Stock Index Arbitrage in the Turkish Market

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Abstract

For the first time in the Turkish stock market, the width of the zero arbitrage band for BIST 30 stock index arbitrage is measured and decomposed into distinct contributions arising from commissions, fees, bid/offer spreads and stock loan costs. This study also extends the literature of stock index arbitrage by utilizing intraday data to compute returns for forward and reverse BIST 30 arbitrage once per minute for 2014 and 2015 futures contracts. These returns enable identification of the frequency for profitable executions net of all costs. The absence of profitable trades and the unusual persistence of BIST 30 futures priced below their costless theoretical fair value are explained by their position within zero arbitrage band thresholds. Decomposition and measurement of arbitrage cost elements confirms the identification for regulators of the need for policies to encourage continuing development of domestic stock loan capabilities that ultimately should improve futures pricing efficiency. The relative attractiveness of present BIST 30 index arbitrage is compared with that occurring a decade ago thereby contributing to the growing literature on the evolution of futures pricing efficiency in global markets after introduction of index futures.

JEL Classification: G13, G15

Keywords: Futures, Arbitrage, Stock Index Futures, Turkey, BIST 30, Fair Value

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1. Literature Review

Since first appearing in the 1980s as a an important transaction occurring daily in global stock index futures markets, the subject of arbitrage between stocks and index futures has been heavily studied. For developed markets excellent surveys of this topic and important aspects of index arbitrage are available to scholars and practitioners [1, 2, 3, 4, 5].The arbitrage mechanics are also explained in detail in numerous academic text books on derivatives. By contrast, literature on index arbitrage in developing markets is comparatively scarce, even though this transaction plays a central role in maintaining futures pricing at or near their fair value.

In Turkey there are studies relating to hedging with stock index futures but very few relating directly to index arbitrage. For example the effectiveness of ISE 30 index futures in hedging the holdings of 28 Turkish Securities Investment Trusts was measured by Avci and Cinko [6] over the period 2007 and 2008, but none of the trusts was designed to track the ISE 30 index. Kalayci and Zeynel [7] also concluded ISE 30 futures were effective in hedging market risks during the financial crisis of 2008 but once again their study did not focus on hedging the ISE 30 index. Olgun and Yetkiner [8] studied time varying hedges using ISE 30 futures for periods of varying length but did not address index arbitrage. Basdas [9] examined the lead-lag relationship between the ISE 30 index and index futures as did Ilter and Alguner [10] over the period 2006 – 2011 but neither addressed the matter of index arbitrage. Cagli and Mandaci [11] examined the spot-futures relationship, observing delays in spot responses to changes in futures prices.

In one paper, however, Kusakci [12] compared market pricing against the cash and carry fair value price for ISE 30 futures contracts during 2005 and 2006. The author found ISE 30 futures were under fair value offering opportunities for reverse stock index arbitrage. These opportunities were not being pursued because of the difficulties in Turkey of locating stock to sell short. In the most complete study of index arbitrage by McMillan and Ulku [13] systematic underpricing of ISE 30futures relative to their fair value was found over the period from 2005 - 2006. The mispricing of index futures was once again attributed largely to the difficulty and cost of locating stock to sell short as part of the reverse arbitrage transaction. Aside from these two articles, no further literature has been found that deals with the practical analysis and implementation of arbitrage transactions in Turkey.

One objective of this paper is to describe and calculate in detail the width of the zero arbitrage band within which no arbitrage is profitable. This calculation requires knowledge of transaction costs and their individual contribution to the band width. Separate calculation of the forward and reverse band widths then allows assessment of what policies are best to pursue if the entire band is to be narrowed.

Intraday pricing once per minute of futures and of the ISE30 index ETF are used to calculate arbitrage returns and so the frequency with which profitable arbitrage is possible during selected trading days in 2014 and 2015. When taken together with the zero arbitrage band calculations it is possible to explain the observed persistence of futures priced below their costless fair value and below the spot index level.

