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Multiple Structural Breaks in Profit Share Rates of Participation Banks in Turkey: Are They Caused by the Recent Global Crises?

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Abstract: The global crises not only affect the economy of the country in which they emerge but also spread to other countries. Economic growth and stability levels will inevitably be affected by these crises especially in developing countries. To this end, the aim of this study is to identify the multiple structural breaks in profit share rates by employing the methodology developed by Bai and Perron (1998, 2003a) and Liu et al. (1997). I used the monthly data covering the period 1998-2018 for the estimated structural break dates. The results of the analysis indicate that there is at least one breakpoint in the time series of the analysed profit share rates. The identified break dates obtained within the study confirm the periods affected by the global crises in 2000-2001 and 2007-2008. Under those results, it is revealed that the participation banks have been exposed to structural changes at various times and it may be emphasized that the profit share rates have become more deteriorated to changes in the global financial market.

Keywords: Participation banks, Dividend pay-out ratios, Global crisis, Structural changes, Multiple structural breaks

JEL Classification: G21, G01, C12, C22, C52

Introduction

The transition to financial liberalization policies has begun to gain momentum due to the developments in the developed and developing economies since the mid-1980s. Especially, the impact of innovations in computer and information technology on financial instruments and financial services and the extraordinary

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increase in new financial instruments not only facilitated the interaction between markets but also spread the crises (Ozturk & Govdere, 2010). Today, globalizing world economies are experiencing crises due to various reasons particularly economic instability and economic fluctuations, and those crises have been influencing countries albeit in different dimensions depending on the degree of economic relations.

The global crises not only affect the economy of a country in which they emerge but also spread to other countries. Economic growth and stability levels will inevitably be affected by those crises. Those crises have more apparent effects in developing countries. The global financial crisis has had negative effects on the real and financial sectors of many countries (Arabacı, 2016). The recent global crises have adversely affected the conventional banking system throughout the world. Islamic banking system has also been affected by the global financial crisis but performance of Islamic banks during the global financial crisis was better than conventional banks (Shafique et al., 2012).

Turkey has been under the influence of the global crises and the economic crises caused by internal dynamics. Turkey experienced its first crisis due to global reasons in 1994. The impact of the crisis in East Asia emerged in 1997 and the following Russian crisis led Turkey to experience another crisis in 2000-2001. Finally, the global financial crisis that stemmed from repayment problems in the US mortgage market in the US, began in 2007 and continued throughout 2007-2008 (Ozturk & Govdere, 2010). This crisis spread rapidly and deeply to financial markets all over the world, especially in the developing countries. The propagation of it was through both local and external factors (Chaudhary & Abbas, 2017). It turned into a global liquidity and credit crisis and damaged confidence in the markets. It emerged as a new crisis that should be defined in the banking and finance areas with the bankruptcy of giant financial companies in 2008. The economic crisis that started as a financial crisis in developed economies started to affect developing economies in the last quarter of 2008 as well. Turkey, which is a developing country, has been affected by the 2008 crisis which had a global and financial nature (Iskenderoglu & Karakozak, 2013).

During the recent global crisis, the Turkish banking system faced some significant difficulties, with an impact on its performance such as profit share level. Financial institutions, especially banks, were inevitably the major and direct victims of the crisis and it significantly impacted their financial patterns, market strategies, and operational policies (Nazir et al., 2012). Accordingly, in fact the cri-

sis seized up money markets and led to a precipitous decline in property and stock values as well as bank failures (Zehri et al., 2012). However, Islamic banks that operate under Shariah principles showed stability during this crisis (Alqahtani and Mayes, 2017; Zehri et al., 2012).

The Turkish banking sector has been affected by many financial crises, especially the 2000-2001 crisis, as well as the 2008 global crisis. In February 2001, intense demand for foreign exchange came mainly from the banking sector, due to the disagreement in the upper echelons of the state. Initially, the Central Bank of Turkey provided some of the foreign exchange demand. However, the exchange rate was allowed to fluctuate as it is understood that the excess demand in foreign currencies could not be stopped. With this decision, excess demand in foreign currencies became widespread and caused a new financial crisis and the banking system reached the point of collapsing (Bastı, 2006). Regulation authorities and central banks could not see the rapid credit growth and the systemic risks caused by the bubble that occurred in the active prices or could not take the necessary precautions. In order to increase the reliability of the financial system after the incidents that happened in the international markets and to minimize the effects of the crises, central banks and governments in the USA and Europe took several precautions and offered saving packages worth trillions of dollars (Erdonmez, 2009). After the global crisis, the economy of Turkey showed a significant performance not only within the frame of the region it is in but also around the world. One of the most important reasons why the effects of the global crisis could not be observed in the Turkish banking sector was the reforms and regulations carried out after the global crisis experienced in 2001 and 2008 (Takim, 2011). Structural reforms were tried to be put in force in the economy of Turkey within this period and aimed at permanent and consistent stability in the economy (Karacor, 2006). As a result of the structural regulations carried out especially after the 2001 crisis, the country showed its stability to the whole world in face of the conditions of 2008 global finance in Turkey. Within this frame, some strict restrictions were introduced to the restructuring of banks, open foreign exchange positions in the banking system, liquidity, and capital sufficiency ratios. The precautions were taken and experiences gained because of those crises enabled the banking sector to have stronger and better structure. By showing a significant performance, thanks to the restructuring and regulations after the global crisis, the economy of Turkey managed to reduce the effects of the global crisis. Consequently, Turkish banking sector was affected by the 2008 global crisis less than the other countries (Gokalp, 2014). The reason for it was the precautions taken by the banks because of the crisis experienced in 2001. The structure of interest-free financial sys-

tem based on risk-sharing basis enables a stronger system and increases its stability against financial crises. After the 2008 global crisis, it was observed that the interest-free banking system is affected less from the volatility and negative incidents on the global markets compared to the conventional banking system (Anac and Kaya, 2017). Besides, it was determined that the participation banks had shown higher performance than the one expected during the global crisis. Since the interest-free banking system cannot securitize the debts and therefore financial transactions with high risks and speculations are not enabled, the interest-free banking system was suggested as an escape from the crisis not only by the Muslim countries but also by the developed countries (TKBB, 2009). The financial crises experienced by Turkey have both weakened the banking sector and have also enabled the banks to find opportunities. It was observed that the stability and flexibility of the participation banking which is attracting more attention day by day around the world against the financial crises have become more apparent along with its growth and strength in the banking system (Fırat and Erdem, 2014). Consequently, while the majority of the banks with conventional system were affected from the global financial crisis experienced at the beginning of 2008, the interest-free banking system was observed to be affected less compared to the conventional banks. During the crisis period, the participation banks proved that they survived from the crises with their own financial strengths hence showing a significant achievement. Deposits of Islamic banks have seen a significant increase after the crisis though influenced by several factors. After the fluctuations in the global markets ended and the growth in the Turkish economy restarted, it was observed that the profitability ratio of the participation banking sector started to increase (Ayricay et al., 2015).

Stock and Watson (1996) revealed that nearly all of the series especially, macroeconomic and financial factors displayed evidence of instability. Accordingly, nearly all of the series relations have been affected by seasonal and cyclical fluctuations or irregular movements due to the influence of various economic developments. In other words, structural change takes place in many time series for any number of reasons, comprising economic and financial crises, changes in organisational regulations, instant changes of policymakers, civil war, natural disasters, an important event in a particular sector, and regime shifts (Ogbonnaya and Otta, 2018; Shahbaz et al., 2010). Also, these time series may involve more than one structural breakpoint. Changes in these reasons may affect the economic relationship between factors in different dimensions and shapes and therefore, the subject of structural changes is significant in the analysis of macroeconomic and financial time series in terms of stability of parameters throughout analysis (Lydia et al., 2014).

