ON THE CAUSAL RELATIONSHIP BETWEEN DEPOSIT RATES IN CONVENTIONAL BANKS AND PROFIT-SHARING RATES IN ISLAMIC BANKS IN TURKEY

TÜRKİYE'DE MEVDUAT BANKASI FAİZLERİ VE KATILIM BANKASI KÂR PAYLARI ARASINDAKİ NEDENSELLİK İLİŞKİSİ

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Abstract: This paper empirically investigates whether profit-sharing rates in Islamic banks follow rates of the conventional banks in Turkey over the sample period March 2001 to June 2019 through employing both standard econometric and wavelet approaches. We identify both unidirectional and bidirectional causality between the monthly observations at different time scales. Moreover, the direction of the relationship considerably varies and displays coefficient sign reversal over wavelet scales. Overall, our findings suggest that the rates of return in both banking sectors are not independent of each other and, therefore, have important implications regarding financial stability and risk management.

Keywords: Wavelets, Islamic Finance, Profit-sharing, Conventional Banks, Causality.

JEL: G21, G23, G29, G32.

Öz: Bu çalışmada, 2001 Mart ve 2019 Haziran dönemine ait verileri kullanarak Türkiye'deki kâr payı oranlarının mevduat faiz oranlarını takip edip etmedikleri, standart ekonometrik ve dalgacıklar analizi aracılığıyla, araştırılmıştır. Aylık gözlemlerin kullanıldığı bu çalışmada, değişkenler arasında faklı zaman ölçeklerinde geçerli hem tek hem de çift yönlü nedensellik ilişkisi bulgusuna rastlanmıştır. Ayrıca, değişkenler arasındaki korelasyon ilişki derecesinin ve yönünün dalgacık ölçeklerine göre önemli derecede değiştiği sonucuna ulaşılmıştır. Bu sonuçlar, her iki bankacılık sektörü getiri oranlarının birbirinden bağımsız olmadığını ve dolayısıyla finansal istikrarı ve risk yönetimine yönelik alınacak kararlar açısından dikkate alınması gerektiğini göstermektedir.

Anahtar Kelimeler: Dalgacıklar, İslami Finans, Kâr Payı, Mevduat Bankası, Nedensellik.

1. Introduction

According to recent estimates, the global Islamic finance market, which is growing at a steady rate during the past five decades in terms of both economic size and number of financial institutions, was estimated to be worth US$2,438 billion in 2017 and expected to reach an asset value of US$3,809 billion across its main sectors including banking, Sukuk (Islamic bonds), funds, takaful (Islamic insurance), and other segments at the end of 2023. The history of modern Islamic banking started with the establishment of Mit Ghamr Savings Bank by Dr. Ahmad El-Nejjar in Egypt in 1963 and was closed by the government in 1967 (Chong and Liu, 2009). Today, the sector increased by 2.7% at the end of 2017 from US$1.675 trillion to US$1.721 trillion. By contributing to over 70% of the global Islamic finance industry, the Islamic banking market is expected to surge to US$2.441 trillion by

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2023 (Thomson Reuters, 2019). Based on total asset value for Islamic banking, Iran leads the list by US$578 billion among the top 10 Islamic finance markets, whereas S. Arabia and Malaysia follow, respectively, by US$509 and US$491 billion. Turkey is, however, ranked ninth with US$54 billion after Indonesia having US$82 billion in 2017, in fact, Turkey's ranking had decreased from 8th place to 9th place, overtaken by Indonesia which had an estimated value of US$21.7 billion in 2014 (Thomson Reuters, 2019).

As of June 2019, the total asset value of the dual banking system with 34 conventional banks, 13 development and investment banks, and six participation (Islamic) banks in Turkey stands at an estimated TRY4.23 trillion, in other words, it has exceeded US$730 billion in Q2 of 2019. During the same period, conventional banks hold over 87 percent of the total assets (US$639.17 billion), followed by development and investment banks with 6.80% (US$49.68 billion) and participation banks with 5.65% (US$41.23 billion). The sector share of the first five major banks, namely two state-owned banks and three private banks, is approximately 53% (US$386.7 billion) in terms of economic size. Of these banks, participation banks rank among the top 15, namely the largest participation bank rank 12th with 2.06% (US$15 billion), while the second and third participation banks, respectively, rank 14th and 15th with 1.20% (US$8.76 billion) and 1.04% (US$7.57 billion) in the second quarter of 2019. Besides, the share of state-owned participation banks, which were founded in the past four years and strongly supported by government institutions, are 0.68%, 0.57%, and 0.10% during the same period (TKBB, 2019). Although participation banks operate in the same banking environment with a relatively small fraction of asset value in Turkey, they may expose to similar risks that the remaining banking types face, which can significantly influence their cost and, therefore, profitability. Here, an important question arising is how, why, and to what extent their funding and lending rates differ from each other.