A third objective is to contribute to the literature on how pricing efficiency in futures markets evolves after introduction of futures contracts. For this purpose current arbitrage results are compared with those obtained in the initial two years following the commencement of futures trading in Turkey a decade ago in January 2005.

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This paper is organized as follows. Section 2 describes the data used in this study and the methodology for its analysis. Section 3 presents an analysis of the data and a discussion of the results. Section 4 summarizes the findings and conclusions.

2. Data and Methodology

The data collected and used in this study is described in Table 1 along with data sources.

Insert Table 1

Turkey's primary stock index is the BIST National 30 index, also known as the BIST 30 or ISE 30 index. The BIST 30 Index measures the joint performances of the 30 most active stocks traded on Istanbul Stock Exchange. The index contains 30 selected stocks trading either on the National Market on the Collective Products Market. Stock index futures and two ETFs are based upon this index.

BIST 30 stock index futures on the index are quoted in index units divided by 1000. Contracts have a currency size calculated by dividing the index level by 1,000 and multiplying the quotient by 100 Turkish Lira (TRY). Futures contracts are cash settled with a T+1 settlement period and contract expiration months are February, April, June, August, October and December. In this research the 2014 futures contracts studied expired in April June, August, October and December while in 2015 only the February contract was included.

The most liquid Turkish ETF based upon the BIST 30 index is the IST30 issued by Finansbank and managed by Finans Asset Management. This ETF was the first of its kind listed in Turkey. A second, less liquid ETF not considered in this analysis is the ISY 30 ETF created by IS investment, a subsidiary of IS Bank. Both ETFs track the BIST 30 index and are quoted in TRY per ETF. Because using a basket of BIST 30 stocks for index arbitrage in Turkey is both difficult and unnecessarily costly the ISE 30 ETF was employed as an index fund proxy.

On each trading day TRLIBOR interest rates for overnight, 30, 60, 90 and 180 days were collected from the Banks Association of Turkey website and recorded along with the index dividend yield from Bloomberg. When computing arbitrage returns the TRLIBOR rate most closely matching the remaining time to futures expiration was chosen.

The calculation of arbitrage returns employed the standard cost of carry model. A fair value for costless arbitrage, FVo, formed the central futures price from which adjustments were made to cover all transaction costs. For BIST 30 futures

$$FVo = (Io / 1000) \times [\, 1 + (r - d)\, n/365 \,] \qquad (1)$$

FVo = Index future costless fair value
Io = BIST 30 index level
r = TRLIBOR rate for n days converted to a 365 day basis
d = dividend yield
n = number of days until futures expiration

Transaction costs for arbitrage include commissions, bid-offer spreads and regulatory fees. Typical commissions for futures and ETFs were sourced from Turkish brokers and typical bid/offer spreads observed from Bloomberg data. A standard Banking and Insurance Transactions Tax (BITT) of 5% on commissions was applied on all transactions thereby

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completing the estimate for forward arbitrage costs. These established and representative costs appear in Table 2.

Insert Table 2

Forward arbitrage will not take place until all transaction costs are covered and similarly for reverse arbitrage. The futures quote above (below) which forward (reverse) arbitrage is profitable is the upper (lower) threshold. The absolute difference between costless fair value, FVo, and the upper (lower) threshold is the width of the forward (reverse) zero arbitrage band. The difference between the upper and lower threshold is the total width of the zero arbitrage band in index points and is the futures price range within which no profitable arbitrage is possible. When divided by FVo the widths of the arbitrage bands are expressed in percentages. Stock markets in developed countries typically have a band width between plus and minus 0.50% of costless fair value. In developing markets such as China and India, the widths are larger due in part to higher commissions, fees and taxes and further increased by the high costs of borrowing stock when executing reverse arbitrage. The data collected in this study permits calculation of zero arbitrage band widths for comparison with other stock markets and this provides a measure of relative futures pricing efficiency within those markets.