The issue of time series with multiple regime shifts has lately allured a great deal of research interest in many fields of theoretical and applied econometrics studies. In this context, analysing for structural change has been a substantial subject in econometric models because many political and economic elements can bring about the relations among economic variables to time series (Onel, 2005). The structural breaks are a permanent change in the structure of a time series in the face of instant shocks such as the economic crisis over time, changes in economic policies, political events, and critical developments in a certain sector or natural disasters (Sevuktekin & Cınar 2017; Guris et al., 2011; Sevuktekin and Nargelecekenler, 2010). The basic definition of structural break is a sudden policy change in institutions or break in the analysis of time series. This sudden change can take place in time-series data or cross-sectional data when there is a sudden change in the relationship being investigated (Allaro et al., 2011). If a break in the time series trend occurs due to the reasons mentioned above and similar reasons and the break in the series returns to its former structure, structural change may not be mentioned. Depending on the length of the examined period and the series, more than one break in the same series, i.e. structural change, maybe observed (Guris et al., 2011).

The study of structural changes in the economic and financial series is one of the issues that have been emphasized for a long time. The idea that some political or economic factors would change the characteristics of the series led economists to examine these changes. Accordingly, overlooking the existence of structural breakpoints leads to incorrect conclusions concerning the macroeconomic time series. Hence, neglect of these structural changes has caused heavy outcomes in the economy and financial markets.

The purpose of this study is to observe whether there is a structural change in the average profit share rate series of the participation banks operating in Turkey or not. In other words, this study focused on whether profit share rates of participation banks operating in Turkey were affected by the crisis. In fact, can the periods affected by the global crises in 2000-2001 and 2007-2008 be taken as years of structural change? Finding the answer to this question is the main purpose of the study. In other words, the recent financial crises have affected the financial markets of both developing countries and developed countries very seriously. For this purpose, it is necessary to define clearly what a crisis is. In this context, the focus of the study was to investigate whether the break dates supported the periods affected by the global crises or not.

What distinguishes this study from other studies, we believe, is that there is a gap in the literature, hence this is one of the first studies to reveal whether there are significant structural transformations in the time series or not through analysing profit share rates of the participation banks by employing multiple structural break tests. Thus, it is considered that this study extends the existing literature in several ways. Therefore, this paper allows us to fill a gap in the literature regarding the effects of global crises.

The rest of the paper is organized as follows. Section 2 briefly describes the exiting literature related to multiple structural breaks; section 3 extensively describes the data and the multiple structural change model and the estimation method of the Bai and Perron (1998, 2003a); section 4 presents the experimental results and analysis; and the last section outlines some concluding remarks mainly on the economic developments of the chosen break dates and future studies.

Literature Review

Methods for identifying structural changes, in time series data are quite utilized in many fields of science and engineering. The econometrics and statistics literature has got several studies related to the subject of structural change in time series. The structural break identification test plays an important role in the econometric modelling process. Therefore, there are many previous studies available that researchers can use to identify structural breaks that are separated into two groups that are analysed for a single structural change and multiple structural breaks. In this context, multiple structural break method based on Bai and Perron (1998, 2003a) was selected in this paper.

Quandt (1958) and Chow (1960) investigate to analyse for structural change for a known single breakpoint at the time series. Many researchers applied Bai and Perron's (1998, 2003a, 2003b) structural break testing methodology too in many areas mainly macroeconomic time series (Stock and Watson, 1996; Caporale and Grier, 2000; Hegwood and Papell, 2002; Rodriquez and Samy, 2003; Rapach and Wohar, 2005; Valadkhani et al., 2005). Garcia and Perron (1996), Rose (1988), Rapach and Wohar (2005), Neely and Rapach (2008), Lai (1998) and Clemente et al. (2017) examine the structural break of U.S. real interest rates using recent econometric methods robust to potential structural breaks. Aggarwal et al. (1999) detect structural changes in the securities market. Caporale and Grier (2000) examines the presence of structural changes in real rates. Malik (2003) and Rapach and Strauss (2008) determine structural breaks in the exchange rate market. Byrne and Na-

gayasu (2008) investigate the relationship between the real exchange rate and real interest rate using structural breaks. Allaro et al. (2011) investigates the structural breakpoints for export, import and GDP in Ethiopia. Bubakova (2012) estimates structural breakpoints in agricultural prices, Jin and Miljkovic (2010) examine the structural breaks in the US relative farm prices, Zainudin and Shaharudin (2011) study the spot and future palm oil prices time series, Czech (2016) detect structural breaks in wheat markets. Onel (2005) tries to test multiple structural breaks in the nominal interest rate and inflation rate; Liao and Suen (2006) examine the dating breaks for global crude oil prices and their volatility. Liao et al. (2008) examine the employment of electronic trading on the returns' conditional volatility in the oil futures market. Cro and Martins (2017) identify structural breaks in international tourism demand considering crises and disasters. Zeileis and Kleiber (2005) try to investigate by validating multiple structural changes from Bai and Perron (2003) using the R statistical. Zeileis et al (2003) investigate the structural changes in different areas such as Nile river discharges, road causalities, and oil prices. Barısık and Cevik (2008) analyse unemployment hysteresis using structural breaks tests. Buberkoku (2015) and (2016) study the impact of oil prices on the Turkish stock market indices under multiple structural breaks. Anlas and Toraman (2016) investigate the efficiency of the Turkish market in weak form. Yurdakul and Akcoraoglu (2005) examine the long-run relationship between Turkish stock returns and macroeconomic variables under the assumption of structural breaks. Karagianni and Kyrtsou (2011) explore the test for structural breaks in inflation and the Dow Jones Index. Sakoulis and Zivot (2000) investigate the time-variation and structural change in the forward discount and rate. Zarei et al. (2015) examine the multiple structural breaks in exchange rate series. Erdas (2018) examine the relationship between the real exchange rate as a Dollar and Euro and gold. Narayan et al. (2013) find out significant structural breaks in the gold, oil and silver market. Wang et al. (2014) explore to analyse structural breaks of the financial time series. Jouini and Boutahar (2005) investigate the evidence on structural changes time series. Pahlavani et al. (2005) explore the structural breakpoints in monetary aggregates and interest rates. Endresz (2004) studies the impact of structural breaks in volatility and VAR forecasting. Weideman et al. (2017) explore structural breaks in renewable energy. Buberkoku and Kizildere (2017) examine the properties of stock exchange by employing multiple structural break tests. Gunay (2014) examines the long memory structure of the index volatility. Hansen (1992), Mankiw and Miron (1986) and Mankiw et al. (1987) estimate an interesting relation of structural change in interest rate. Carlson et al. (2000) apply breakpoint procedures to inves-

tigate the stability of the M2 velocity relation. Moreover, many researchers employ similar analyses to estimate multiple breaks in different time segments (Perron and Qu, 2006; Qu and Perron, 2007; Huang and Cheng, 2005).

When we examined the academic studies of participation banks in Turkey we came to know that, the causality relationship between profit share rates and deposit interest rates, the effects of macroeconomic changes on participation banks, the analysis of deposit returns and the risk of interest rates on participation banks have been investigated (Charap and Cevik, 2011; Sarac and Zeren, 2015; Ata et al., 2016; Aysan et al., 2017; Yuksel et al., 2017; Tekin et al., 2017; Minny and Gormus, 2017; Koc, 2018; Dinc, 2019). Saleh and Zeitun (2006), Erturk and Yuksel (2013), Gokalp (2014), and Eyceyurt and Gungor (2016) investigate the participation banks' profitability in pre and post-crisis periods. They found that the recent global crisis had an effect on the profitability of participation banks. Sakarya and Kaya (2013), and Ayrıcay et al. (2014) concluded that the global crisis affected the performance and profitability of the participating banks. Al-smadi et al. (2017) found that the Islamic financial system performed superior to the conventional financial system during the financial crisis in Turkey. Canbas et al. (2005) observed the financial structures to conclude that conventional banks' profits decreased during the global financial crisis. Kendirli et al. (2019) indicate that in the global crisis in 2008, the participation banks performed better and were more profitable in terms of their financial value. Yolsal (2010), Selcuk (2010), Sarıtas and Saray (2012), and Kok and Ay (2013) revealed that the profitability of the Turkish banking sector was affected from the global financial crisis and the efficiency levels of the banks and financial institutions decreased significantly in 2008 as a result of the global crisis. The performance of Islamic banks during the global financial crisis has been discussed by many researchers, such as Ahmed (2009), Chapra (2011), Kayed and Hassan (2011), Warde (2012), Zehri et al. (2012), and Alqahtani et al. (2016). There is a general agreement that Islamic finance principles prevent Islamic financial institutions from being directly exposed to the crisis. In the study of Kassim and Majid (2010) where they studied the effects of the crises on the interest-free banks in Malaysia by using the data from the period 1997-2009 which also includes the 2008 financial crisis, they concluded that it did affect the interest-free banks. Amba and Almun (2013) also studied the effects of the global crises on the profitability of the interest-free banks. They revealed that the financial crises have negative effects on the profitability of the Islamic banks. It was also observed in their study that the Islamic banks were more profitable in the financial crisis period than the conventional banks; however, the result was statistically insignificant. Hassan and Dridi