Although both bank types are profit-driven financial institutions, they considerably differ in funding and activity structures, i.e., in terms of the regulatory structure and operating principles. The main difference, as noted by Zarrouk et al. (2016), between conventional and Islamic banks is the prohibition of interest rates (riba), in other words, the activity of the latter must be Shariah-compliant. All transactions of Islamic banks must also be free from risk and uncertainty (gharar) and all forms of speculation and be backed by real assets. The profit-and-loss sharing (PLS) paradigm, however, is the distinctive feature of Islamic banking, which is mainly derived from the musyarakah (joint venture) and mudharabah (profit-sharing) contracts (Chong and Liu, 2009). Even though the Islamic banks are Shariah-compliant, namely, they are adhering to the equity participation and risk-sharing principles, and earn income through venture financing-type investments, in theory, many recent empirical works show that they strictly follow conventional banks in creating assets through non-PLS instruments (Cevik and Charap, 2015; Saraç and Zeren, 2015). In practice, Islamic financing products are not interest-free instruments, but very similar to conventional bank deposits (Chong and Liu, 2009), which is explained by the intense competition environments in the dual banking system (Saraç and Zeren, 2015). Besides, Chong and Liu (2009) argue that principal-agent problems and lack of management and control rights in Islamic finance, however, could be cited as a critical factor for the poor adoption of the PLS paradigm in practice. Operating in the same banking system exposes Islamic banks to facing similar risks –market, credit, and operational risk– that conventional banks

faces. Among these risks, interest rate risk –a type of market risk– arising due to maturity mismatch or re-pricing risk is the most influential factor that Islamic banks must deal with it (Zainol and Kassim, 2010), making them highly sensitive to the movement in interest rates given that they are asset-based and asset-driven banks, in contrast, their counterparties are interest-based and debt-driven (Ajmi et al., 2014). As provided by Khediri et al. (2015), they also diverge in terms of insolvency and credit risk, and off-balance sheet activities but behave similarly in terms of liquidity and profitability.

The literature includes an abundant amount of research works investigating the motives of why customers deposit their money in Islamic banks. Many earliest papers, including Gerrard and Cunningham (1997) and Metawa and Almossawi (1998), had shown that religiosity was the primary factor for Muslims in selecting Islamic banks. In a pioneering work, Metawa and Almossawi (1998) prioritized the relative importance of factors that affect the selection of Islamic banks as (i) adherence to the Islamic principles, (ii) the rate of return, (iii) the recommendations of their family and friends, and (iv) the location of a branch bank in Bahrain. In line with these findings, Gerrard and Cunningham (1997) observed that both Muslim and non-Muslim customers had different attitudes towards the Islamic banking movement in Singapore; namely, both religiosity and profit motives were the main reasons for 70 percent of Muslims and 37.9 percent of non-Muslims. Additionally, 66.5 percent of non-Muslim and 62.1 percent of Muslim customers, however, would withdraw their deposits in case of an unsuccessful distribution of sufficient profits. Subsequent empirical works have demonstrated that Islamic savings and investment decisions are also determined by a range of products and services and speed and efficiency of transactions (Okumus, 2005; Dusuki, 2008; Hoq et al., 2010; Marimuthu et al., 2010; and Echchabi and Olaniyi, 2012). In a pioneering paper, Okumus (2005) pointed out that the primary motive behind choosing both conventional and Islamic banks was product-related in Turkey. For example, staff friendliness, efficiency, and speed in completing a transaction, financial counseling, location of the branch, and consumer confidentiality played a chief role in selecting the Islamic banks while some factors such as the higher return on investment, followed by both the religiosity and profit motives and resistance to economic crises did not. Dusuki (2008) concluded that the stakeholders of Islamic banks must also concentrate on promoting Islamic norms such as poverty reduction and improvements in essential aspects of human welfare, which favors improving the reputation of the bank, instead of being only profit-driven banks to achieve their economic goals. The paper of Hoq et al. (2010), on the other hand, revealed that trust, customer satisfaction, and image of the Islamic banks, which are Shariah-compliant, played a crucial role in enhancing Muslim and non-Muslim customers' loyalty in Malaysia. Marimuthu et al. (2010) reported that the factors of ethnic background and religion were no longer prominent reasons in attracting depositors. Conversely, (i) insufficient information about Islamic banks' operations, (ii) wrong perception that Islamic banks were solely for Muslims, (iii) inadequate branch network were the significant factors among reasons why people in Malaysia remained away from these banks. In a recent paper by Echchabi and Olaniyi (2012), it was documented that the quality of their services and products would be enhanced through training and updating their employees on the latest innovations related to Islamic banking services and providing updated facilities in their branches to strengthen their image and reputation.

