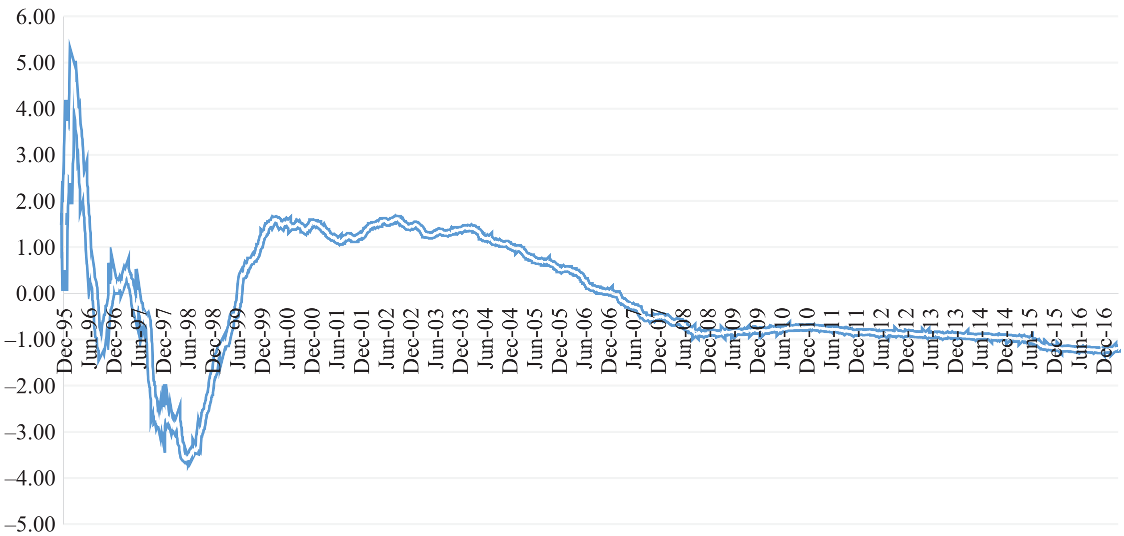
5% levels. This indicates that both KLCI and FKLI are stationary at the first difference (I(1)).

In order to establish the presence of a long-run association between economic variables, co-integration tests are routinely applied. In this article, the Johansen co-integration test is performed for KLCI and FKLI. Statistically, a long-term relationship suggests that the variables change together over time in such a fashion that transitory aberrations from the long-term, dominant trends are corrected (Manning and Andrianacos 1993). The Johansen co-integration test results are presented in Exhibit 11. The co-integration rank test between KLCI and FKLI indicates that there is—minimum—1 co-integration equation among the two variables at 5% levels. Thus, we conclude that a long-run relationship prevails between FKLI and KLCI.

Following the results of ADF-statistics and Johansen co-integration, we conduct pairwise Granger causality tests between KLCI and FKLI at the first difference of the series, which are shown in Exhibits 10–12. Based on the F-statistic values posted above, H_0 can be rejected (null being that KLCI does not Granger-cause FKLI.) Put differently, the results buttress the hypothesis that KLCI Granger-causes FKLI. Similarly, FKLI also is found to Granger-cause KLCI. This means the direction of causality between the two variables is bi-directional. This can be construed as evidence of a feedback effect both ways between the cash market and the futures market. Similar evidence had been reported by Hen, Arzad, and Hasan (2006). This, however, contrasts with the findings of Zakaria and Shamsuddin (2012), who found evidence of mono-directional causality, which ran from KLCI to FKLI only, meaning the cash market leads the futures market. This study was based on data from January 2006 until November 2011. The conclusion at the time was that the Malaysian index futures market was less active than the cash market such that information is reflected faster in the cash market than in the futures market.

Exhibit 13

FKLI Premium and Discount to KLCI or Rolling Average Basis (FKLI – KLCI)



Notes: This exhibit demonstrates the rolling average basis (FKLI – KLCI) from December 1995 to December 2016. FKLI was trading at a deep discount to KLCI between December 1997 and December 1998, and was trading at huge premium to KLCI in December 1995.