(2010) studied the performances of Islamic banks and conventional banks within the crisis period. They researched the effects of the crisis on profitability, assets and credit increases. They concluded that the crisis caused different results on the profitability of the Islamic banks and conventional banks and that the negative effects of the 2008 crisis on the profitability of Islamic banks are lesser than on conventional banks. Beck et al. (2013) revealed that the Islamic banking system showed better performance during the crises. Al-Qadi (2012) investigated the impact of global financial crisis on Islamic banks. The results indicate that the global financial crisis had a negative impact on the Islamic banks.

However, it has been observed that the studies on participation banks with respect to global crisis did not investigate with econometric methods whether there had been a change in profit sharing ratios of these banks or not. To the best my knowledge, the literature on profit share rates distributed by participation banks has hardly ever applied a brake testing methodology that allows for multiple breaks from SupFT, double maximum tests (UDmax, WDmax) and sequential (SupFT(l+1/l) breaks under the assumptions unknown breakpoints. To the effect, it shows that we have performed research, which fulfils that gap in the literature via this current paper.

Data and Methodology

Because the data on the profit share rate is time series, it is necessary to determine an important concept in the time financial series. Islamic banks mainly run on the profit-sharing system between themselves and their depositors because the addition of interest, in other words, the rate of return on deposits cannot be fixed by the bank and interest cannot be charged on loans since it is strictly prohibited in Sharia law (Zulkhibri, 2018). Islamic banks and profit-sharing deposit holders share profits derived from investment and financial activities undertaken by banks. In this context, this paper employs monthly profit share rates of participation banks of Turkey. The ratio of the distribution between the two parties is called the deposit profit share rates. The monthly time series are obtained from the Participation Banks Association of Turkey database. The total sample consists of three participation banks which are Albaraka Turk, Kuveyt Turk, and Turkiye Finans and monthly profit share rate series cover the period from January 1998 to January 2018.

Nowadays, the researchers try to apply appropriate methods and techniques for structural changes in time series data. It is seen that previous studies have so far mostly employed macroeconomic and financial time series data. Conversely,

there are no studies that deal with profit share time series. In this context, this study applies Bai and Perron's (2003a) test to investigate structural changes by identifying profit share rates. The data series are month-end observations on each profit share rate, while Eviews 10.0 is employed.

There exist the studies of different methods which have been suggested in the literature for determining multiple structural breaks in an endogenising time series, for example; Zivot and Andrews (1992), Perron (1989), Lumsdaine and Papell (1997), and Bai and Perron (1998, 2003a, 2003b) which allows for the determination of multiple breaks in series means. One of these leading methods is the model developed by Bai-Perron (1998, 2003a, and 2003b). To that effect, Bai and Perron (1998, 2003a) provide a comprehensive analysis of several issues that considers multiple structural changes in a linear model detected by least squares (Ndako, 2012). Furthermore, considering the heterogeneous relationship among regimes if sequential Bai and Perron tests are accepted as homogeneous, structural break analysis based on information criteria can be preferred.

However, this estimation of structural changes cannot present our knowledge about the source of the shock all the time, but it does ensure an answer to the question of which shocks are substantial for modelling time series (Bubakova, 2012).

As the study focused on the 2000-2001 and 2007-2008 global crises, which deeply affected the developing countries, the focus is laid on two periods as the beginning and the first signals of exit from the crisis, and the maximum number of breaks was determined as four, considering that the crisis of 2000-2001 and 2007-2008 crisis could have caused structural changes. Firstly, SupFt test was used to determine whether the series had a structural change or not. Next, Bai and Perron (2003a) multiple structural breaks and Liu et al. (1997) global information criteria tests were employed to determine the number and location of the breakpoints. Bai-Perron developed various test strategies finding the coefficients minimizing the sum of squared errors and break dates through dynamic programming by the means of algorithms on the linear model (Bai and Perron 1998, 2003a). The algorithm is based on dynamic programming, and each breakpoint is estimated by least squares (Barısık and Cevik, 2008). Bai and Perron have considered the following multiple linear regression model with m breaks (m+1 regimes) and to evaluate the least-squares criterion function at all potential break dates to determine whether there is a regime change in the model (Bai et al., 1998). However, Bai and Perron's tests are not the unit root test, on the contrary, Perron (1989), Zivot and Andrews (1992), Lee and Strazicich (2003), Narayan and Popp (2010) use unit root test for

structural break. In other words, Bai and Perron (2003a) discover significant structural breaks in the linear model by disregarding whether variables are stationary or not, and split the correlations between the variables into regimes. The model considered is the multiple linear regression model with m breaks and m+1 regimes, and the model is written as follows:

$$(1) \qquad y_t = x_t'\beta + z_t'\delta_j + u_t \quad t = T_{j-1}+1,...,T_j, \;\; j = 1,...,m+1, \;\; T_0 = 0, \;\; T_{m+1} = T$$

where, y_t is the dependent variable at time *t*, x_t *(px1)* and z_t *(qx1)* represents covariate vectors independent variables, β and δ_j *(j=1,...,m+1)* are the corresponding vectors of coefficients, u_t is the disturbance at time *t* (Loscos et al., 2011), T_j is the endpoints of the all observed period, *m* is the number of structural changes, *j* is a regime which represents set of data between two turning breakpoints, *T* is the sample size and $T_1,...,T_m$ represents breakpoints treated endogenously or divided intervals. The basic purpose is to estimate the unknown regression coefficients and the break dates ($\beta, \delta_0,...,\delta_m, T_1,...,T_m$) when *T* observations on (Y_t, X_t, Z_t) are available (El-Ghini and Saidi, 2014). The β parameter vector is a partial structural change model if this model does not change from regime to regime, in other words, it is not dependent on breaks, i.e. estimated by the whole sample. When *p*=0 in Equation 1, all of the coefficients are dependent on changes, thus, a complete structural change model is obtained (Isi et al., 2016) because when *p*=0, the term *xt'*β will not be in Equation 1.