Although the interaction between deposit rates and profit-sharing rates has received noteworthy interest among researchers and policy-makers, the debate on whether deposit rates cause profit-sharing rates and vice versa or they move in the same, or the opposite, direction still continues. Among many of others, empirical papers that provide causality from deposit rates to profit-sharing rates include Kaleem and Isa (2003), Erturk and Yuksel (2013), and Cevik and Charap (2015); report causality from profit-sharing rates to deposit rates comprise Zainol and Kassim (2010) and Sukmana and Ibrahim (2017); present causality in both directions consist of Yazdan et al. (2012), Erturk and Yuksel (2013), Ata et al. (2016), Korkut and Ozgur (2017), and Yuksel et al. (2017); and find out causality in neither direction cover Yusof et al. (2015). The reasons behind those theoretically differing results mostly are the frequency of data and model or approach settings, period selected, of which encourage us to reinvestigate this relationship through the wavelets. By employing wavelet analysis as a robust technique, we intended to analyze the strength and the direction of the movement between the underlying variables since it will not only corroborate the finding of the traditional approaches but will also provide more accurate detail about the linkage across time scales and frequencies (see for details Kim and In, 2007; Andrieş et al., 2014; Saiti et al., 2016; Ferrer et al., 2016, and Gök, 2019).

This paper empirically studies the existence and kind of the cointegration and causal relationship between the conventional banks' deposit interest rates and participation banks' rate of return in Turkey over the period March 2001 to June 2019. The sample data set includes 1-, 3-, 6-, and 12-month deposit rates for both the banking industry. Corroborating the findings of many papers in literature, we discover both unidirectional and bidirectional causalities that intensify across different wavelet scales. Also, the direction of the linkage considerably varies and displays coefficient sign reversal over wavelet scales. Thus, we strongly recommend using frequency-based tools since our findings yield several implications for policymakers in constructing monetary policies to strengthen the price and financial stability.

The remainder of the paper is organized as follows. In Section 2, we provide brief literature regarding the deposit rates-profit-sharing rates relationship. The next section 3 describes the empirical methodology and provides the relevant literature for these approaches. In Section 4, we briefly describe our variables. The summary statistics and the empirical findings are presented and discussed in Section 5. In Section 6, we conclude with some crucial remarks for policy-makers.

2. Literature Review

The pioneer empirical work of Kaleem and Isa (2003) reveal evidence of significant linear causality between the rate of Islamic and conventional banks in Malaysia. More clearly, the term deposit returns (TDRs) of conventional banks lead to one-way Granger causality over the TDRs of Islamic banks for 1-, 3-, 6-, 9-, and 12-month maturities under commercial banks and finance companies with an exception for 1-month rates with a bidirectional relationship. In addition, the TDRs of conventional banks triggers one-way Granger causality over the TDRs of Islamic banks for 1-, 3-, and 6-month maturities and two-way causal association between the underlying variables for 9- and 12-month maturities offered under merchant banks at the 1% significance level.

A noteworthy finding of the Yap and Kader (2008) paper is that Islamic bank customers are found to be reacting reasonably to the interest rate movements and withdraw their deposits because of the profit motive and avoiding the adverse effects of interest rate risk.

In a related paper, Ito (2013) captures evidence of a significant cointegration relationship, indicating the effects of interest rates sensitivity on both rates, for all maturities and detects bidirectional causality for these pairs of variables due to the government's commitment and strong support for developing an Islamic financial system in Malaysia.

Based on the findings of the Granger causality test, Ergec and Kaytanci (2014) argue that the changes in deposit rates could be used to predict the movements in profit-sharing rates due to the presence of arbitrage opportunities and the sensitiveness of the profit-sharing rates to the interest rate changes in Turkey.

Ajmi et al. (2014) conclude that the Islamic finance system may not provide a good cushion in case of global financial crises or shocks due to a lack of hedging strategies, leading to an underperform performance during bear market conditions.

Saraç and Zeren (2015) claim the significant correlation between Islamic banks and conventional banks is considered a convergence of the former to the latter and the violation of the operating principles of Islamic finance, i.e., the risk-sharing principle is ignored. Their test findings, on the other hand, show that 3 out of 4 profit-sharing rates of Islamic banks are found to be co-move with the deposit rates of conventional banks. The paper implicitly supports the presence of unidirectional causal relation from the deposit rates to the profit-sharing rates at low-frequency intervals; namely, the causality is permanent, leading to predictable long-run profit-sharing rates in Turkey.

By employing nonlinear methods, Sukmana and Ibrahim (2017) report evidence in favor of cointegration relations between the conventional and Islamic bank rates for all matched maturities due to providing similar depository services and not being completely segmented indeed. In the pricing of their investment products, however, the Islamic banks consider only consumer reactions instead of strictly pegging their rates to the conventional bank rates in Malaysia.