Including in the cost of carry model a TRY cost (Cf) for a single futures-ETF arbitrage, allows the calculation of a futures price, Ff, at which forward arbitrage produces zero profit. Expressed as a percentage of FVo the result is

$$Ff / FVo = 1 + Cf / (100\ FVo) = 1 + 2 \times C1 / (100\ FVo) + C2 / (100\ FVo) \quad (2)$$

$Cf = 2\ C1 + C2$ = TRY transaction cost for a single future-ETF forward arbitrage
$2 \times C1$ = TRY two--way costs for commissions and fees
$C2$ = TRY full bid-offer costs

$Cf / (100\ FVo)$ = percentage width of forward zero arbitrage band
$2 \times C1 / (100\ FVo)$ = percentage width of forward zero arbitrage band from commissions and fees
$C2 / (100\ FVo)$ = percentage width of forward zero arbitrage band from bid-offer spreads

Similarly for reverse arbitrage including a TRY cost (Cr) for a single futures-ETF arbitrage results in a future price, Fr, at which reverse arbitrage produces zero profit. Expressed as a percentage of FVo the result is

$$Fr / FVo = 1 + Cr / (100\ FVo) = 1 + 2 \times C1 / (100\ FVo) + C2 / (100\ FVo) + C3/(100\ FVo) \quad (3)$$

$Cr = 2\ C1 + C2 + C3$ = TRY transaction cost for a single future-ETF reverse arbitrage
$2 \times C1$ = TRY two--way costs for commissions and fees
$C2$ = TRY full bid-offer costs
$C3$ = TRY costs for stock loan

$Cf / (100\ FVo)$ = percentage width of reverse zero arbitrage band
$2 \times C1 / (100\ FVo)$ = percentage width of reverse zero arbitrage band from commissions and fees
$C2 / (100\ FVo)$ = percentage width of reverse zero arbitrage band from bid-offer spreads
$C3 / (100\ FVo)$ = percentage width of reverse zero arbitrage band from stock loan costs

Stock lending in Turkey is generally a very costly business with stock rebate rates often approximating short term interest rates. Calculations in this paper assume a stock loan rebate rate of 15% of TRLIBOR although that rate is often lower. *C1* and *C2* are a fixed percentage of the traded cost of a futures contract while *C3* has a time-dependent component arising from the remaining stock borrow rate until futures expiration. All arbitrage returns in this paper assume holding a position until futures expiration.

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Up to and including the futures contract expiration an index level, a futures quotation and an ETF price were captured each minute of each trading day. Forward and reverse arbitrage returns were computed using costs in Table 2. Knowing the upper and lower arbitrage futures thresholds, Ff and Fr, the frequency of profitable transactions was determined for each futures contract prior to expiration. Comparing the results with arbitrage studied by McMillan in the earliest two years of trading for BIST 30 futures (2005-2006) revealed insight into the evolution of futures fair value pricing as the Turkish market matured.

3. Research Results

The annualized returns for forward arbitrage for April 2014 futures are shown in Figure 1 for trade date April 3. These returns are typical of our findings in all futures examined in the study period in that returns were clustered in a relatively narrow range revealing not one profitable opportunity found on that date. The zero arbitrage band for April 2014 futures as a percentage of costless fair value is shown in Figure 2 for that same trade date. In the histogram for forward arbitrage transactions both the forward and reverse zero arbitrage band widths are displayed. The composition of both the forward and reverse arbitrage bands was determined and is shown in Table 3 along with a comparison of zero arbitrage bands in the China [14] and India markets [15].

Insert Figure 1
Insert Figure 2

The asymmetry between forward and reverse bands is attributable to regulatory and short sales constraints. Mostly the cost of stock borrowing in all three countries in Table 3 creates this asymmetry by making it far more costly to undertake reverse arbitrage than forward arbitrage. The resulting absence of reverse arbitrage until all costs are covered allows futures to remain under their fair value for extended periods of time. Knowing about this market inefficiency China regulators have strongly encouraged the growth of the stock lending business. The ability of arbitrageurs to locate and cheaply borrow stock for short sales is essential if reverse arbitrage is to produce profitable transactions. A developed stock loan business facilitates reverse arbitrage in sufficient size to put upward price pressure on futures that in turn lessens negative mispricing. Introducing and encouraging a liquid stock lending business is known to reduce arbitrage asymmetry. In Greece [16] and Korea [17], for example, negative mispricing of futures was mitigated following introduction of stock borrowing facilities.