The method of estimation evaluated is based on the least-squares method. For each *m*-partition $(T_1,...,T_m)$, the associated least-squares estimates of β and δ_j are acquired by minimizing the sum of squared residuals (Bai and Perron, 2003a; Liao and Suen, 2006). Then the estimated break points $(T_1,...,T_m)$ are attained by solving *arg-min* $S_T(T_1,...,T_{m)}$ as given below (Bai and Perron, 2003b; El-Ghini and Saidi, 2014):

$$(2) \qquad S_T\left(T_1,...,T_m\right) = \sum_{i=1}^{m+1} \sum_{t=T_{i-1}+1}^{T_i} \left[y_t - x_t'\beta - z_t'\delta_i \right]^2$$

Substituting estimates $\hat{\beta}\left(\{T_j\}\right)$ and $\hat{\delta}\left(\{T_j\}\right)$ state the estimates based on the given *m* regimes $(T_1,...,T_m)$, denoted $\{T_j\}$. These are the global minimum of the sum of squared residuals objective function. Thus, the estimated break points $(T_1,...,T_m)$ are obtained by solving *arg-min*, and can be defined by the following equation (Choi et al., 2006; Wang et al., 2014):

$$(3) \qquad \left(T_1,...T_m\right) = \arg\min_{T_1,...T_m} S_T\left(T_1,...,T_m\right)$$

These authors design several test statistics for multiple breaks to determine the number of breakpoints as proposed by Bai and Perron. In order to estimate the number of multiple structural changes in a linear model, Bai and Perron (1998, 2003a) developed three tests which are structural stability versus a fixed number of changes *(SupF$_T$)*, structural stability versus an unknown number of breaks (double maximum test) and sequential test. Bai and Perron (2003) also suggest three selection criteria which are the Bayesian information criterion (BIC) developed by Yao (1988), the modified Schwarz criterion developed by Liu et al. (1997), and Bai and Perron (1998) criterion information based on a sequential test (*SupF$_T$(l+1/l)*. However, *SupF$_T$*, double maximum (*UDmax-WDmax*) and sequential application of the *SupF$_T$(l+1/l)*, test statistics have some advantages and disadvantages. For this reason, they suggest that the best way is combining of the above tests for identifying multiple structural breaks in time series. Considering the previous research in this study, an investigation of the presence of structural change requires one to first control whether the *SupF$_T$* test and double maximum tests are examined to test the structural breaks are significant or not. In the next step, it is necessary to use a sequential test (*SupF$_T$(l+1/l)* to determine the numbers related to structural change. These applications help us in terms of the right structural change (Liao and Suen, 2006).

According to the proposed method, in the analysis process, *UDmax* and *WDmax* critical values are used to determine whether there is a structural break in the series or not. After the existence of structural breaks is confirmed, the number of structural breaks and regimes are determined. For this purpose, *SupF$_T$(l)* and *SupF$_T$(l+1/l)* test statistics can be used to determine the number of structural changes. (Emirmahmutoglu et al., 2010). These test strategies are explained briefly below.

Bai and Perron (1998, 2003a) used the *SupF$_T$* test to consider the problem of asymmetry. The *SupF$_T$* test is carried out under the null hypothesis of no turning point (i.e. m=0, no structural change) versus the alternative hypothesis of *k* turning points (i.e. m=k, m structural changes). Later, $\lambda_j = T_j/T$, $j=1,\ldots,m$, and $T_i = T\lambda_i$, $i = 1,\ldots,k$, and $(R\delta)' = (\delta_1' - \delta_2', \ldots, \delta_k' - \delta_{k+1}')$, *R* is the conventional matrix. We can define the following equation:

$$F_T(\lambda_1, \lambda_2 \ldots\ldots, \lambda_k; q) = \frac{1}{T}\left(\frac{T - (k+1)q - p}{kq}\right)\delta' R' \left(R\hat{V}\left(\hat{\delta}\right)R'\right)^{-1} R\hat{\delta} \tag{4}$$

In equation (4), $\hat{V}\left(\hat{\delta}\right)$ is an estimate of the variance-covariance matrix $\hat{\delta}$ that is robust to serial correlation and heteroscedasticity (Perron and Yamamoto 2015; Qu and Perron, 2007). Finally, an *F* test is performed comparing the assumption that no break has occurred against that *k* breaks have occurred. If the statistic is above the critical value, then the said number of breaks have occurred. Bai-Perron (2003b) provides details on an algorithm to solve for break dates as outlined above (Milewski, 2017). Besides, this predictor is more robust and consistent in case of changing variance and serial correlation, and it is expressed as (Bai and Perron 2003a):

$$(5)\ \hat{V}\left(\hat{\delta}\right) = p\lim_{T\to\infty}\left(\bar{Z}'M_x\bar{Z}\right)^{-1}\bar{Z}'M_x\Omega M_x\left(\bar{Z}'M_x\bar{Z}\right)^{-1}, \Omega = E\left(UU'\right), M_x = I\text{-}X(X'X)^{-1}X'$$

Finally, the $SupF_T$ test statistics is then defined as follows (Bai and Perron, 1998):

$$(6)\qquad SupF_T\left(n;q\right) = \sup_{(\lambda_1,\ldots,\lambda_m)\in\wedge_\varepsilon} F_T\left(\lambda_1,\ldots,\lambda_m;q\right) = F_T\left(\hat{\lambda}_1,\ldots,\hat{\lambda}_m;q\right)$$

The test is used $SupF_T(k;q) = F_T(\lambda_1, \lambda_2,\ldots, \lambda_k;q)$ where $\lambda_1, \lambda_2,\ldots, \lambda_k$ minimize the global sum up squared residuals under the specified trimming which is equivalent to maximizing the F-test undertaking spherical errors (Emirmahmutoglu et al., 2010; Bai and Perron 2003a). Different types of these tests can be expanded depending on the distribution of the regressors and the errors across segments (Bai and Perron, 2003a). The asymptotic distributions depend on a trimming parameter via the imposition of the minimal length (*h)* of a segment, and is expressed (ε = h/T) (Bai and Perron, 2003a). Here, *T* is the sample size and *h* is the minimal permissible length of a segment.

Bai and Perron (1993, 2003a) suggest two assessments of the null hypothesis of no structural break against an unknown number of breaks given some upper bound *M*. They define these double maximum tests which are strong as the best power that can be acquired utilizing the test for the accurate number of breakpoints (Arezki et al., 2013). The statistics of *UDmax* and *WDmax* tests have to be calculated for double maximum tests that examine for the hypothesis (i.e. m=0, no structural change) of no structural breaks against the presence of an unknown containing an arbitrary number of breakpoints with the given upper bound of breaks *M (1≤m≤ M)* (Barısık and Cevik, 2008; Ketenci, 2014). The Bai-Perron test of 1 to M globally identified breaks is applied from 1 to the maximum number of breaks up to which we cannot refuse the H_0 hypothesis. In any case, both scaled and weighted test statistics surpass the critical value. Thus, the multiple breakpoint tests conclude that there are as many as five break dates (Czech, 2016), and it can be described by the following equation:

$$UD\max F_T(M,q) = \max_{1\le m\le M} \; \underset{(\lambda_1,\ldots,\lambda_m)\in\wedge_\varepsilon}{Sup} F_T(\lambda_1,\ldots\lambda_m;q) \tag{7}$$

where $F_T(\lambda_1,\ldots,\lambda_m;q)$ is the sum of m dependent chi-square random variables, each divided by m, with q as degrees of freedom (Ketenci, 2014).

Then, they conceive a different set of weights in such a way that the marginal p-values are equal for all values of m. This version of the test is denoted as the *WDmax* statistic (Karagianni and Kyrtsou, 2011). The differences between *UDmax* and *WDmax* statistics are the weights, where *UDmax's* weight is unity, and *WDmax*'s weight $c(q, \alpha, m)$ is the asymptotic critical value of the individual tests for a significance level α (Liao and Suen, 2006). The weights are then defined as $a_1=1$ and $a_m = c(q, \alpha, 10)/ c(q, \alpha, m)$.