The findings of Yusof et al.'s (2015) paper provide evidence against the long-run relationship between the Islamic bank rates and conventional rates in GCC countries. The null hypothesis of one-way causal relationship over the profit-sharing rates is rejected only for the Saudi Arabia case, indicating a somewhat moderate relationship due to the real rate of return and/or the opportunity cost of capital and they claim that the products of Islamic banks are not actually interest rate free, pointing to the interest rate sensitivity for the Islamic banks in Saudi Arabia.

Meslier et al. (2017) present evidence of market segmentation between the Islamic and conventional banks in 20 countries with dual banking systems. In addition, their results show that these banks significantly differ in terms of pricing behavior. In other words, the conventional banks with having lower market power are forced to provide higher return rates to attract depositors in dominant Muslim societies, pointing to the having difficulty of competing against the Islamic banks and potential adverse effects on financial stability. Inconsistent with the findings of previous papers, they state that the rates of conventional banks are significantly

sensitive to the profit-sharing rates while the reverse not true since the Islamic banks are only affected by their peers.

3. Methodology

In this paper, we use Harvey et al. (2013) unit root test for stationarity of the time series. For the pairs of variables that nonstationary in level, we implement a publicly available GAUSS code for cointegration test with multiple (two) unknown structural breaks proposed by Hatemi-J (2008). Given the results of the test, we are required to studying a causal linkage in the VECM approach. The computation of the LM test statistics, as well as probability values for a causal relationship in variance proposed by Hafner and Herwartz (2006) for the pairs of stationary variables, is obtained by the codes written in E-views econometric software package. In addition to the time-domain analysis, we utilize a novel wavelet technique enabling us to extract the time- and frequency-domain information by decomposing the underlying pairs of the first-differenced variables into different frequency levels. For brevity, however, the technical details of the well-known tests (for wavelets see Gencay et al. (2002), Ramsey (2014), and Kim and In (2007); for the unit root test see Harvey et al. (2013) and for the cointegration test see Hatemi-J (2008)) is left to the reader.

In their paper, Hafner and Herwartz (2006) test the following null hypothesis of a stochastic process with the stationary assumption of $\{\epsilon_t\}$ and $E[\epsilon_t|\mathcal{F}_{t-1}] = 0$ conditions for a given $i, j = 1, \dots, N$, where $i \neq j$

$$H_0 : \mathrm{Var}\big(\epsilon_{it}|\mathcal{F}_{t-1}^{(j)}\big) = \mathrm{Var}(\epsilon_{it}|\mathcal{F}_{t-1}), \quad \mathcal{F}_t^{(j)} = \mathcal{F}_t \backslash \sigma(\epsilon_{j\tau}, \tau \leq t) \tag{1}$$

Consider the following model to test the null hypothesis,

$$\epsilon_{it} = \mathcal{H}_{it}\sqrt{\sigma_{it}^2 h_t}, \quad h_t = 1 + m_{jt}'\omega, \quad m_{jt} = \big(\epsilon_{jt-1}^2, \sigma_{jt-1}^2\big)' \tag{2}$$

where $\sigma_{it}^2 = \varphi_i + a_i\epsilon_{i,t-1}^2 + b_i\sigma_{i,t-1}^2$ and $\mathcal{H}_{it}$ refer to the standardized residuals of the GARCH process. In addition, ϵ_{it}, the score of the Gaussian log-likelihood function, is given by $x_{it}(\mathcal{H}_{it-1}^2) * 0.5$ with the conditions of $x_{it} = \sigma_{it}^{-2}(\partial\sigma_{it}^2/\partial\Phi_i)$ and $\Phi_i = (\kappa_i, a_i, b_i)'$. If $\omega = 0$ condition holds for equation (1), then the testing of the null hypothesis $H_0 : \omega = 0$ against the alternative hypothesis of LM test $H_0 : \omega \neq 0$ can be valid. The following test statistic is offered for the test causality in variance

$$\lambda_{LM} = 0.25T\left(\sum_{t=1}^{T}(\mathcal{H}_{it-1}^2)m_{jt}'\right)\frac{1}{\Omega(\Phi_i)}\left(\sum_{t=1}^{T}(\mathcal{H}_{it-1}^2)m_{jt}\right) \overset{d}{\to} \chi^2(2) \tag{3}$$

To put it in another way, the LM test statistic can be obtained through auxiliary regression as given

1. In order to obtain standardized residuals, derivatives, and volatility process, estimate first a GARCH(1,1) model for ϵ_{it} and ϵ_{jt}.
2. Regress $(\mathcal{H}_{it-1}^2)$ on derivatives x_{it}' and misspecification indicators in m_{jt}'.
3. Finally, obtain the statistic λ_{LM} as multiplying observation numbers (T) with the degree of explanation coefficient, R^2, of the latter regression.

Given that the number of misspecification indicators in m_{jt} determines the asymptotic distribution, the LM test statistic, λ_{LM}, will include two degrees of freedom for chi-square distribution.

