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Financial Crisis and Contagion: The Effects of the 2008 Financial Crisis on the Turkish Financial Sector

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Abstract: The paper intends to provide further evidence of the widespread nature of contagion caused by the 2008 U.S. financial crisis. This paper investigates the period before and after the September 2008 bankruptcy of Lehman Brothers and measures the impact of that event on the potential transmission of contagion to emerging markets; namely, the Turkish financial services sector. Our data consists of daily prices over the January 2007 to September 2010 period for seventy-eight firms in the Turkish financial sector, comprising the banking, mutual fund, real estate, insurance, and leasing industries. Correlations were estimated for the pre-crisis period and the post-crisis period between the returns of individual firms and the returns of representative U.S. indices. In this study, we find that the Turkish banking and insurance industries were significantly affected by cross-border contagion stemming from the 2008 financial crisis. The other Turkish financial services industries (mutual funds, real estate and leasing) remained largely unaffected. A potential reason for this is that the banking and insurance industries are dominated, either directly or indirectly, by international firms. To avoid the negative effects of cross-border contagion, we suggest that it may be possible to immunize the financial sector with proper regulation.

Keywords: Contagion, financial crisis, Turkey, emerging markets

JEL Classification: C19, E44, G01, G15

1. Introduction

The September 15th, 2008 bankruptcy filing of Lehman Brothers, one of the oldest and largest investment banking firms in the world, deepened the then ongoing U.S. financial crisis. Although the financial crisis may have been triggered by the subprime mortgage crisis and the subsequent bankruptcy of Lehman Brothers in the U.S., its effects were transmitted rapidly to Europe, Asia and Latin America. Global financial markets experienced sharp declines in currency, commodity and equity values. The spread of the effects of this event to the financial markets of a number of countries at approximately the same time led to the widespread belief that the Lehman Brothers bankruptcy caused a contagion effect. While a number of papers have described the various channels by which contagion could occur, previous empirical work sharply disagrees whether contagion actually occurred as a result of the 2008 financial crisis. This paper investigates the period before and after the September bankruptcy of Lehman Brothers and measures the impact of that event on the potential transmission of contagion to emerging markets, namely the Turkish financial services sector. The paper intends to provide further evidence of the widespread nature of contagion caused by the 2008 U.S. financial crisis.

There is no uniform definition of what constitutes contagion. Contagion refers to the spread of market disturbances from one country to another, or to a group of countries; and is a process observed through co-movements in exchange rates, stock prices, sovereign spreads and capital flows. Contagion can occur for different reasons and can conceptually be divided into two categories (Masson, 1998; Wolf, 1999; Pritsker, 1997). The first category emphasizes spillovers resulting from the normal interdependence among market economies. Such interdependence means that shocks, whether of a localized or global nature, will be transmitted across countries because of their real and financial linkages. This form of co-movement is not considered to constitute contagion since it reflects normal interdependence, which may intensify during a period of crisis in a country. Category 1 empirical studies seek to explain the degree of co-movements and mechanisms of transmitting them.

The second type of contagion arises when there is co-movement that cannot be explained on the basis of economic fundamentals. This type of contagion involves a purely financial crisis, which cannot be linked to observed changes in macroeconomic conditions or fundamental events and is solely the result of the behavior of investors or other financial agents. Under this definition, a crisis in one country may, for example, lead investors to withdraw their investments from many markets without recognizing or distinguishing the differences in each market's economic fundamentals. This type of contagion is likely to be caused by a unique phenomenon, such as financial panic, with subsequent reactions illustrating herd behavior, a general loss of confidence, and an overall increase in risk aversion.

A variety of econometric techniques have been used to investigate whether a contagion occurred during previous financial and currency crises. These techniques include testing simple cross-market correlation coefficients; as well as applying GARCH models, cointegration techniques, and probit models to measure the transmission of shocks. Tests based on cross-market correlation coefficients measure the correlation in returns between two markets during a stable period and then test whether a significant increase occurs in this correlation coefficient after a known shock. If the correlation coefficient increases significantly, this suggests that the transmission mechanism between the two markets increases after the shock and that contagion occurs. The ARCH-GARCH framework tests for contagion by estimating the variance-covariance transmission mechanism across countries. However, a significant spillover from one market to another may or may not constitute a contagion. Further clarification depends on whether the spillover is caused by a fundamental change or by financial panic. Cointegration tests for contagion focus on the long-run relationships between markets and the test examines changes in the co-integrating vector between the separate market returns instead of in the variance-covariance matrix. This analysis, however, does not provide an accurate test for pinpointing contagion – a contagion event, which is typically a short-term phenomenon, could be lost within a longer time period which is required to measure for cointegation across markets. The probit method directly measures changes in the propagation mechanism of returns of one market onto another. Spatial probit models apply a "distance" vector or other aspect of interrelation to further measure the potential for contagion across markets.