WDmax test statistic is defined by following equation:

$$WD\max F_T(M,q) = \max_{1\le m\le M} \frac{c(q,\alpha,1)}{c(q,\alpha,m)} x \; \underset{(\lambda_1,\ldots,\lambda_m)\in\wedge_\varepsilon}{Sup} F_T(\lambda_1,\ldots\lambda_m;q) \tag{8}$$

Bai and Perron propose that an analyst should firstly investigate the results from the *UDmax* and *WDmax* test statistics to see in case at least one structural break exists (Anoruo, 2011). If the *UDmax* and *WDmax* statistic tests reject the hypothesis of no breaks; in other words, in case there is proof for structural change, a sequential test for l versus $l+1$ breaks, denoted $SupF(l+1 \mid l)$ has to be performed to determine the number of breaks in series (Ketenci, 2014). Thus, the test can be defined as follows:

$$F_T(l+1/l) = \left\{ Q_T\left(\hat{T}_1,\ldots,\hat{T}_l\right) - \min_{1\le i\le l+1} \inf_{\lambda\in\wedge_{i,n}} Q_T\left(\hat{T}_1,\ldots,\hat{T}_{i-1},\lambda,\hat{T}_i,\ldots,\hat{T}_l\right)\right\} \frac{1}{\hat{\sigma}^2} \tag{9}$$

where, $\wedge_{i,n} = \left\{\lambda; T_{i-1} + \left(\hat{T}_i,\ldots,\hat{T}_{i-1}\right)\eta \le \lambda \le T_i - \left(\hat{T}_i,\ldots,\hat{T}_{i-1}\right)\eta\right\}$, and $\hat{\sigma}^2$ is a consistent estimator of σ^2 under the hypothesis of no breaks. $Q_T\left(\hat{T}_1,\ldots,\hat{T}_{i-1},\lambda,\hat{T}_i,\ldots,\hat{T}_l\right)$ is the sum of squared residuals resulting from the least-squares estimation from the each m-partition $(T_1,\ldots,T_m)$. The breakpoints are then selected by investigating the test statistics from the sequential $SupF(l+1 \mid l)$ test which tests the null hypothesis of l structural breaks against the alternative hypothesis of $l+1$ breaks (Maatoug et al., 2018).

The number of breaks in series can be complemented by minimizing the global information criteria of Yao (1998) and Liu et al. (1997). Yao (1998) suggests Bayesian Information Criterion (BIC) while Liu et al. (1997) suggest a modified Schwarz Criterion (LWZ). The structural break numbers are determined according

to the points that BIC and LWZ criteria take the minimum values for (Buberkoku, 2015). It is stated that the asymptotic theory formed for these tests is created for variables that do not contain trends and that the critical values can be used safely even if the variables contain trends (Barısık and Cevik, 2008). Liu et al. (1997) first used the Schwarz criterion customized to estimate the number of subsets in their study on multivariate segmented regression models with different linear forms in different subsets of the independent variable. They then tried to predict the limits (threshold values) and regression coefficients of these subsets by minimizing the residual sum of squares (Isi et al., 2016). As a result of their simulation study, Bai and Perron (2003a) concluded that BIC and LWZ results are reliable if autocorrelation does not occur in the errors; however, in the case of autocorrelation in the errors, these tests deliver higher values than the actual ones (Gunay, 2014). The multiple break dates estimate approach according to Bai and Perron (2003a) and Liu et al. (1997) is applied in this study as a convenient procedure, because we do not know the number of breakpoints in the time series, and it is assumed that more breakpoints could be present in one time series.

Analysis and Findings

In this study, it aimed to examine the development of the profit share rate of the participating banks within the framework of economic, political, and legislative changes. Especially, it was targeted to determine how the crisis of 2000-2001, as well as the 2007-2008 global crisis, affected the size of the system. This paper has been authored with the aim to identify and apply the test statistics process to determine the structural breaks in the profit share rate time series data over 21 years relating to three participation banks in Turkey.

To be analysed, time series is the series of profit share rate that is announced at the end of each month by participation banks during the January 1998-January 2018 period. Based on the test statistics, after determining there is a structural change in the constant term, tests of Bai and Perron (1998, 2003a, 2003b) and Liu et al. (1997) that are based on the knowledge criteria were utilized to specify the number of structural breaks. In this context, the results of these tests are shown in the tables below. Because the maximum break number is assumed to be four and the residual distributions to be homogeneous for each regime in the analyses, the Trimaj value (ε) was taken as 0.15 for a series of T=241 and the minimum number of observations between the estimated structural change points is calculated as h=36. The estimation procedure is based on running a regression with a constant as a regressor (z_t= [1]) that accounts

for potential serial correlation (Zarei et al., 2015). When *UDmax* and *WDmax* test statistics are examined, it is seen that both test statistics reject the H_0 hypothesis of "no structural change" at a 5% significance level for all profit share rates.

The estimation model in Eviews 10 for this study is based on the regression equation under the least square method; with the profit share rate playing the role of dependent variable regressed against constant and trend value. The application results for three participation banks are revealed in three steps: the first step is the presentation of summary statistics, and the second step is the endogenous structural changes and the number of breakpoints results and discussion of events surrounding the breakpoints.

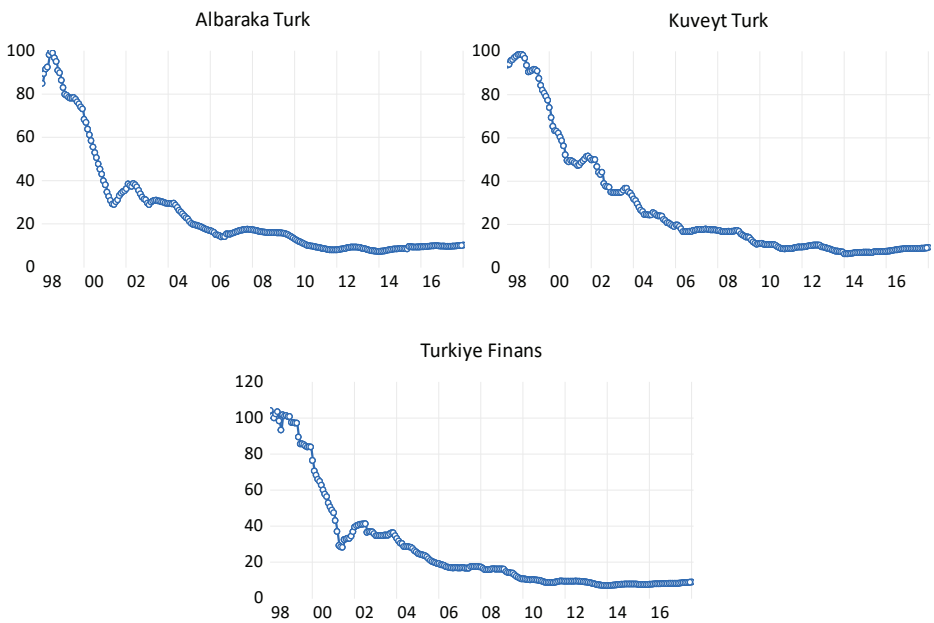

Figure 1. Plot for profit share rate

Source: Author compilation and values obtained from E-views.

As can be seen in Figure 1, profit share rates given by all three participation banks show a decreasing trend in the period examined. In the early 2000s, there was a serious break in the series. It is seen that the time series of profit share rates given by the participation banks are similar to each other in the period under question. There is a downtrend between 1998 and 2001 in terms of profit share rates. As it can be observed that the profit share rates suggest a similar trend with each other between 1998 and 2018.

First, descriptive statistics were gathered to obtain knowledge about the general characteristics of the time series. Understanding the relationship between the mean and median is important. These statistic values indicate the average value of a distribution of the series. Descriptive statistics are applied to analyse the distribution of data to account for mean, median, standard deviation. The results of these values are presented in Table 1 below.

Table 1.
Descriptive statistics for the profit share rates

Variables	Mean	Median	Minimum	Maximum	Std. Dev.	Jarq-Bera
Albaraka Turk	24.89616	15.64000	6.930000	99.38667	23.47519	171.4399*
Kuveyt Turk	27.33362	16.54000	6.170000	98.35790	26.12727	101.6543*
Turkiye Finans	26.76860	16.40100	6.646800	103.8260	26.64880	147.8461*

Source: Author compilation and values obtained from E-views.

Notes: Monthly percent change in profit share rates, * $p < 0.01$ and none of the series is normally distributed.