4. Data

To shed light on the direction and strength of the linkage between the profit share rate of participation banks and interest rates of conventional banks, we use monthly observations in Turkey from March 2001 to June 2019. Our sample data comprises 1-, 3-, 6-, and 12-month rates for both the banking industries and derived from the Participation Banks Association of Turkey and Central Bank of the Republic of Turkey. We depict the time series of the data in the following figure to provide an overview of the rates and it is evident that they exhibited a rather similar pattern during the tested period.
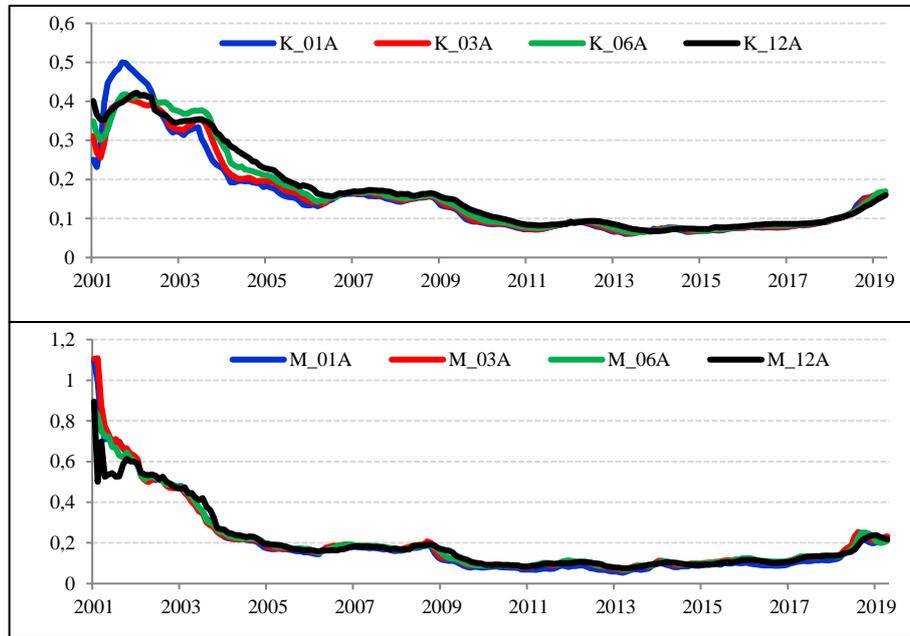

Figure 1 Monthly observations of the profit-sharing (upper) and deposit rates (bottom) in the Turkish Banking Sector

5. Empirical Results and Discussion

In the following empirical analysis, both the raw (P_t) and the first-differenced data (P_t - P_{t-1}) are used.

Table 1 Descriptive Statistics

Profit-sharing rates	K_01A	K_03A	K_06A	K_12A
Mean	0.1533	0.1532	0.1612	0.1661
Median	0.1213	0.1229	0.1241	0.1289
Max	0.4999	0.4143	0.4186	0.4223
Min	0.0603	0.0614	0.0643	0.0668
Std Dev	0.1082	0.0984	0.1062	0.1047
Skewness	1.7387	1.3323	1.2682	1.138
Kurtosis	5.2709	3.6489	3.3357	2.9871
JB	158.106***	68.942***	59.997***	47.485***
n	220	220	220	220
Deposit Rates	M_01A	M_03A	M_06A	M_12A
Mean	0.1926	0.2039	0.2013	0.198
Median	0.1242	0.1391	0.1415	0.1549
Max	1.094	1.1079	0.8576	0.8953
Min	0.0529	0.0659	0.0706	0.0753
Std Dev	0.1763	0.1773	0.1612	0.1492
Skewness	2.3517	2.5611	2.0801	1.8917
Kurtosis	8.8172	10.1944	6.6894	6.0454
JB	512.977***	714.952***	283.405***	216.212***
n	220	220	220	220

Note: *, **, or *** indicate rejection of the null hypothesis at 10%, 5%, and 1% significance levels, respectively.

Table 1 provides summary statistics for the sample data. It is evident that the first five statistics of the profit share rate of participation banks have remained below the interest rates of conventional banks regardless of maturities over the period. The average profit shares varied between 6.03% [K_01A] and 49.99% [K_01A] while average deposit rates varied between 5.29% [M_01A] and 110.79% [M_03A]. 1-month share [K_01A] and 3-month deposit rates [M_03A] are highly volatile with high standard deviations within their groups by 10.82% and 17.73%, respectively. In other words, the standard deviation of the 3-month deposit rates displays by far the highest volatility among all rates. Furthermore, all rates exhibit positive skewness, excess kurtosis, except for [K_12A], and deviation from normality, indicating that our data have an asymmetrical distribution with the long right and heavy tails whereas K_12A has short but right thin tails.