The examination of the possible contagion from the 2008 financial crisis is important for portfolio investment strategy and provides a justification of multilateral intervention. First, a critical tenet of investment strategies is that most economic disturbances are country-specific, so stock markets

in different countries should exhibit relatively low correlations. International diversification should substantially reduce portfolio risk while still seeking to increase expected returns. However, if the correlation between two markets' returns increases after a bad shock or from a contagion, the rationale for international diversification would be undermined. Second, policy makers worry that a negative shock to one country can reduce financial flows to another country, even if the fundamentals of the second economy are strong and there are few real linkages between two countries, such as with the U.S. and Turkey. Even if this effect is temporary, it could lead to a financial crisis in the second country, a crisis completely unwarranted by the country's fundamentals and policies. In the presence of a contagion, multilateral intervention and contribution to bailout funds can be justified.

The paper is divided into five sections. Following this Section I introduction, Section II discusses previous research in this area. Section III describes the data and explains the methodology. Section IV analyzes the empirical results. Section V concludes the paper.

2. Literature Review

In context to this study, the literature is divided into three parts; the growth of the financial services sector in Turkey, the study of previous financial crises for contagion, and the impact of the 2008 financial crisis on global markets.

The extent and the impact of foreign market penetration and foreign ownership of Turkish financial sector firms is discussed in Apak and Tavşanci (2011). There has been much liberalization within the Turkish financial services sector over the preceding two decades, to the extent in which capital freely flows from one market to another is both enhanced, in a positive vein; but, becomes more sensitive to shocks. Over the last few decades, foreign banks increased their presence in Turkey from only four banks, in total, in 1980; to twenty-four banks in 1991; and further growing to comprise 3% of the banking sector by the mid-2000's. Additionally, foreign bank ownership of Turkish banks and the number of Turkish national banks converting to foreign bank status increased to the extent that 12.6% of total assets and 16% of outstanding loans in Turkey were held by foreign or foreign-controlled banks. Tevfik and Tevfik (2006) and Alptekin (2009) describe the mutual fund and pension fund industry in Turkey. The investment in this industry grew from very modest beginnings, to being 2.4% of Turkish GDP in 2001. Mutual funds are still relatively new types of investments in Turkey; and, as such, would be sensitivity to potentially large inflows and outflows which may arise from economic shocks.

Several studies exist that analyze previous financial crises, their effects on asset prices, as well as their potential for contagion. The study of the scope, severity and the impact of the 2008 financial crisis follows approximately one decade after one of the most devastating and widespread financial crises in recent history - the Asian financial crisis, which began in July 1997. That crisis has been cited as one of the worst financial crisis in the history of postwar Asia. In addition to having devastating effects within the region, there was significant danger of the crisis spreading from Asia to the non-Asian trading partners around the globe. Moreno, Pasadilla, and Remolona (1998) discuss the weaknesses in the Southeast Asian countries' financial systems and argue that these weaknesses were one of the main causes of this crisis. Tan (1998) finds that Asian equity markets suffered the effects from contagion. Esquivel and Larrain (1998) examined the effect of the

Southeast Asian crisis on Latin American countries. They also debated possible policy options for these regional economies. Hassan (1998) examined the impact of the Asian currency crisis on the Bangladesh economy, as well as other Asian countries. He suggests regulatory changes to help avoid a repeat of an Asian-type currency crisis. Baig and Goldfajn (1999) found evidence of contagion in the currency and equity markets. Reside and Gochoco-Bautista (1999) examined the relationships among exchange rates in the Asian region and isolated the country-specific effects of contagion. Their simulation results show that the currencies of Korea, Malaysia, the Philippines and Thailand would have depreciated in the long run even in the absence of short run effects of potential contagion from other countries. In contrast, their simulation results for Singapore, China and Japan show that the exchange rates of these countries would have been stronger in the long run without the impact of contagion from other countries.

