A Comparison Of Futures Prices On Turkdex With Conventional Pricing Theory

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Abstract

Derivatives are very sophisticated financial innovations and require highly sophisticated financial markets before they are introduced successfully. The well-known arbitrage free pricing theory applied when pricing derivative securities is based on some assumptions, which may not be verified in many of the emerging markets. Therefore, the applicability of the conventional theory to the emerging markets must be studied in details. This paper questions conformity of conventional arbitrage free pricing theory for emerging markets and discusses efficiency on newly organized Turkish derivative exchange (TURKDEX). Based on the market data in Turkey a comparison will be made between daily market prices and theoretical prices of 43 futures contracts. The results show that currency futures in TURKDEX are evaluated by market players fairly but ISE-30 and ISE-100 contracts offer arbitrage opportunities. Additionally, this work shows that theory and market differences rely mainly on inexperienced market players and newly established market regulations. Conservative regulations on short-selling are another problem to be solved.

Keywords: futures, TURKDEX, cost of carry, arbitrage theory, emerging markets, pricing

1.INTRODUCTION

Forward and future contracts are two basic types of derivatives, where they referred in the literature as unconditional derivatives (Daniel Siegel & Diane Siegel 1990).While evaluating them, the basic pricing approach is "cost of carry" approach (CC). CC is derived from an arbitrage-free market theory, while an arbitrage-free market is characterized as follows (Rudolph & Schäfer 2010);

- There is no taxes, transaction and information cost
- Short selling is allowed
- All market players have the same opportunities on the market
- A cash flow stream and a derivative instrument can be arbitrarily divided.

However, the above mentioned assumptions are only valid for a well-developed market and can be justified only under the well-known efficient market hypothesis (EMH) according to which the current price of a stock fully reflects, at any time, available information exploited by traders. As new information becomes available, any imbalance is immediately detected and accounted for by a counteracting change in stock market price (Fama 1965). Thus, the prices follow random walk and there are no clear arbitrage opportunities on an efficient market (Malkiel 2003; Atsalakis & Valavanis 2009). This, however, requires high liquidity, sufficient depth and well informed market participants. On the other hand, emerging financial markets, like Turkish capital market, may exhibit a different profile and may suffer from low

liquidity and poor information dissemination which bears arbitrage changes and speculations on the market.

After each financial crisis many researchers blamed derivatives and questioned their presence (Buckley 2011). Most developing countries are still skeptical of positive effects of the derivative markets on the financial markets as a whole and apply strict regulations, which complicate trading and discourage international investors.

This paper questions conformity of conventional arbitrage free pricing theory for emerging markets and discusses efficiency of newly organized Turkish derivative exchange (TURKDEX). Based on the market data in Turkey a comparison will be made between daily market prices and theoretical prices of 43 futures contracts, which had been traded on TURKDEX in years 2005 and 2006.

2.RELATED WORK

Although derivatives started to be traded on over-the-counter markets and on Istanbul Stock Exchange (ISE) in 2001, the TURKDEX formally became the only entity authorized by the Capital Markets Board (CMB) to offer financial derivatives in 2005 (Kusakci 2010). Clearing is handled by the Istanbul Stock Exchange (ISE) Settlement and the Custody Bank Inc. (Takasbank) (Kasman 2009). Given its short history there are not many scientific work addressing TURKDEX and its effect on Turkish capital market.

Bektaş et al. (2010) tested the price efficiency of TRYUSD and TRYEUR futures contracts and utilized a random walk model. Low level of coefficient of determination for TRY/$ and TRY/€ contracts supports the existence of random walk for TRY/€ contracts. They mentioned also that TRY/€ contracts are more volatile than TRY/$ contracts in TURKDEX. Thus, EMH cannot be falsified for TRY/$ and TRY/€ contracts. Thus, conventional pricing theory is applicable to these financial instruments.

Avci and Çinko (2010) studied hedging effectiveness of the ISE-30 index futures contract and the effect of hedging period length on hedging effectiveness. The results of the study presented that the ISE-30 index futures contract is effective in hedging the risks associated with the Securities Investment Trusts (SITs) traded in ISE. Their study indicates that the weekly hedges are more effective than daily hedges (Avci & Çinko 2010).

Kasman (2009) examined long memory property of the Turkish futures market. For modeling the volatility, the GARCH and FIGARCH models have been employed. The estimation results provide evidence supporting the FIGARCH models. The results of the FIGARCH model show that estimates of the long memory parameters are significantly different from zero, suggesting that volatility series are long memory processes in the Turkish futures market.

Doğru and Bulut (2012) investigated relation between daily closing prices and trading volume of USD futures contracts in the TURKDEX. The results show no significant relation between prices and trading volume in the short run, but a clear price-volume relation in the long run. Their work showed that the data concerning trading volume affect prices. They conclude that the trading volume changes might be used in price forecasts and thus the futures market in Turkey is not efficient. We should point out that this study analysis only TRY/USD futures contracts from January 2, 2009 to December 30, 2011. Hence, the findings cannot be generalized to all derivative instruments traded on TURKDEX.