In Turkey stock lending is regulated by the Capital Markets Board and implemented through the Securities Lending and Borrowing Market which is itself operated by the BIST Settlement and Custody Bank (Takasbank). Collateral for stock loan can be cash, Treasury bills, government bonds, equities, investment funds, ETFs and other approved securities. The market value of any single order cannot exceed TRY 1.5 million which because of its size is unlikely to act as a constraint on any single reverse arbitrage transaction. The Capital Markets Board classifies equities traded on the BIST into A, B, C, D groups according to specific criteria. Only A-classified stocks are eligible for stock lending. Normally this includes all BIST 30 stocks and the ISE 30 ETF. Prices for borrowing stock are called commission rates and are quoted on an annualized basis. Other than the limitations of being an A group stock with a size not exceeding TRY 1.5 million, the only other regulatory constraint is the uptick rule for short sales which is standard in most capital markets.

Other than the cited regulatory constraints, the limitations on reverse arbitrage transactions are provided by the price for borrowing and the number of shares offered for loan. The stock lending

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commission rate in Turkey often rises to nearly the cash borrowing rate, which then makes reverse arbitrage prohibitive. In addition a typically limited supply of ISE 30 ETFs for 1 or 2 month borrowing acts as a potent constraint on transactions in this study period.

Insert Table 3

The way in which the results obtained in this study differ from those in the McMillan study on index arbitrage in Turkey gives some insight into how the market has evolved since BIST 30 futures were first introduced in January 2005, almost a decade ago. In Table 4 are arbitrage elements from the McMillan study and those observed in the current study.

Insert Table 4

In the current study futures prices moved in a narrow range about the spot index level (1.38% above to 0.17% below) rather than persistently appearing in 2005-2006 at 3% to 4% below spot or infrequently 1% - 3% above spot. While in each study futures persistently traded below costless fair value the magnitude of mispricing was far less in the current study (1.03% above to 1.19% below compared with 5% - 8% below). Because futures and stock commissions changed little over the past decade the Table 4 difference between the two studies in the sum of two-way commissions and bid/offer spreads is primarily attributed to the narrowing of bid/offer spreads. McMillan observed futures purchases occurring when pricing reached 3% to 4% below spot. Also observed was less frequent positive mispricing of 1% to 3% above spot which was not helpful in inducing arbitrage. By inference these two observations suggest a 5% to 8% range of the reverse arbitrage band width and a forward zero arbitrage band width of approximately 3% or higher. Taken together these suggest both the forward and reverse arbitrage band widths have declined sharply to their respective 0.50% and maximum of 2.19% levels in the current study.

4. Summary

For the first time we know of in the Turkish stock market, the width of the zero arbitrage band for BIST 30 stock index arbitrage was measured and then decomposed into distinct contributions arising from commissions, fees, bid/offer spreads and stock loan costs. Intraday data and these costs were used to compute returns for forward and reverse BIST 30 index arbitrage in one minute intervals for futures with differing monthly expirations. The computed returns enabled identification of the frequency of profitable executions net of all costs. The regular absence of profitable arbitrage trades and the seemingly abnormal persistence of BIST 30 futures priced below costless theoretical fair value could then be understood by identifying futures prices as consistently residing within their zero arbitrage band thresholds.

In the intervening years since introduction of BIST 30 index futures in 2005, the magnitude of mispricing from spot and from costless fair value has significantly declined into a far narrower range. The sharp reduction in the width of the full zero arbitrage band originated primarily from improvements in the two-way bid/offer spread and probable reduction in the cost of stock borrowing. Such evolution in the Turkish futures market was to be expected if other markets are any guide. In the US, Japan, Korea and Greece, as observed by McMillan, futures mispricing following the introduction of stock index futures gradually lessened with time as market participants increased and transaction costs declined. However, the current study verifies that the Turkish evolutionary path is consistent with other futures markets.