There are relatively few studies on the impact of the Asian crisis on foreign firms operating in the region. Chan and Timsawat (2000) investigated the impact of the Asian crisis on U.S. joint ventures. Their arguments indicate that joint ventures are a preferred mode of entry to the highly profitable region because of certain foreign laws, risk and cost sharing with local firms, and reduction in political and economic risks. The crisis had impacted the profits of U.S. firms adversely by increasing the cost of importing goods by about one-third overnight. The currency devaluation had also increased the cost of local production at a time when local demand was expected to fall because of lower purchasing power. Emmons and Schmid (2000) analyze the exposure of large U.S. firms to the Asian crisis. Their empirical results show that the Asian crisis had changed these firms' sensitivities to the market index. They also report evidence of a link between the Asian crisis and changes in firms' risk levels as sales exposures of firms in the region increased. Coughlin and Pollard (2000) examined the export activities of U.S. states to the Asian region. Real merchandise exports from the U.S. to East Asia fell by 12% as a result of a decline in demand within the region after the crisis. The analysis of each U.S. state shows that the Asian crisis resulted in a decline in exports of most states, but the severity of the decline varied across states. In terms of region, western U.S. states were most influenced from declining exports because they were more dependent on the East Asian markets. Alper and Yilmaz (2004) found that the Asian crisis did not have a significant impact on the Turkish economy overall; but, there was an impact on the financial markets of Turkey as there was for other emerging markets. The 1998 Russian economic crisis had a more wide-ranging impact on Turkey, affecting not only the Istanbul Stock Exchange; but, also, due to the trade and investment ties of Russia and Turkey, the market for Turkish exports as well. This latter event demonstrated the separate effects of both contagion as well as economic integration.

Kaminsky and Schmukler (1999) examined the Asian financial markets during the crisis by concentrating on those days having the largest one-day increases and declines in each country's stock market prices. Their results show that some of these one-day swings cannot be explained by any economic or political news, but rather driven by herd instincts of the market itself. They also found that news impacts both domestic and foreign markets, supporting the existence of contagion effects. Finally, during that crisis, both good news and bad news impacted investors' behaviors equally. The relationship between hedge funds and the Asian crisis was investigated by Brown, et al. (2000). They estimate the exposure of the top ten global hedge funds to Asian currencies before and during the crisis. Their findings indicate that there is little evidence of unusual exposure at that time and found no evidence that major fund operators profited from the crisis.

Finally, studies on the 2008 financial crisis mainly focus on causes and policy responses. Wim Naude (2009) discusses the effect of the crisis on the developing countries and argues that they will be affected less than developed countries. Akmese and Cetin (2009) and Afsar, et. al. (2013) look at the effects of the 2008 financial crisis on the Turkish economy and found that the Turkish economy, like the rest of the world, was negatively affected by the crisis. Sun and Zhang (2009) showed the impact that the U.S. financial crisis had on both Chinese (Shanghai Composite index) and Hong Kong (Hang Seng index) stock markets. These markets displayed, in different degrees, both price and volatility spillovers (contagion) from the 2008 crisis. Shehzad and De Haan (2013) illustrate that the while banks in emerging markets were impacted by the 2008 crisis, that impact was temporary and not to the same degree as larger, Western banks.

3. Theoretical Methodology

Despite research for both financial crises and contagion being fairly extensive, opinions vary widely on what constitutes contagion. This lack of consensus has led to a wide variety of testing methodologies and metrics that measure and differentiates contagion effects from normal co-movements across international markets. The most popular methods include changes in the correlation of asset returns, changes in the cointegration relationships, structural breaks or regime shifts across the crisis period, and application of extreme value theory. Each of these methods has its advantages as well as drawbacks. The primary aim of all methods is to differentiate between the effects - those caused by existing dependencies and those caused by abnormal behavior. In early correlation change studies, such as Bertero and Mayer (1990), King and Wadhwani (1990) as well as later research, such as Lee and Kim (1993); higher correlation indicated contagion. But Forbes and Rigobon (2002) show that covariance tests are biased towards accepting the alternative. However, Kaplanis (1988) and Ratner (1992) show that international correlations over adjacent sub-periods are fairly constant; moreover, although covariances may increase, correlations can be stable. Given these results, correlation tests can serve as adequate metrics of contagion. Longin and Solnik (1995) further refine these tests by explicitly modeling correlations on a conditional multivariate distribution. Phylaktis and Xia (2009) show that contagion effects are sector specific; i.e., the effects differ across different sectors of the market.