The statistical values reported in this table have a systematic distribution. The series seems to be normally distributed as can be verified from the values of means and medians, which are close to one another. It implies that the average monthly percent change in profit share rate of participation banks indicates moderate variability. The means of the *Albaraka Turk*, *Kuveyt Turk*, and *Turkiye Finans* are 24.89616, 27.33362 and 26.76860 respectively. Accordingly, it can also be observed that the changes in the average values of the profit share rates of participation banks are closely related to each other. The maximum value of the profit share rates is of *Turkiye Finans* and the minimum value of the profit share rates is of *Kuveyt Turk*. The standard deviation values of the *Albaraka Turk*, *Kuveyt Turk*, and *Turkiye Finans* are 23.47519, 26.12727 and 26.64800 respectively and it can be observed that the standard deviation values of the profit share rates are close to each other. It is pointed from these values that the participation banks are affected by the events in the markets at the same level. The Jarque-Bera statistics also indicate that the profit share rates are not normally distributed.

Table 2.
Estimate output of the profit share rates

Estimate Output of *Albaraka Turk*

Coefficient	Std. Error	t-Statistic	Prob.	Regime shifts
74.71877	18.28721	4.085848	0.0001	1998M01-2000M12 (36 obs)
31.54252	7.076366	4.457446	0.0000	2001M01-2004M09 (45 obs)
16.45292	1.249144	13.17135	0.0000	2004M10-2010M01 (64 obs)
8.726042	0.487598	17.89597	0.0000	2010M02-2018M01 (96 obs)
R-squared: 0.914970; Adj. R-squared: 0.913893; F-statistic: 850.0799; Prob(F-statistic): 0.000000				

Estimate Output *of Kuveyt Turk*

Coefficient	Std. Error	t-Statistic	Prob.	Regime shifts
80.83290	22.05463	3.665121	0.0003	1998M01-2000M12 (36 obs)
41.54790	86.18069	0.482102	0.6302	2001M01-2004M02 (38 obs)
19.06909	1.879186	10.14753	0.0000	2004M03-2009M06 (64 obs)
8.525985	0.626549	13.60786	0.0000	2009M07-2018M01 (103 obs)
R-squared: 0.924856; Adj. R-squared: 0.923905; F-statistic: 972.3172; Prob(F-statistic): 0.000000				

Estimate Output of *Turkiye Finans*

Coefficient	Std. Error	t-Statistic	Prob.	Regime shifts
83.43603	29.72336	2.807086	0.0054	1998M01-2000M12 (36 obs)
34.31051	3.191567	10.75036	0.0000	2001M01-2004M11 (47 obs)
17.64355	1.645480	10.72243	0.0000	2004M12-2009M07 (56 obs)
8.302977	0.419496	19.79274	0.0000	2009M08-2018M01 (102 obs)
R-squared: 0.925376; Adj. R-squared: 0.924431; F-statistic: 979.6416; Prob(F-statistic): 0.000000				

Source: Author compilation and values obtained from E-views.

The estimation results of structural regimes in profit share rates of *Albaraka Turk*, *Kuveyt Turk*, and *Turkiye Finans* are exhibited in Table 2. According to the results, under the 15% trimming and at the significance level 5%, there are four different significant regime shifts for each series. Multiple regimes predictive regression model estimation results based on the Bai and Perron methodology indicate that there are three significant breakpoints in all series. Table 2 reported that all the regimes for each series,

except for the second regime of *Kuveyt Turk* were found significant at the significance level of 1%. Breakpoint model of each series reveals that the constant coefficients of Albaraka Turk are significant and positive in all regimes, the constant coefficients of *Kuveyt Turk* are significant and positive in the all regime expect for the second regime, the constant coefficients of *Turkiye Finans* are significant and positive in the all regimes. The estimated output of profit share rates is given as follows respectively.

Table 3.
Multiple breakpoint tests: profit share rates

	Specifications					
z_t = [1]	q = 1	p = 0	h = 36	*m = 4*	ε = 0.15	*T = 241*
			Tests			
	SupF$_t$ (1)	***SupF$_t$ (2)***	***SupF$_t$ (3)***	***SupF$_t$ (4)***	***UDmax***	***WDmax***
Albaraka Turk	9.5436816*	6.468341	18.41040*	14.39123*	18.41040*	26.50356*
	[8.58]	[7.22]	[5.96]	[4.99]	[8.88]	[9.91]
	SupF$_t$ (1)	***SupF$_t$ (2)***	***SupF$_t$ (3)***	***SupF$_t$ (4)***	***UDmax***	***WDmax***
Kuveyt Turk	0.025225	5.252907	13.43737*	8.767749*	13.43737*	19.34440*
	[8.58]	[7.22]	[5.96]	[4.99]	[8.88]	[9.91]
	SupF$_t$ (1)	***SupF$_t$ (2)***	***SupF$_t$ (3)***	***SupF$_t$ (4)***	***UDmax***	***WDmax***
Turkiye Finans	4.933504	12.14584*	32.99669*	24.50966*	32.99669*	47.50966*
	[8.58]	[7.22]	[5.96]	[4.99]	[8.88]	[9.91]

Source: Author compilation and values obtained from E-views.

Notes: Maximum breaks (*m*) = 4, Trimming percentage (ε) = 0.15 * denotes that the tests are significant at 0.05 levels. [ ] represents Bai and Perron (2013) critical values. 0.05 significance level for the multiple breakpoint test is employed.

In the specification, z_t represents changing independent variables based on regimes; *q* represents the number of changing independent variables based on regimes; *p* represents unchanging dependent variables based on regimes; *h* represents the minimum number of observations in any regimes; *m* represents the maximum number of breaks. *T* is the number of observations.

The estimation results for the breakpoint specification in *Albaraka Turk*, *Kuveyt Turk,* and *Turkiye Finans* are given in Table 3. The critical table values at the 5% level

of the *UDmax* and *WDmax* statistic for each series are calculated as 8.88 and 9.91 respectively. From that point, in the case of *Albaraka Turk*, *UDmax* and *WDmax* statistical values were calculated as 18.41040 and 26.50356 respectively. The identified structural break dates are found significant because of *UDmax statistic>UDmax* critical value and *WDmax statistic>WDmax* critical value. It can be observed in Table 3 that the null hypothesis of no break for $SupF_t(I)$ test statistics is rejected at 5% level of significance in any case, except $SupF_t(2)$. *UDmax*, *WDmax* and the $supF_T(I)$ tests indicate at least one structural break in *Albaraka Turk*. Next, *Global L breaks vs. none* is passed to the test and critical values must be compared with Scaled F-statistic or Weighted F-statistic to test hypotheses. As $SupF_T(2)$= 6.468341<7.22, where, a structural break is estimated, yet as both statistical F values were less than critical values, it is determined that it is not a significant structural break. As $SupF_T(1)$=9.5436816>8.58, $SupF_T(3)$=18.41040>5.96, $SupF_T(4)$=14.39123>4.99, H_0: m=0 null hypothesis was rejected and it is found that there is a significant structural break in the series. The highest values of $SupF_t(I)$ were calculated as 18.41040 and 14.39123, based upon Scaled F-statistic or Weighted F-statistic values. In the case of *Kuveyt Turk*, *UDmax* and *WDmax* statistical values were calculated as 13.43737 and 19.34440, respectively. The estimated structural break dates are found significant because of *UDmax statistic>UDmax* critical value and *WDmax statistic>WDmax* critical value. It can be observed in Table 3 that the H_0 hypothesis of no break for $SupF_t(I)$ test statistics is rejected at 5% level of significance in any case, except $SupF_t(1)$ and $SupF_t(2)$. *UDmax*, *WDmax* and the $supF_T(I)$ tests indicate at least one structural break in *Kuveyt Turk*. Proceeding to the next step, *Global L breaks vs. none* is passed to the test and critical values are compared with Scaled F-statistic or Weighted F-statistic in order to test hypotheses. As $SupF_t(1)$=0.025225<8.58 and $SupF_T(2)$=5.252907<7.22, where, a structural break is estimated, yet as both statistical F values were less than critical values, it is determined that it is not a significant structural break. As $SupF_T(3)$=13.43737>5.96, $SupF_T(4)$=8.767749>4.99. H_0: m=0 null hypothesis was rejected, and it is found that there is a significant structural break in the series. The highest values of $SupF_t(I)$ were calculated as 13.43737 and 13.43737, based upon Scaled F-statistic or Weighted F-statistic values. In the case of *Turkiye Finans*, *UDmax* and *WDmax* statistical values were calculated as 32.99669 and 47.50966 respectively. The identified structural break dates are found significant because of *UDmax statistic>UDmax* critical value and *WDmax statistic>WDmax* critical value. It can be observed in Table 3 that the H_0 hypothesis of no break for $SupF_t(I)$ test statistics is rejected at 5% level of significance in any case, except $SupF_t(1)$. *UDmax*, *WDmax* and the $supF_T(I)$ tests indicate at least one structural break in *Turkiye Finans*. Next step, *Global L breaks vs. none* is