Another question arising while analyzing derivative markets is how efficient they are as hedging tools during financial crisis. Kalayci and Zeynel (2009) addressed hedging

effectiveness through the index contracts in the Turkish Derivatives Exchange. The analysis employs a dynamic hedging at the short position against the risk of the fall in prices, and ISE-30 Index contracts are found hedge effective.

Yılmaz and Kurun (2007) presented empirical evidence from the Turkish capital market by investigating the risk perception of the companies and discussed the impact of derivatives on the financial stability in Turkish economy. They focused on non-financial companies that play a vital role in foreign trade operations and have close relations with the banking industry. The results showed that most of the companies give priority to currency risk, followed by commodity price risk. Surprisingly, they do not pay much attention to interest rate risk. Although the firms know derivative products traded on TURKDEX, most of them are reluctant to use them because of the lack of education and experience.

3.COST OF CARRY APPROACH

Based on the aforementioned assumptions in introduction section, CC secures a simple evaluation idea, which equates price of a futures contract to cost of holding a spot market position on the underlying asset, as in (1).

where

$$F_{0,T} = S_0 e^{rT} \tag{1}$$

S_0 Spot price at time 0

$F_{0,T}$ Futures/Forward price at time 0 with a settlement at time T

e^{rT} Annual interest factor with interest rate of r for a time period of (0-T)

The arbitrage-free market, which is the underlying assumption in equation (1), rests upon a smoothly running market mechanism and foresees that each arbitrage opportunity will be detected and utilized. Two possible strategies, namely cash and carry and reverse cash and carry strategies, to take advantage of this arbitrage profits explains this market mechanism (Luenberger 1998).

Under the assumption of an arbitrage free market the theoretical price of a futures contract paying dividends with a continuous rate of q can be calculated as (Hull 2008);

$$F_{t,T} = S_t e^{(r-q)(T-t)} \tag{2}$$

where

S_t Index value at time t

Equation (2) relies on an implicit assumption that a stock basket representing perfectly the ISE-30 and ISE-100 Indices can be rebuilt and this stock basket is paying dividends (Rudolph & Schäfer 2010).

The evaluation of currency futures relies on arbitrage opportunities when same money invested in the foreign currency. A TRY/$ or TRY/€ futures contract can be evaluated as follows;

$$F_{t,T} = S_t e^{(r-r_f)(T-t)} \quad (3)$$

where

r_f Interest rate of the corresponding foreign country

4.EMPIRICAL STUDY ON FUTURES IN TURKDEX

4.1.Dataset and Methodology

In this part an empirical analysis is conducted on the futures contracts written on ISE-30 and ISE-100 Indices and TRY/$ and TRY/€ exchange rates traded in TURKDEX in the years 2005 and 2006. This time period is selected because it covers developing phase, first two years, of the TURKDEX. The number of contracts covered in this period and number of dataset is given in Table 1. Here we will present only the results on annual basis due to the limited space of the paper.

	Number of contracts	Number of dataset
ISE-30 Index futures	12	1314
ISE-100 Index futures	7	747
TRY/$ Futures	12	1392
TRY/€ Futures	12	1392

Table 1: Dataset used in empirical study

While pricing the contracts transaction costs are not considered. Additionally, no physical delivery of the underlying asset takes place. Dividend rate q is taken as 2% in 2005 and 1.8% in 2006 based on the interview made with the market makers on TURKDEX.

The condition for efficiency of ISE-Index futures can be defined as follows: the expected value of and arbitrage profit following a Cash and Carry or Reverse Cash and Carry-strategy must be zero. Thus, the Null-Hypothesis and its alternative can be formulated as:

$$H_0 : \mu_f = \mu_r$$
$$H_1 : \mu_f \neq \mu_r \quad (4)$$

μ_f Expected value of fair price F

μ_r Expected value of market price P

When the results are analyzed, the difference between fair price and market price increases in 2006 when compared with 2005. This indicates more volatile prices in 2006. Table 2 shows the market price, fair price and differences between both prices as well as the related statistics. As indicated by the given t-values of 4.653 and 7.801 for 2005 and 2006 respectively, the null hypothesis must be rejected. Thus, there exist arbitrage opportunities for ISE-30 contracts on

TURKDEX. The results can be observed also for ISE-100 futures contracts based on the given values in Table 3.

Mostly futures price at the market lies under the expected spot price for both types of contracts in TURKDEX. This phenomena is called Normal Backwardation (Hull 2008).

The arbitrage opportunities on the market can be justified with following arguments:

There is no practical way of short selling.

Individual expectations are given more weight than theoretical analysis by market participants. As volatility of underlying asset increases, mispricing increases.