As previously mentioned, the sample of seventy-eight firms within the Turkish financial services sector returns is split into two sub-periods. The period from January 2007 to August 2008 is the sub-period preceding the crisis. The period from September 2008 to September 2010 is the sub-period that covers the crisis and subsequent events. The sample was split by using a cusum test on the return series to identify any possible break. Although we could not reject the null hypothesis of no structural break, there is evidence of a kink in the cumulative residuals which coincides roughly with the timing of the Lehman Brothers collapse; i.e., September 2008. We split the sample at this point into the above mentioned sub-periods. The following two figures illustrate this break. Figure 1 is a plot of the cumulative residuals from the returns of a firm from the mutual fund sector and Figure 2 is a plot of the residuals of a firm from the banking sector. Figures for the three other industries are not included since they essentially demonstrate similar plots. The residuals for the cusum test are obtained by regressing the firm returns against returns of the appropriate U.S. index. The cusum statistic is computed as

$$W_t = \sum_{t=k+1}^{T} \frac{w_t}{s_t} \tag{1}$$

where w_τ is the cumulative residual and s_τ is the standard error of the regression. The upper and lower bounds are calculated as $[k, \pm 0.948(T-k)^{1/2}]$ and $[T, 3 \times \pm 0.948(T-k)^{1/2}]$.

Figure 1
Illustrative Cumulative Residuals of a Representative Turkish Mutual Fund Firm

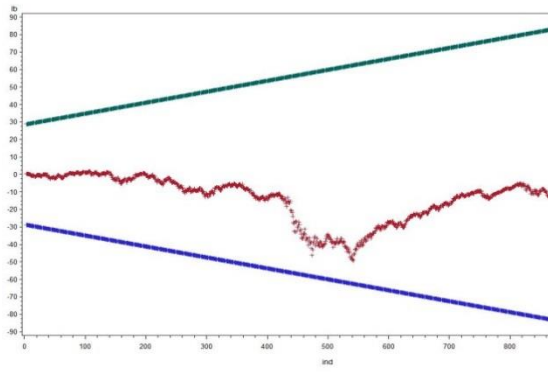
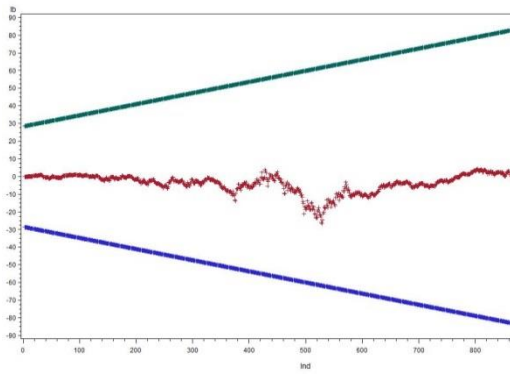


Figure 2
Illustrative Cumulative Residuals of a Representative Turkish Banking Firm



As argued previously, a financial contagion need not affect all sectors of a market. It does need specific channels of transmission through which a shock spreads to another market. In our study, we model the unconditional correlations between U.S. market indices from different industries with individual firm returns of corresponding industries using daily return data from Turkey. We compare the correlation coefficients before and during the crisis and test for changes; i.e., an increase in correlation during the crisis period using the Fisher Z transformation. For additional robustness, we regress the returns of the appropriate U.S. index against the returns of Turkish firms and test for increases in the size of the coefficient.

Correlations were estimated for the pre-crisis period and the crisis period (hereafter referred to as the post-crisis period) between the returns of individual firms and the returns of the U.S. index. Any increase in correlation is tested by transforming the difference using the Fisher Z transformation as follows:

$$Z_i = \frac{1}{2} \ln \frac{1+\rho_i}{1-\rho_i} \tag{2}$$

where ρ_i is the correlation between the returns of ith firm and those of the appropriate U.S. index. The distribution of $\left(Z_{i,pre} - Z_{i,post}\right)$ is approximately normal with a zero mean and variance of

$$\sigma_i = \frac{1}{n_{i,pre} - 3} + \frac{1}{n_{i,post} - 3} \tag{3}$$

where $n_{i,pre}$ and $n_{i,post}$ are the pre- and post-sample sizes.

As an additional measure, a test for changes in the size of the coefficient; i.e., a size effect, was also estimated. Regressions were run individually between the returns of the index and the returns of the firm for the pre-crisis and post-crisis periods. The same regression is run on the pooled sample including a dummy variable and an interaction term. The dummy takes the values of 0 for the pre-crisis period and 1 for the post-crisis period. The coefficient on the dummy measures changes to the intercept, which captures the effect of any changes caused by macroeconomic factors. The interaction term is defined as the product of the dummy and the index returns; the coefficient of the interaction measures the change in the coefficient of the returns; i.e., the size effect. This is the critical test of any change that has occurred due to the crisis. The individual regression models are as follows:

$$FR_{i,pre} = \beta_{0,pre} + \beta_{i,pre} IR_{pre} + \varepsilon_{i,pre} \tag{4}$$

where $FR_{i,pre}$ are the returns of the ith firm and IR_{pre} are the returns of the U.S. index from the pre-crisis sub-period; and