passed to the test and critical values must be compared with Scaled F-statistic or Weighted F-statistic to test hypotheses. As $SupF_t(1)$=4.933504<8.58, where, a structural break is estimated, yet as both statistical F values were less than critical values, it is found that it is not a significant structural break. As $SupF_T(2)$=12.14584>7.22, $SupF_T(3)$=32.99669>5.96, $SupF_T(4)$=24.50966>4.99. H_0: m=0 null hypothesis was rejected and it is found that there is a significant structural break in the series. The highest values of $SupF_t(I)$ were calculated as 32.99669 and 32.99669, based upon Scaled F-statistic or Weighted F-statistic values.

Table 4.
Multiple breakpoints test of the profit share rates

Number of Breaks Selected					
Test		*Albaraka Turk*	*Kuveyt Turk*	*Türkiye Finans*	
UDmax-WDmax		3-3	3-3	3-3	
Significant-F		4	4	4	
Sequential		1	0	4	
SIC		3	3	3	
LWZ		3	3	3	
Estimates with *m* Breaks					
Series	Tests	T_1	T_2	T_3	T_4
Albaraka Turk	*UD-WDmax*	2001M01	2004M10	2010M02	-
	Sig-F	2001M01	2004M10	2010M02	2015M02
	LWZ	2001M01	2004M10	2010M02	-
Kuveyt Turk	*UD-WDmax*	2001M01	2004M03	2009M07	-
	Sig-F	2001M01	2004M03	2009M07	2010M01
	LWZ	2001M01	2004M03	2009M07	-
Turkiye Finans	*UD-WDmax*	2001M01	2004M12	2009M08	-
	Sig-F	2001M01	2004M12	2009M08	2013M02
	LWZ	2001M01	2004M12	2009M08	-

Source: Author compilation and values obtained from E-views.

Notes: For the multiple breakpoints estimation method, HAC covariances was determined and for the Prewhitening with lags = 1, Quadratic-Spectral kernel, Andrews bandwith options were used. The lag length for selected breaks was determined using Schwarz and LWZ information criteria. (-) indicates the observations from where there is no breakpoint.

Table 4 reports the number of breaks and estimates with *m* breakpoints to test for infrequent structural breaks in profit share rate. This table represents the actual breakpoints identified by the *UDmax-WDmax, and LWZ* test statistics. The application of scaled and weighted maximized statistics suggests close to the number of break dates. The maximized value of scaled F-statistic (*UDmax*) and the value of maximized weighted statistics (*WDmax*) exceed the critical statistic values. Null hypothesis of no breaks are refused in favour of an alternative hypothesis of a single break, and the alternative hypotheses starting from one structural break up to three breaks are accepted. From that point, *UDmax-WDmax, LWZ* test statistic results, except *Sig-F* statistic, indicate that there are significant three break dates at the significance level 5% for both three series. In the case of *Albaraka Turk*, three structural breaks were located at month-1 (2001), month-10 (2004), and month-2 (2010). In the case of *Kuveyt Turk*, three structural breaks are identified which are at month-1 (2001), month-3 (2004), and month-7 (2009). In the case of *Turkiye Finans*, three breaks are determined which are at month-1 (2001), month-12 (2004), and month-8 (2009). Table 4 reveals that the month-1 (2001) breakpoint is identified, as a similar point for both 'three series' and this break date seems in each test statistic model. Moreover, other identified structural breakpoints (T_1, T_2, T_3), except T_4, are found in the same year but in different months. According to *significant-F* test statistic results, T_1, T_2, and T_3 structural breaks are identified close to one another while T_4 structural break is found at the different breakpoints. The significant structural breaks (T_4) of *Albaraka Turk*, *Kuveyt Turk,* and *Turkiye Finans* are identified at month-2 (2015), month-1 (2010), and month-2 (2013) respectively. We can conclude that three significant structural changes exist in the profit share rates mean between January 1998 and January 2018. For the determined structural breakpoints, we focus to identify their rationale, i.e. the presence of a crisis in Turkish participation banking. Going back to reported highlights, it needs to be stressed that the identified break dates are covering the period of the beginning of the global crisis. For example, in the case of *Albaraka Turk*, *Kuveyt Turk* and *Turkiye Finans*, T_1, T_2 break dates namely, month-1 (2001) and month-10 (2004) discovered within the study support the periods affected by the 2001-2002 crisis. Additionally, the T_3 break date for both three series is associated with the period of beginning and ending of 2007-2008 global financial crises. Because of these results, the identified break dates discovered within the study support the periods affected by the 2001-2002 global crisis that lasted up to the last quarter of 2005, and those of 2008-2009 global crises until the last quarter of 2011. It needs to be emphasized that the estimated breakpoints cover the time of the beginning of the global crisis. This crisis came through both the internal and external factors that directly or indirectly affect profit share rate series movements.

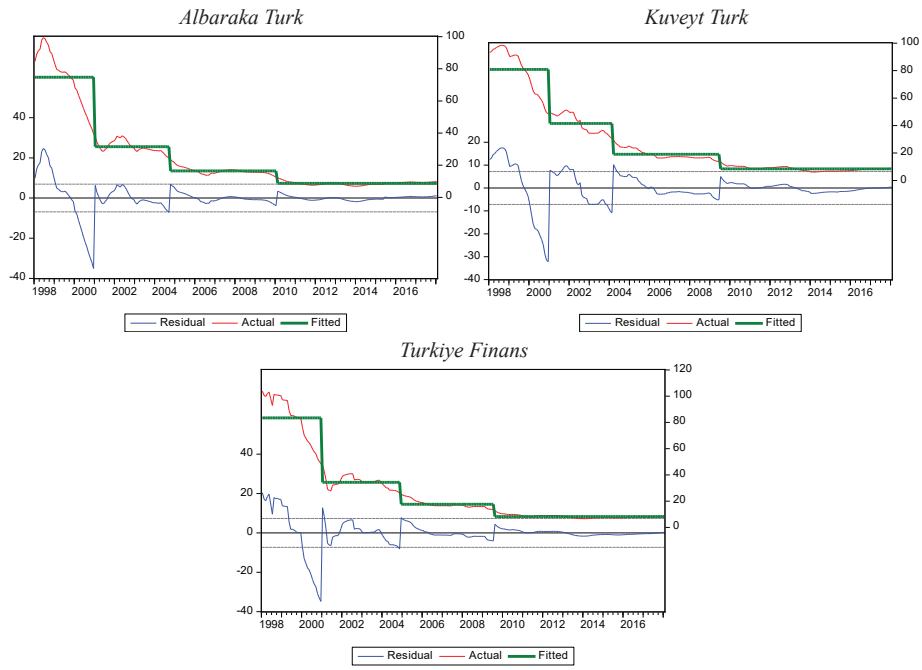

Figure 2. Graphical line of structural breaks of the profit share rates

Source: Author compilation and graphical line obtained from E-views.