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The size of the full zero arbitrage band width in Turkey is consistent with other developing markets. The forward zero arbitrage band for BIST 30 futures appears to be approximately the same as that observed in most mature futures markets (about 0.50%). This suggests reducing the reverse zero arbitrage band width is the more attractive way to facilitate further arbitrage. Such a reduction could be accomplished primarily by lowering the cost of stock borrowing. Without lower costs arising from the ability to easily locate and borrow stocks or ETFs for short sales, reverse index arbitrage will remain unprofitable. To increase reverse arbitrage policies and incentives from regulators, with backing from exchanges, dealers and stock loan agents, are needed to encourage the further development of the domestic stock loan business in Turkey. Arbitrageurs will then happily expedite more efficient futures pricing.

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Table 1
Data Collected and Sources

Data Type	Source	Collected
BIST 30 / ISE 30 Index	Bloomberg	1 minute interval prices for each trading day
TRLIBOR	Banks Association of Turkey	O/N, 30, 60, 90, 180 day rates each trading day
Dividend Yields	Bloomberg	Daily Yields
BIST 30 / ISE 30 Futures Prices	Bloomberg	1 minute interval prices for each trading day
Commissions on Futures / ETFs	Turkish Brokers	Typical Commissions
Banking & Insurance Transactions Tax	Revenue Administration of Turkey	Banking and Insurance Transactions Tax
Bid/Offer Spreads on Futures/ETFs	Bloomberg	Typical Bid/Offer Spreads
IST30 ETF Prices	Bloomberg	1 minute interval prices for each trading day

Table 2: One-Way Transaction Costs for Forward Arbitrage of BIST 30

Cost	ETFs	Futures
Commissions	0.0005 x ETF Value in TRY	0.0006 x Futures Contract Size in TRY
BITT*	5% x Commissions	5% x Commissions
Bid/Offer Spread	0.10% of ETF Value in TRY	0.17% of Futures Contract Size in TRY

* Banking & Investment Transaction Tax

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Table 3
Zero Arbitrage Bandwidths as a Percent of Fair Value

Zero Arbitrage Band Widths (ZAB)	Turkey	China [14]	India [15]
Forward Arbitrage Band Width	BIST 30 Futures vs. ETF	CSI 300 Futures vs ETFs	JWSTEEL Futures vs. Stock
Forward ZAB width from Commissions & Fees	0.23%		
Forward ZAB width from B/O spread in stocks and futures	0.27%		
Forward ZAB width	0.50%	0.76%	0.90%
Reverse Arbitrage Band Width			
Reverse ZAB width from Commissions & Fees	0.23%		
Reverse ZAB width from B/O spread in stocks and futures	0.27%		
Reverse ZAB width from Stock Borrow Costs	1.70%		
Reverse ZAB width	2.19%	1.20%	1.57%
Full Zero Arbitrage Band Width	2.69%	1.96%	2.47%

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Table 4
BIST 30 Arbitrage Observations 2005-06 and 2014-15

Typical Arbitrage Element	McMillan Study (2005-06)	Current Study (2014-15)
Futures prices below spot index	3% - 4% below	0.17% below*
Futures prices above spot index	1% - 3% above	1.38% above*
Futures prices vs. costless fair value	5% - 8% below	1.0% above – 1.2 % below
Futures Commissions (One Way)	0.05%	0.06%
Stock Commissions (One Way)	0.08%	0.05%
Arbitrage Commissions plus bid/offer spreads (Two-Way)	0.80% - 1.0%	0.50%
Forward Arbitrage Band width as % of costless fair value	3+% (est)	0.50%
Reverse Arbitrage Band width as % of costless fair value	5% - 8% (est)	1.79% - 2.19%

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Figures 1 and 2 are in an accompanying Excel spreadsheet along with the data used to create them.