Table 2 Harvey et al. (2013) unit root tests with one and two structural breaks

Variable	Level		Differenced	
	MDF$_1$	MDF$_2$	MDF$_1$	MDF$_2$
K_01A	-3.458	-5.118***	-7.065***	-7.162***
K_03A	-3.698*	-3.848	-4.468***	-4.721**
K_06A	-3.024	-3.529	-4.593***	-4.673**
K_12A	-2.55	-3.388	-4.04**	-4.03
M_01A	-3.297	-5.164***	-3.482	-3.553
M_03A	-3.288	-5.329***	-5.502***	-6.214***
M_06A	-2.073	-3.82	-5.205***	-5.278***
M_12A	-2.97	-6.381***	-2.746	-3.149

Note: *, **, or *** indicate rejection of the null hypothesis of a unit root where the relevant critical values for MDF$_1$ test are -3.57, -3.85, and -4.40, and for MDF$_2$ test are -4.30, -4.58, and -5.10 at 10%, 5%, and 1% significance levels, respectively.

Table 2 reports the results of a preliminary and necessary step before employing cointegration and causality tests for the raw and the first-differenced data. A perusal of the table shows that the null hypothesis of a unit root could be strongly rejected only for K_03A in the one break in trend case (MDF$_1$) and for K_01A, M_01A, M_03A, and M_12A in the two breaks in trend case (MDF$_2$) using the Harvey et al. (2013) approach, indicating level-stationarity for these variables. Conversely, K_12A is found to be the first-differenced stationary according to MDF$_1$, whereas K_06A and M_06A are integrated of the first order according to MDF$_1$ and MDF$_2$. Given the outcome of the Harvey et al. (2013) unit root test, we proceed to investigate possible long-run associations by employing the Hatemi-J (2008) cointegration approach which its results are reported in Table 3.

Table 3 Hatemi-J (2008) cointegration test

Model			ADF	BP1	BP2	Phillips Za	BP1	BP2
K_M06	$\nRightarrow$	M_M06	-6.56***	2006-01	2007-07	-36.506	2003-11	2006-06
M_M06	$\nRightarrow$	K_M06	-6.715***	2004-04	2010-11	-44.409	2004-01	2011-01

Note: *, **, or *** denote the rejection of the null hypothesis at the 10%, 5%, or 1% significance levels, respectively.

The first line shows the modified ADF and Phillips test statistics and relevant breakpoints when the 6-month participation share return is regressed on the 6-month deposit rates, while the information of the reverse-order regressions is given in the second line. The findings reveal that the null of no cointegration linkage is strongly rejected for both cases, indicating that both variables move in tandem in the long-run. In other words, the profit-sharing rates are strongly integrated with the deposit rates for the six-month investment horizon and it seems that they quickly react to the changes in rates of conventional banks. Our evidence reinforces the conclusion drawn by Ito (2013) for Malaysia; Cevik and Charap (2015) for Turkey and Malaysia; Saraç and Zeren (2015) for Turkey; Adewuyi and Naim (2016) for Bahrain, Indonesia, and Malaysia; and Samad (2018) for Bahrain. We should, therefore, proceed to apply the method of Granger causality test in the VECM model to identify the direction of the causal relationship in the short- or/and long-run.

Table 4 Granger causality test results based on VECM

Model			Lag	χ^2 Statistics	ect_{t-1}
K_M06	$\nRightarrow$	M_M06	6	9.12543	-0.02395
M_M06	$\nRightarrow$	K_M06	7	57.14333***	-0.05577***

Note: *, **, or *** denote the rejection of the null hypothesis at the 10%, 5%, or 1% significance levels, respectively.

Evidently, we fail to reject the null hypothesis of no causation effects running from K_M06 to M_M06, i.e., M_M06 co-moves with, however, is led by K_M06 in neither short-run nor long-run. In other words, the movements in the 6-month profit-sharing rates cannot be used to predict the deposit rate changes in dual banking markets in Turkey. However, the 6-month deposit rates strongly Granger-cause 6-month participation rates, i.e. M_M06 unilaterally Granger-cause K_M06 at the 1% significance level in the short and long run. The adjusted coefficient, ect_{t-1}, is significantly negative and suggests that the potential disequilibrium of the long-run relationship will be restored in the following 17.93 [=1/0.05577] months if the underlying variables deviate from the long-term equilibrium. Consistent with the findings of recent papers by Cetin (2014) for Turkey, Cevik and Charap (2015) for Malaysia and Turkey, and Samad (2018) for Bahrain, our results reveal the significantly the predictive power of deposit rates on the profit-sharing rates in the short- and long-run.