$$FR_{i,post} = \beta_{0,post} + \beta_{i,post} IR_{post} + \varepsilon_{i,post} \tag{5}$$

where $FR_{i,post}$ are the returns of the ith firm and IR_{post} are the returns of the U.S. index from the post-crisis sub-period. The pooled regression is modeled as

$$FR_{i,pooled} = \beta_{0,pooled} + \beta_{i,pooled} IR_{pooled} + \beta_{i,Dum} DUM_i + \beta_{i,intr} DUM_i * IR_{pooled} + \varepsilon_{i,pooled} \tag{6}$$

where $FR_{i,pooled}$ and IR_{pooled} are the firm and index returns from the pooled sample, DUM = 0,1 (pre, post) and the interaction term $DUM_i * IR_{pooled}$ is the product of the dummy and the index returns.

4. Data Sources and Empirical Results

4.1 Data Sources

Our data consists of daily prices over the January 2007 to September 2010 period for financial sector firms which are listed on the Turkish equities markets. The sample is separated into five industries and is also split into two sub-periods, as described in the subsequent methodology. The sample covers seventy-eight firms in the financial sector, comprising the banking, mutual fund, real estate, insurance, and leasing industries. The mutual fund industry has the largest representation in the sample, consisting of thirty-eight firms. The banking industry is represented by fifteen firms; real estate, twelve; leasing, seven; and insurance, six. The daily price returns of each of these Turkish firms are compared to the daily returns of a corresponding index in the United States. The banking, real estate, and insurance industries are compared to the Keefe, Bruyette and Woods (KBW) Index, the Dow Jones REIT Index, and the Dow Jones Insurance

Index, respectively. The mutual fund and leasing industries are compared to value-weighted indices comprising U.S. firms.

4.2 Empirical Results

We first examine the descriptive statistics of the data. Table 1 shows the descriptive statistics of the pre-crisis and post-crisis periods. The results do not exhibit any anomalies and the mean returns for the periods do not differ very much. In the post-crisis period, the mean returns seem to be slightly positive; whereas, in the period leading up to the crisis, most of the means were slightly negative (suggesting, perhaps, some leakage of information preceding the Lehman bankruptcy announcement); although both means are very close to zero. The third and fourth moments seem to depart from normality as the returns in both periods are leptokurtic and skewed.

The main thrust of this paper, however, is the correlation change between the pre-crisis and post-crisis periods. Table 2 contains the correlations between the returns of each firm and the returns of the corresponding U.S. sector for the period preceding the crisis. The first column contains the estimate of the correlation and the second column contains the p-value. Although all the correlations are positive and significant, they are low, indicating a low co-movement. In the post-crisis period; i.e., Table 3, the correlations remain similarly low and highly significant for all industries except the banking and insurance, where the correlations show a significant increase. The results of the formal test for change in correlation, shown in Table 4, confirm this result. The correlations for the pre-crisis and post-crisis periods are in Columns 1 and 2, the Fischer Z, the change in correlations, is in Column 3 with the p-value is in Column 4. The change in correlation for the mutual fund, real estate and leasing industries are not significant, as seen from the p-values; however, the correlations for the banking and insurance industries show a very significant increase. This result confirms those of Phylaktis & Xia (2009) – that contagion is not generalized and affects sectors differentially. One possible explanation for such asymmetric contagion effects is that the Turkish mutual fund, leasing and real estate markets are regulated by the Turkish government and had remained relatively immune to U.S. market influences. In contrast, the banking and insurance industries are dominated by foreign firms; i.e., most of the firms in these industries are either wholly owned or controlled by U.S. and European banking and insurance firms. This relationship has provided a broader channel of transmission for any contagion to pass through into these sectors of the Turkish market. If the mode of infection of the contagion was more generalized, through broad macroeconomic factors, we should have seen more widespread evidence across all industries. We can further confirm this through a regression analysis of U.S. index returns against the Turkish firm returns.

We regress U.S. index returns against individual Turkish firm returns for the pre-crisis and post-crisis sub-periods and then repeat for the pooled sample with the addition of a dummy variable and an interaction term. The coefficient of the dummy from the term $\beta_{i,Dum} DUM_i$ will capture the effects of the macro variables by showing a change in the intercept, while the coefficient of the interaction term from $\beta_{i,intr} DUM_i * IR_{pooled}$ will capture the change in slope, that is, the increase or decrease in the size of the coefficient of the index returns. If the contagion has affected specific industries, we should see a significant increase in the size of the coefficient, which means that the coefficient of the interaction term should be positive and significant. If contagion through macroeconomic variables exists, we should see changes in the intercept; i.e., a significant

coefficient of the dummy variable. The tables list the firm names in first column. The second and third columns show the estimate of the coefficient on the index returns and the associated p-value from the individual regressions for the pre-period. The fourth and fifth columns show those from the individual regressions, for the post-period. The sixth and seventh columns show the coefficient and p-value of the dummy variable, whereas the eighth and ninth columns show the same for the interaction term from the pooled sample regression.