Studies on advanced economies with more developed stock markets generally find that futures prices foreshadow stock and cash prices. Thus, our results can be construed as a sign of the Malaysian futures market growing in maturity and sophistication.

The bilateral causality between KLCI and FKLCI is partially attributable to FKLI trading activities, which have been waxing for the past decade. In 2006, only 1.6 million FKLI contracts were traded, which translates into 6,478 average daily contracts (equivalent to RM 355.1 million contract value traded per day). This represents only 31% of daily trading value in the equity stock market. This has since doubled to 3.0 million FKLI contracts traded in 2015 or 12,195 average daily contracts worth RM 1.03 billion per day. This is equivalent to 50% of the traded value in the equity stock market (cash market). Therefore, since futures market activity is now half of the cash market activity, it is only natural that information flow can go both ways. This is even more convincing when market is on a downward trend, as investors can freely express their bearish views in the futures market compared to the generally restrictive cash market (due to short selling constraints and collars put on retail investors). The opportunity of leveraging up to 22 times is just icing on the cake, making it even more appealing to trade in the futures market. Moving forward, once there is deeper breadth and depth in the Malaysian index futures market in terms of market participants and players, aided by full recovery in the global economy, it is plausible that the Malaysian futures market will be leading the cash market, as regularly evidenced in advanced economies.

CONCLUSION

The empirical findings of this study show that the Kuala Lumpur index futures spot month, on average, lay in backwardation of −1.2 points from December 15, 1995 until April 5, 2017. From Exhibit 13, rolling average basis since December 15, 1995 was largely in contango mode during 1995–1996 and 1999–2006. Beginning in January 2007, the average basis turns into backwardation and has prevailed in that mode to date.

The observed contango or backwardation formation in the index futures could be attributed to changes in market expectation and sentiment. When the KLCI is in downtrend due to gloomy investor sentiment, the market turned to backwardation, as market participants sell futures to act on their bearish views. Similarly, during an uptrending market, futures turned to contango, as investors buy futures in an attempt to profit from the bull ride. Moreover, we observe that whenever index futures are in heavy backwardation, it is strongly suggestive of cash market bottoms, which can be imputed to by minimum eight observations in the sample period, as in Exhibit 4.

Next, seasonality could also affect futures formation. It is noted that April to June and August are identified as the seasons of backwardation, while December is the sole month consistent for contango. This is explained, in part, by foreign investors' penchant for unburdening their portfolios ahead of the summer holidays and reflects the resulting liquidation. On the other hand, futures activities in December could be explained by investor anticipation of upcoming economic events and regulatory policy announcements impending in January and February. This is reinforced by an appreciation of KLCI, where foreign capital inflow resumes around this time of the year to rebuild the portfolio. Moving on, the article also observes that cost of carry model is able to predict the period of contango and backwardation of FKLI 67% of the time by referring to the RF–D term. This is the quickest and easiest form for forecasting FKLI formation correctly. The final factor contributing to contango and backwardation in FKLI is the volatility of KLCI. It is observed that whenever KLCI hits its peak volatility, index futures will experience either a strong contango or a strong backwardation depending on investors' prevailing sentiments. The latter part of the article presents findings from unit root tests that demonstrate the stationarity of KLCI and FKLI at first difference. Subsequent co-integration tests allude to a long-run association between the cash market (FBM-KLCI) and the futures market (FKLI). Furthermore, Granger causality tests suggest a bi-directional causality between the cash market index and the futures market index.

A professed limitation of this study is the absence of isolation of FKLI movement due to the convergence property, whereby futures prices merge with spot prices. Theoretically, the basis naturally tightens several days prior to the maturity date and is thus considered an intrinsic factor contributing to futures index movement. Future research on the topic could benefit from separating this influence factor and incorporating its associated impact towards backwardation or contango in futures prices.

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