Table 5 Hafner and Herwartz (2006) Causality Test in Variance

			Return	d1 [2-4)	d2 [4-8)	d3 [8-16)	d4 [16-32)	d5 [32-64)	s5 [64 <)
D_K_M01	⇏	D_M_M01	11.053***	2.803	0.257	18.593***	13.581***	10.506***	36.52***
D_M_M01	⇏	D_K_M01	64.016***	16.193***	18.394***	57.329***	2.055	53.036***	28.923***
D_K_M03	⇏	D_M_M03	3.178	2.561	0.569	2.645	29.522***	68.823***	30.491***
D_M_M03	⇏	D_K_M03	13.387***	28.592***	4.824*	23.078***	52.999***	32.484***	18.696***
D_K_M06	⇏	D_M_M06	3.127	13.368***	0.578	3.842	13.98***	47.96***	3.554
D_M_M06	⇏	D_K_M06	3.245	43.146***	5.458*	15.89***	43.411***	25.734***	3.228
D_K_M12	⇏	D_M_M12	3.587	1.032	1.789	2.285	0.876	8.547**	38.256***
D_M_M12	⇏	D_K_M12	1.920	5.250*	7.275*	1.208	5.580*	82.163***	32.594***

Note: ***, **,** or ******* denote the rejection of the null hypothesis at the 10%, 5%, or 1% significance levels, respectively. The shaded area represents the insignificant causality result in variance.

The empirical test findings pertinent to the causality test in variance using the Hafner and Herwartz (2006) approach are given in Table 5. The findings of our paper show a two-way causality between monthly rates and a one-way causal linkage between the 3-month rates for the differenced raw data. In addition, neither of the remaining maturities is the Granger cause of each other, indicating that the volatility of the deposit rates does not have a significant effect on the volatility of the profit-sharing rates and vice versa. Our findings are entirely similar to the Zainol and Kassim (2010) paper for Malaysia and partially in line with the results of Ergec and Kaytanci (2014) and Ata et al. (2016) for Turkey and Yusof et al. (2015) for S. Arabia.

On the other hand, Table 5 also provides the linear causality test results for the wavelet decomposed series. By decomposing the differenced rates into five-time scales applying the MODWT MRA with the Daubechies Least Asymmetric [LA(8)] wavelet filter, in which the observations of each level is equal to 219 [=N-1], through the R package "waveslim" introduced by Whitcher (2005), we detect both unidirectional and bidirectional causalities in variance. Applying the Hafner and Herwartz (2006) test to the decomposed series, we find evidence against the null hypothesis of no causality between the 6- and 12-month rates. For example, we unravel significant two-way causal relations at the first, fourth, and fifth scale between the 6-month rates and unilateral causality running from the deposit rates to the profit-sharing rates at scales d2 and d3, corresponding to [2-16) month periods. On the other hand, some unidirectional causality associations running from the 12-month deposit rates to the 12-month profit-sharing rates uncovered at scales d1, d2, and d4, namely, from 2 months to 8 months and from 16 months to 32 months. Finally, at the highest scales of d5 and d6, in other words, at the lowest frequency intervals, there seems to appear bidirectional causality in variance, suggesting a feedback mechanism between these rates. In addition to unravel the hidden relations across frequencies, wavelets also enable us to detect which scale contributes to the overall relationship. For example, the profit-sharing rates of the 1-month unilaterally Granger-cause the deposit rates of 1-month beyond the third-level time scale, indicating the contribution of the medium- and long-run causalities to the overall unidirectional causal relationship. A similar result is obtained for the reverse order causality at all wavelet scales except the fourth level of decomposition.