Table 5 shows the regression estimates for the mutual fund industry. As observed, the coefficients for the individual regressions from both sub-periods are significant at the 1% level. The size effect; i.e., the coefficient on the interaction term (column eight) shows an increase for more than half the firms. About 15 of the 38 firms (39.5%) show an increase which is significant at the 1% level, for 6 firms (15.8%), the increase is significant at the 5% level and 5 firms (13.15%) the increase is significant at the 10% level. About 31.6% of the firms show no significant change. Recall that the correlation test shows a significant increase in correlations for 11 firms (29%). The regression tests show that, overall, about 68.5% of the firms have an increased size effect. We surmise that the difference could perhaps be explained by the portfolios that the mutual fund firms hold. If the portfolios are dominated by investments in foreign (U.S.) firms, then such firms could show an increase in the size effect. However, lacking information on the exact investment strategies of the mutual funds, we cannot substantiate this claim.

The banking industry results are shown in Table 6. Once again, all the coefficients from the individual regressions for both the pre-crisis and post-crisis periods are highly significant. The most important result; however, is the increase in the size (column eight). As expected from the correlation tests, all the increases in the size effect are highly significant.

In the real estate industry (Table 7), only two out of twelve firms (16.6%) have significant coefficients at the 1% level in the pre -period and three (25%) are significant at the 5% level. Almost all the firms have significant coefficients in the post-crisis period. Only four firms (33.3%) show a significant increase in the size of the coefficient. This sector seems to be only mildly affected by the financial crisis.

In the leasing industry (Table 8), no firm has a coefficient that is significant at the 1% level in the pre-crisis period, while half the firms have significant coefficients at this level in the post-crisis period. Only three firms show an increase in the size of the coefficient.

Finally, of the six firms in the insurance industry (Table 9), all the coefficients are significant in the individual regressions. More importantly, the coefficients of the interaction term are highly significant.

Summarizing, it would seem that the banking and insurance industries are affected by the contagion and the other three industries show mild to no effects. The coefficient of the dummy term is not significant for all sectors, indicating that the intercept is unchanged; i.e., there are no perceptible macro variable effects.

5. Summary and Conclusions

Given an increasing occurrence of financial crises, the study of contagion effects has assumed greater importance. This paper studies the effect of the 2008 financial crisis on the Turkish market for two important reasons. First, the previous literature has focused mostly on broad economic zones or only on the very large markets of the U.S., the U.K., and other G-7 countries. Second, as Turkey intends to be integrated as a full member of the European Union, it will be of great importance to examine whether such a move would make it more vulnerable to future contagion effects. Our analysis is, however, constrained by the data that was available for the U.S.; consequently, we focus on the five industries within the Turkish financial sector only. Similar to previous findings, we confirm that correlations increase during financial crises and that contagion effects are not homogeneous across industries. Such differential effects can be directly traced to channels of transmission. We expect that industries and business sectors that are more integrated are more intensely affected.

In this study, we find that the Turkish banking and insurance industries were very significantly affected by cross-border contagion stemming from the 2008 financial crisis. Both the correlation test and regression test confirm this. The other Turkish financial services industries (mutual funds, real estate and leasing) remained largely unaffected. The reason for this is that the banking and insurance industries are dominated, either directly or by proxy, by international firms. This is supported by the findings of Shehzad and De Haan (2013). To avoid the negative effects of cross-border contagion, we suggest that it may be possible to immunize the financial sector with proper regulation; but, this cannot be confirmed by our study and further research is necessary to either establish or refute it. The study can be extended by conditioning the correlations on different firm and macro level factors, to specifically identify contamination vectors. Similarly, the regression models can be improved by controlling for various firm specific variations.

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Table 1. Summary of Descriptive Statistics of Pre-Crisis and Post-Crisis Returns for Turkish Financial Industries

	Mean Return (%)		Variance		Skewness		Kurtosis	
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
Mutual Funds	-0.08	0.13	0.09	0.11	0.044	0.124	6.519	6.188
Banks	-0.03	0.08	0.09	0.10	0.521	0.098	4.099	4.052
REITs	-0.06	0.06	0.09	0.13	0.281	-0.48	4.392	4.062
Leasing	-0.06	0.08	0.11	0.12	0.615	-0.006	6.982	4.847
Insurance	0.07	0.04	0.09	0.10	0.693	-0.086	3.445	5.772

Table 2. Correlation of Turkish Financial Sector Firms' Pre-Crisis Returns with the Corresponding U.S. Industry Indices.