Fig. 1. Frequency Histogram for April Futures as % of Costless Fair Value: Trade Date 3 April 2014

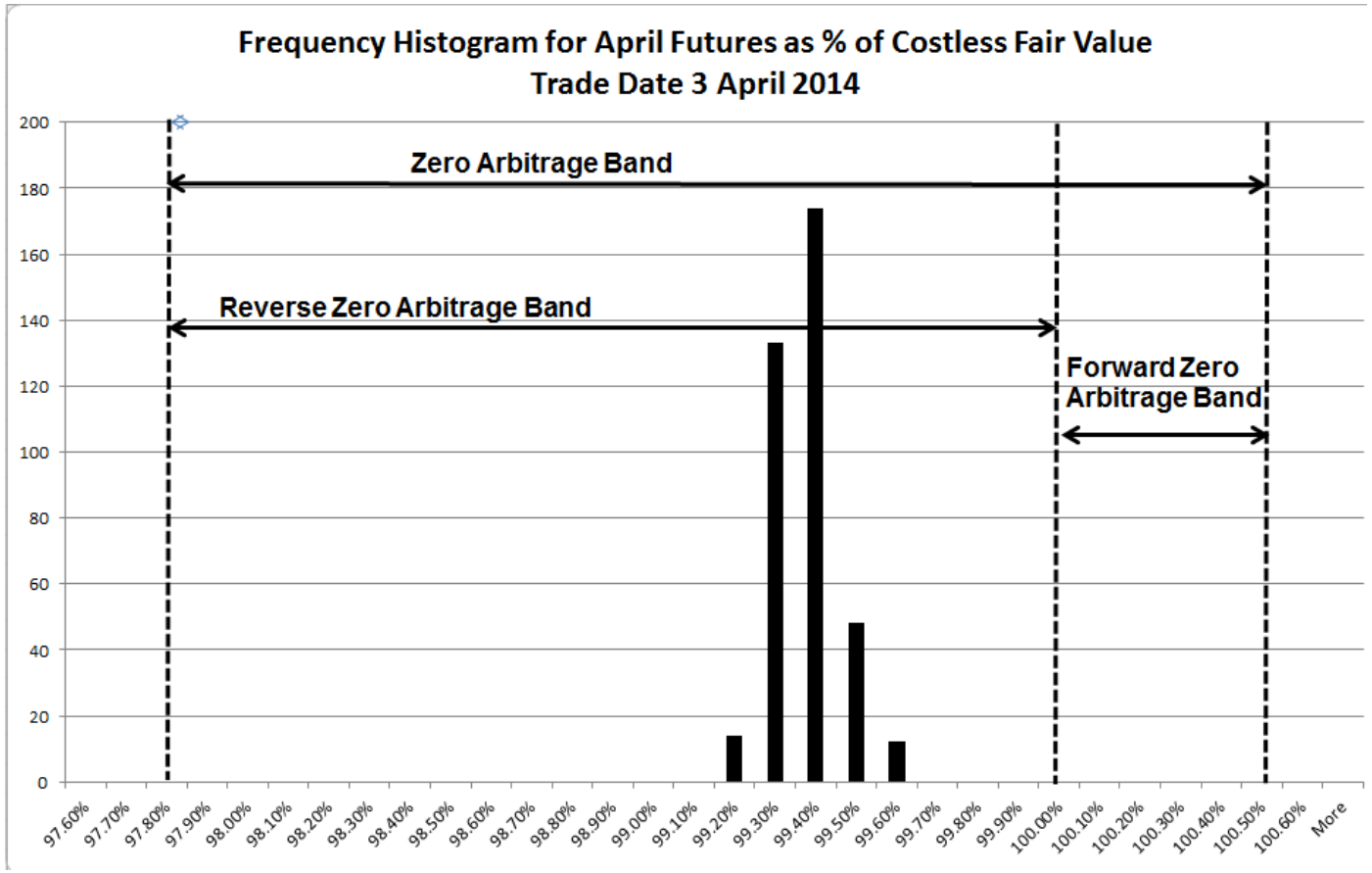

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Fig. 2. Annualized BIST 30 Arbitrage Returns for April 2014 Futures: Trade Date 3 April 2014