Along with the cointegration and causality relationship, we are also interested in investigating whether the direction of the relationship is stable over the period, and if not, when significant changes in unconditional wavelet correlations take place by considering various investment horizons. The wavelet decomposition on the raw rates into five time-scales applying the MODWT function with reflecting boundary and its significance tests are performed with the "waveslim" and the "Brainwaver" R package developed by Achard (2012), respectively. When using reflection boundary condition on the raw series in level, the number of wavelet and scaling coefficients extend to 2N series, which has the same sample mean and variance, since it is assumed that the input data beyond its boundaries is to be a symmetric reflection on itself. Consequently, we are left with 433, 419, 391, 335, and 223 non-boundary wavelet coefficients for scales d1, d2, d3, d4, and d5 while it is the same with the final level, i.e., 223 for non-boundary scaling coefficient, s5. It is evident that the number of boundary coefficients increases [7, 21, 49, 105, 217] with decomposition level.
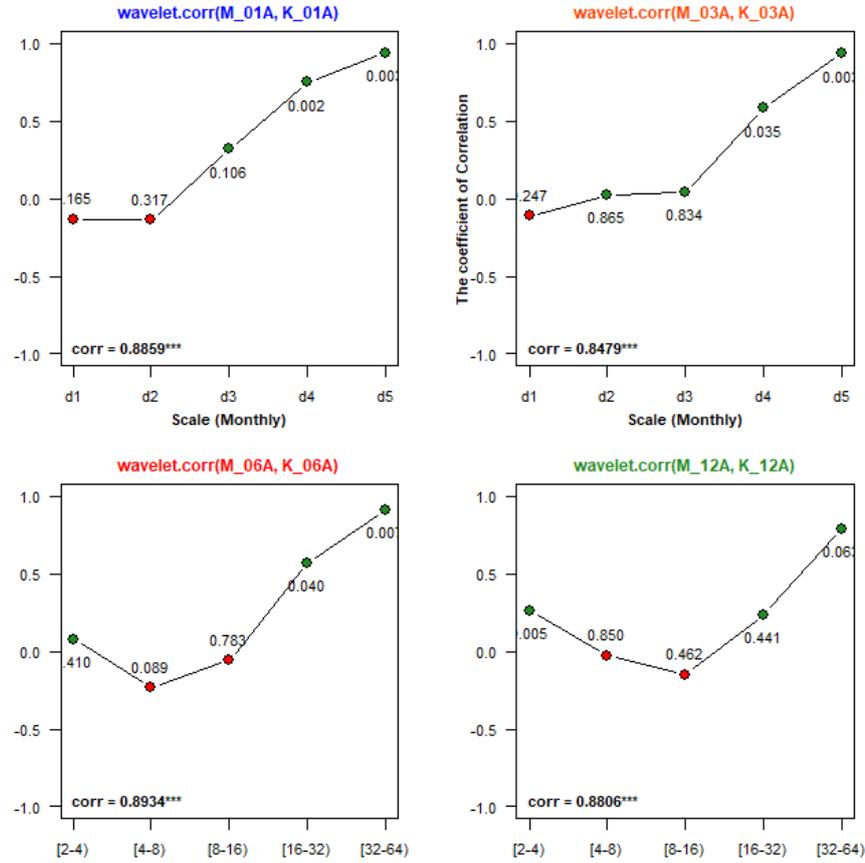
Figure 2: Wavelet-Based Correlations by Decomposition Levels

After decomposing our data, we can proceed to study the wavelet-based unconditional correlation relationship for a robust check of the causality test results, as depicted in Figure 2. First of all, the correlation coefficient is, as expected in theory, strongly and significantly positive between the pairs of variables of raw series, which is provided at the left-bottom of the figure. This is in line with Saraç and Zeren (2015), who claim that a positive correlation could be considered as a convergence of both banking industries and a sign of the violation of the operating principles of Islamic finance in Turkey.

When using this test on the decomposed series, the magnitudes of the wavelet-based correlation commonly close to zero in absolute value at the shortest scales of d1 and d2, and they become significantly positive and stronger ranging from 0.79 to 0.93 at the highest scale, d5, for all cases. For example, we find out that the relationship is significantly positive at scale d1 [0.005] but turns out to be insignificantly negative at scale d2 [0.85] and d3 [0.462], however, it becomes insignificantly positive [0.441] at scale d4 and significantly positive at scale d5, corresponding to [32-64] month periods for the 12-month maturity case. By confirming the validity of the wavelet-based causality relationship in the long-run, the strength and the direction of

wavelet correlations significantly vary as the time scale increases. Our unconditional and wavelet-based results corroborate the findings of Haron and Ahmad (2000) for a negative and the empirical findings of Zainol and Kassim (2010), Tekin et al. (2017), and Samad (2018) for a statistically significant and strong positive connection between deposit and profit-sharing rates. Besides, the result for the positive linkages is partly in line with Ajmi et al. (2014), who state that evidence of co-movement reduces the benefits of portfolio diversification with Sharia-based markets in the short- and long-run.

6. Conclusion

In this paper, we study whether or not profit-sharing rates in Islamic banks follow rates of the conventional banks in Turkey over the sample period March 2001 to June 2019. By employing both the standard econometric approaches and wavelets, we find that the dynamicity and strength of the causal and correlation interconnections strengthen over time, suggesting that the feedback mechanism between the Islamic and conventional banks intensifies as the time-scale increases. The results regarding the fact that the participant banks have significant impacts on conventional banks (i) could be interpreted as a violation of the operating principles of Islamic finance (Saraç and Zeren, 2015) due to operating in the same banking system; (ii) could be attributed to the increasing and intensifying competition in the banking industry (Chong and Liu, 2009); and (iii) could be attributed to the strong commitment and support from the current government to develop an Islamic financial system and make Turkey as a regional hub for Islamic finance.

Our findings have significant implications for risk management strategies and constructing monetary policies. Although conventional and participation banks considerably differ in funding and operating structures, it is observed that they co-move in the long-run and lead each other, which is the unavoidable consequence due to performing in the same banking environment, therefore, expose them to the same risks such as inflation, interest, repricing, and currency risks. In conclusion, identifying whether or not the return rate of Islamic banks are influenced by the changes in deposit rates is crucial in terms of financial stability and economic growth for policy-makers to construct monetary policies and in terms of risk management strategies for managers in these institutions.

7. References

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