MUTUAL FUNDS			BANKS			LEASING FIRMS		
Firm	Rho	p value	Firm	Rho	p value	Firm	Rho	p value
AKYO	0.1465	0.002	AKBNK	0.2039	<.0001	CRDFA	0.10113	0.038
ARFYO	0.2431	<.0001	ALNTF	0.1768	3E-04	FFKRL	0.02506	0.609
ATAYO	0.2013	<.0001	ASYAB	0.0471	0.337	FONFK	-0.02959	0.545
ATLAS	0.2207	<.0001	DENIZ	0.1466	0.003	GARFA	0.0865	0.077
ATSYO	0.1803	2E-04	FINBN	0.0503	0.306	ISFIN	0.11917	0.015
AVRSY	0.1465	0.002	FORTS	0.2085	<.0001	VAKFN	0.03823	0.435
BNKTR	0.2769	<.0001	GARAN	0.1511	0.002	YKFIN	0.10448	0.032
BSKYO	0.1303	0.007	ISCTR	0.215	<.0001			
BUMYO	0.1584	0.001	SKBNK	0.1391	0.004			
DNZYO	0.1554	0.001	TEBNK	0.1154	0.018	INSURANCE FIRMS		
ECBYO	0.2453	<.0001	TEKST	0.1051	0.032	AKGRT	0.16037	0.001
ECZYT	0.2154	<.0001	TKBNK	0.0807	0.1	ANHYT	0.09379	0.056
EGCYO	0.1500	0.002	TSKB	0.1549	0.002	ANSGR	0.17954	2E-04
EMBYO	0.1623	7E-04	VAKBN	0.1828	2E-04	AVIVA	0.0984	0.045
EVNYO	0.0982	0.042	YKBNK	0.208	<.0001	GU.S.GR	0.10911	0.026
FNSYO	0.0676	0.162				YKSGR	0.12104	0.014
GDKYO	0.1266	0.009						
GLDTR	-0.1732	3E-04	REITS					
GRNYO	0.2083	<.0001	AGYO	0.1181	0.016			
HDFYO	0.1579	0.001	AKMGY	0.0574	0.241			
IBTYO	0.1036	0.032	ALGYO	0.0564	0.25			
INFYO	0.0755	0.119	DGGYO	0.1254	0.01			
ISGSY	0.1586	0.001	EGYO	0.0701	0.153			
ISYAT	0.1790	2E-04	ISGYO	0.1557	0.001			
METYO	0.1705	4E-04	NUGYO	0.0783	0.11			
MIPAZ	0.1842	1E-04	OZGYO	0.0472	0.336			
MRBYO	0.1339	0.006	PEGYO	0.0497	0.311			
MYZYO	0.1834	1E-04	VKGYO	0.1171	0.017			
NFIST	0.2926	<.0001	YKGYO	0.0995	0.042			
TACYO	0.1382	0.004	YYGYO	0.0559	0.254			
TCRYO	0.1725	3E-04						
TEKFK	0.2203	<.0001						
TKSYO	-0.0575	0						
TSKYO	0.1304	0.007						
VARYO	0.1083	0.025						
VKFRS	0.0874	0.071						
VKFYT	0.0965	0.046						
YKRYO	0.2722	<.0001						

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Table 3. Correlation of Turkish Financial Sector Firms' Post-Crisis Returns with the Corresponding U.S. Industry Indices