Figure 2 reports the structural breaks for both 'three series' between 1998M01 and 2018M01. The location of the breakpoints is given in Figure 2. Figure 2 indicates the results of stage division during the 2000-2001 and 2007-2008 the global financial crises. When we consider the residual, actual and fitted values in Figure 2, test models estimated three significant structural breaks and four different regimes in the *Albaraka Turk, Kuveyt Turk, and Turkiye Finans*. According to Figure 2, the graphical line indicates that structural changes are the similar zone in profit share rates for three participation banks and three series experienced its first break date at month-1 (2001) and regime at 1998M01-2000M12. In the case of *Albaraka Turk*, three break dates and four regimes were estimated in the plot, as shown at the graphical line respectively for; 2001; 2004; 2010, and 1998M01-2000M12; 2001M01-2004M09; 2004M10-2010M01; 2010M02-2018M01. In the case of *Kuveyt Turk*, three break dates and four regimes were identified in the plot, as reported on the graphical line respectively for, 2001; 2004; 2009, and 1998M01-2000M12; 2001M01-2004M02; 2004M03-2009M06; 2009M07-2018M01. In the case of

Turkiye Finans, three break dates and four regimes were identified in the plot, as reported on the graphical line respectively for, 2001; 2004; 2009, and 1998M01-2000M12; 2001M01-2004M11; 2004M12-2009M07; 2009M08-2018M01. From this point, it is seen that the structural changes in profit share rates are covering the period of beginning and end of the recent global crisis. In the last stages of the crisis, the global crisis in 2008 became increasingly stable under the efforts of the government in Turkey. Hence, profit share rates of participation banks have been exposed to structural regimes at different periods of time. However, it seems that the participation banks overcome crisis with the least negative effects during the financial crisis times in Turkey.

Break periods, consistent with our expectations, correspond to the crisis in 2000-2001 and the global financial crisis in 2007-2008. It is seen that the structural breaks occurred within the economics and financial crisis concerning internal and external factors. As can be understood from Figure 2, structural break periods are observed more clearly on the profit share rates. It was observed that the restructuring program after the global crisis made the participation banking system more durable against the crises and vulnerability. It is possible to say that since the participation banks got over the effects of the crises right after the financial crises, they have a decreasing role in financial fluctuations and they can survive the crises with their own financial powers by being stronger. Since the interest-free banking system is affected less from the global crisis, it became a strong alternative and therefore, it is possible to say that the interest-free banking system should be considered as an example. It can be emphasized that Islamic economic system can help to bring stability which the world needs.

Conclusion and Policy Recommendations

Going back to experienced news, the developing economies all over the globe are affected by the crisis. Turkey, an emerging market economy, is being seriously affected by the global economic and financial crises. In the most recent instance, Turkey experienced a severe banking crisis during the 2001-2002 Turkish economic crisis and 2007-2008 global financial crisis stemming from mortgage loans.

Approximately 15 economic and financial crises have occurred in the Republic of Turkey. Turkey, at the end of the 1970s, has experienced successive economic crises. Without a doubt, the most severe economic crises experienced were the crisis of 2001 and the global financial crisis that started in early 2007. As a result of experiencing these crises that led Turkey's credit channels based on the internati-

onal banking system stop, as well as the decreases in capital inflows and external demand, many sectors started to shrink and almost all sectors, except financial institutions, experienced a recession.

Modelling structural breaks occupies an important position in empirical macroeconomics and finance. This is obvious from the ever-increasing number of researches and discussions in recent decades. For this reason, the structural break identification test plays an important role in the economics and financial time series. Economic, financial or political crises may cause structural change in many time series. The issues of regime shift in macroeconomic and financial time series have recently got a great amount of attention in terms of theoretical and applied research.

In this paper, we attempted to investigate the empirical evidence of the variability in the face of various important facts in a certain industry and international economic incidents in the tests of multiple structural break models. In this direction, one of the main issues in the study is to understand whether a crisis of 2001-2002 that lasted up to the last quarter of 2005, and those of 2008-2009 global financial crises did until the last quarter of 2011 have had any effect on the significant changes in the profit share rate. To this end, the Bai & Perron (1998; 2003a) and Liu et al. (1997) break test methodologies are employed to explain how profit share rate series have evolved between 1998 and 2018. The results exhibit three structural breaks in the profit share rate mean at the 5% level of significance. The results indicate that there is at least one significant structural break in profit share rate in all three participation banks. All conducted tests indicate that there is a significant common breakpoint in 2001M01 for three participation banks in the analyses. The findings from testing profit share rates of three-participation banks data series that the maximized value of scaled F-statistic (UDmax), and Liu et al (1997) indicate is that there are as many as three breakpoints close to one another. Accordingly, all conducted tests show that more than one breakpoints were obtained in most of the time series of profit share rate. All breakpoints which were confirmed using these statistics can be associated with structural changes in the profit share rate of participation banks and financial markets. According to the findings, both tests implied the evidence of at least one significant structural break for most of the participating banks. According to both test statistics results, three structural breaks are significant for Albaraka Turk, Kuveyt Turk and Turkiye Finans at the confidence interval level 5%. The significant breakpoints were estimated at month-1 (2001), month-10 (2004), month-2 (2010); month-1 (2001), month-3

(2004), month-9 (2010); month-1 (2001), month-12 (2004), and month-8 (2010) respectively, which means that profit share rates distributed by participation banks have observed more and more fragile to changes in the markets. We also find out that the dates of structural breaks in most cases are associated with the period of the beginning of 2001-2002 and 2007-2008 global financial crises. It may suggest that profit share rates have become more and more sensitive to changes in global financial markets.

The test statistic models would have us believe that most of the participation banks operating in Turkey experienced at least one structural break period during the breakdown of 2000-2001 and 2007-2008 global financial crises. From that point, it is implied that the identified break dates indicate that the global crises of 2001-2002 and 2007-2008 have influenced both the real and financial sectors of many countries. It can be implied that profit share rates of participation banks have become more deteriorated due to changes in the global financial markets and have been exposed to structural regimes at different times. Accordingly, it can be said that financial crisis has a negative effect on the profit share rates of participation banks. However, thanks to the continuous expansion, the proportion of debt increase significantly and exceed payment ability in Turkey, hence the global financial crisis was brought under control during the current government in Turkey.

As a result, this current paper suggests that in the presence of structural breaks stemming from many factors such as global economic crises, the changes in economic and political policies, the developments in economic structure, and a striking event in an important sector, pursue a structural trend on macroeconomic variables, and these factors cause structural breaks. The results support that for the macroeconomic and financial time series under investigation the endogenously identified breakpoints closely correspond to the important phenomena in the period of global markets since 1998.

In this study, the break dates and numbers of the monthly profit share rates of participation banks that have an important place in the economy of a country and strengthen the active structure in the sectors have been given and the relation between break dates and important events experienced at national and international levels has been examined. For this purpose, some policy implications can be drawn for the development of Islamic banking in Turkey. The fund structure of participation banks seems to be increasing steadily. These funds are very important in terms of the real economy. Both government and financial decision-makers have to follow these developments and take various initiatives to bring these funds into

the real economy. Accordingly, it is expected that participating banks will strengthen their assets and capital structures with the introduction of potential new players in the sector in the coming years and will take on the role of the market maker by avoiding the role of following the market. In order to be less affected by the crisis, it is very important to increase funding opportunities, to expand product and service diversity and to strengthen perception and promotion activities so that they can expand market share and become competitive with the entire financial sector in the coming period. Besides, the gains in profit sharing deposits in Islamic banks depend on the performance/profitability of their basic financial investments. Islamic banks determine the rate of profit sharing according to their performance affected by market conditions. Given that the global crisis regulation is a direct result of increased risk appetite and lack of liquidity, the real sector for Islamic financial stability can contribute to the financial sector linking and promoting diversification of portfolios. For this reason, changing traditional financial instruments with Islamic instruments may be an option for investors to obtain stable returns and policymakers to promote financial stability.

Our study has contributions, but it also has some limitations. It is recommended that information about the structural changes in the time series can be utilized for other modelling in more complex models. Moreover, further developments and applications with a larger sample of countries would help to generalize our findings to a greater number of countries. There is also a requirement to develop and analyse instruments to determine those structural changes. I believe this paper is significant for future research developments and for policy recommendations.

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