US Dollar and Euro spot prices are quoted with a bid-ask spread. For cash and carry strategy ask-prices are taken spot prices. The expected value of arbitrage opportunity for the futures must be not positive. Thus, the null-hypothesis and its alternative for cash and carry read as;

$$H_0 : E(F_{t,r} - F_{t,f}) \le 0$$
$$H_1 : E(F_{t,r} - F_{t,f}) > 0 \quad (5)$$

On the other hand the reverse cash and carry strategy requires a long position in the futures market. In order that there exists no arbitrage opportunities, the null-hypothesis and its alternative for reverse cash and carry read as;

$$H_0 : E(F_{t,f} - F_{t,r}) \le 0$$
$$H_1 : E(F_{t,f} - F_{t,r}) > 0 \quad (6)$$

	all			2005			2006		
ISE-30	P	F	F-P	P	F	F-P	P	F	F-P
St. Dev.	8,221	8,614	1,383	4,381	4,558	1,138	5,539	5,444	1,404
(n)	1314	1314	1314	566	566	566	749	749	749
Mean	43,500	45,294	1,795	36,065	37,302	1,237	49,127	51,341	2,214
Min	29,825	30,036	-1,574	29,825	30,036	-1,574	38,775	40,492	-1,167
Max	60,350	63,890	8,282	50,625	50,637	4,512	60,350	63,890	8,282
t-value			5,464			4,653			7,801

Table 2: Market price, fair price and difference of both prices with related t-statistics for ISE-30 index futures

	all			2005			2006		
ISE-100	P	F	F-P	P	F	F-P	P	F	F-P
St. Dev.	4,056	4,082	1,521	2,151	1,793	0,489	4,094	4,092	1,545
(n)	747	747	747	41	41	41	706	706	706

Mean	39,149	40,691	1,542	36,636	37,318	0,682	39,295	40,887	1,592
Min	31,325	31,993	-4,163	32,025	33,445	-0,120	31,325	31,993	-4,163
Max	50,275	50,366	5,829	39,875	39,851	1,560	50,275	50,366	5,829
t-value			7,326			1,560			7,310

Table 3: Market price, fair price and difference of both prices with related t-statistics for ISE-100 index futures

Table 4 summarizes the results of the study for TRY/$ futures contracts. The average price differences are 0.002 and -0.009 for cash and carry and reverse cash and carry strategies respectively. This value is almost zero in 2005 while a slight increase is observable due to the highly volatile exchange rates in 2006. TRY/€ contracts give a similar picture as given in Table 5.The results indicate that there is practically no arbitrage opportunities to be exploited for both currency futures.

5.CONCLUSION

For certain, the derivative products as one of the main triggers of deep recession we experienced must be examined more precisely, especially in developing economies like Turkey. Since their presence reflects not only huge potentials but also huge risks for an emerging market. This study compared the market prices on TURKDEX with theoretical fair prices under arbitrage-free market assumption.

The results showed that the index futures on ISE-30 and ISE-100 are undervalued and exhibit reverse cash and carry arbitrage opportunities. However, this is not entirely feasible, as the market does not allow short-selling of ISE-30 and ISE-100 indices or any stock basket recreating the indices.

The currency futures contracts, TRY/$ and TRY/€, do not offer any practical arbitrage profit as the market prices and fair prices are not moving beyond the arbitrage-free band.

TRY/$	P	Fask	Fask- P	Fbid	Fbid- P	P	Fask	Fask- P	Fbid	Fbid- P	P	Fask	Fask- P	Fbid	Fbid- P
St. Dev.	0.096	0.092	0.016	0.091	0.017	0.032	0.035	0.009	0.035	0.009	0.110	0.104	0.020	0.103	0.020
(n)	1392	1392	1392	1392	1392	570	570	570	570	570	823	823	823	823	823
Mean	1.430	1.428	0.002	1.421	-0.009	1.381	1.382	0.000	1.375	-0.006	1.464	1.461	0.003	1.454	-0.010
Min	1.284	1.284	-0.051	1.278	-0.152	1.284	1.284	-0.039	1.278	-0.037	1.313	1.318	-0.051	1.311	-0.152
Max	1.882	1.772	0.143	1.763	0.043	1.477	1.482	0.031	1.475	0.032	1.882	1.772	0.143	1.763	0.043
t-value			0.487		-2.421			-0.126		-3.203			0.587		-1.921

Table 4: Pricing of TRY/$ contracts for cash and carry and reverse cash and carry strategies and their comparison with market price.

TRY/€	P	Fask	Fask-P	Fbid	Fbid- P	P	Fask	Fask-P	Fbid	Fbid-P	P	Fask	Fask-P	Fbid	Fbid- P
St. Dev.	0.154	0.148	0.020	0.148	0.020	0.074	0.076	0.013	0.076	0.013	0.179	0.172	0.023	0.171	0.024
(n)	1393	1393	1393	1393	1393	570	570	570	570	570	823	823	823	823	823
Mean	1.789	1.788	0.002	1.779	-0.010	1.729	1.731	-0.002	1.723	-0.006	1.831	1.827	0.004	1.818	-0.013
Min	1.559	1.562	-0.062	1.554	-0.148	1.595	1.598	-0.052	1.590	-0.051	1.559	1.562	-0.062	1.554	-0.148
Max	2.357	2.248	0.138	2.237	0.052	1.907	1.934	0.042	1.925	0.043	2.357	2.248	0.138	2.237	0.052
t-value			0.266		-1.767			-0.503		-1.374			0.476		-1.492

Table 5: Pricing of TRY/€ contracts for cash and carry and reverse cash and carry strategies and their comparison with market price.

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