MUTUAL FUNDS			BANKS			LEASING FIRMS		
Firm	Rho	p value	Firm	Rho	p value	Firm	Rho	p value
AKYO	0.2462	<.0001	AKBNK	0.340	<.0001	CRDFA	0.1522	0.0007
ARFYO	0.3099	<.0001	ALNTF	0.328	<.0001	FFKRL	0.089	0.049
ATAYO	0.2448	<.0001	ASYAB	0.3243	<.0001	FONFK	0.1265	0.005
ATLAS	0.1899	<.0001	DENIZ	0.1001	0.0269	GARFA	0.112	0.0131
ATSYO	0.1869	<.0001	FINBN	0.1925	<.0001	ISFIN	0.2083	<.0001
AVRSY	0.2182	<.0001	FORTS	0.3136	<.0001	VAKFN	0.1356	0.0026
BNKTR	0.4301	<.0001	GARAN	0.3365	<.0001	YKFIN	-0.0134	0.7671
BSKYO	0.116	0.0102	ISCTR	0.3573	<.0001			
BUMYO	0.1926	<.0001	SKBNK	0.3672	<.0001			
DNZYO	0.0897	0.0473	TEBNK	0.3405	<.0001	INSURANCE FIRMS		
ECBYO	0.3099	<.0001	TEKST	0.331	<.0001	AKGRT	0.3293	<.0001
ECZYT	0.2698	<.0001	TKBNK	0.217	<.0001	ANHYT	0.3063	<.0001
EGCYO	0.1951	<.0001	TSKB	0.3042	<.0001	ANSGR	0.2854	<.0001
EMBYO	0.0584	0.1972	VAKBN	0.3625	<.0001	AVIVA	0.2351	<.0001
EVNYO	0.101	0.0254	YKBNK	0.3697	<.0001	GU.S.GR	0.2887	<.0001
FNSYO	0.2833	<.0001				YKSGR	0.2768	<.0001
GDKYO	0.175	<.0001						
GLDTR	-0.2199	<.0001	REITS					
GRNYO	0.2717	<.0001	AGYO	0.2717	<.0001			
HDFYO	0.134	0.003	AKMGY	0.1134	0.0118			
IBTYO	0.2574	<.0001	ALGYO	0.1411	0.0017			
INFYO	0.2108	<.0001	DGGYO	0.1631	0.0003			
ISGSY	0.2233	<.0001	EGYO	0.057	0.2073			
ISYAT	0.3334	<.0001	ISGYO	0.2931	<.0001			
METYO	0.2232	<.0001	NUGYO	0.1372	0.0023			
MIPAZ	0.2739	<.0001	OZGYO	0.0918	0.0418			
MRBYO	0.1175	0.0092	PEGYO	0.335	<.0001			
MYZYO	0.1291	0.0042	VKGYO	0.163	0.0003			
NFIST	0.4614	<.0001	YKGYO	0.2161	<.0001			
TACYO	0.2196	<.0001	YYGYO	0.148	0.001			
TCRYO	0.2512	<.0001						
TEKFK	0.264	<.0001						
TKSYO	0.0516	0.2541						
TSKYO	0.3272	<.0001						
VARYO	0.1937	<.0001						
VKFRS	0.1389	0.0021						
VKFYT	0.2053	<.0001						
YKRYO	0.3496	<.0001						

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Table 4. Fisher Test for Differences in Pre-Crisis and Post-Crisis Correlation Coefficients

MUTUAL FUNDS					MUTUAL FUNDS					LEASING FIRMS				
Firm	ρ_{post}	ρ_{Pre}	$Z(\rho_{post} - \rho_{pre})$	p value	Firm	ρ_{post}	ρ_{Pre}	$Z(\rho_{post} - \rho_{pre})$	p value	Firm	ρ_{post}	ρ_{Pre}	$Z(\rho_{post} - \rho_{pre})$	p value
AKYO	0.2513	0.1476	1.5642	0.12	TCRYO	0.1348	0.1593	-0.3683	0.71	CRDFA	0.1365	0.0383	1.4723	0.14
ARFYO	0.2218	0.1476	1.1179	0.26	TEKFK	0.1398	..0876	0.7867	0.43	FFKRL	0.2114	0.1197	1.3733	0.17
ATAYO	0.1891	0.1823	0.1023	0.92	TKSYO	0.2811	0.1864	1.4281	0.15	FONFK	0.1534	0.1015	0.7788	0.44
ATLAS	0.3396	0.1312	3.1426	0.001***	TSKYO	-0.2235	-0.1749	-0.7327	0.46	GARFA	0.0892	0.0251	0.9618	0.34
ATSYO	0.2232	0.1391	1.2681	0.2	VARYO	0.5149	0.336	2.6963	0.007***	ISFIN	-0.0134	-0.1049	-1.7728	0.07*
AVRSY	0.0899	0.1567	-1.007	0.31	VKFRS	0.4216	0.2172	3.081	0.002***	VAKFN	0.1272	-0.0296	2.3504	0.018**
BNKTR	0.2787	0.2114	1.0143	0.31	VKFYT	0.4991	0.3015	2.98	0.002***	YKFIN	0.1124	0.0867	0.3855	0.7
BSKYO	0.1014	0.0985	0.0432	0.97	YKRYO	0.4601	0.2843	2.6493	0.008***					
BUMYO	0.3467	0.181	2.4981	0.012**			BANKS			INSURANCE FIRMS				
DNZYO	0.3204	0.2481	1.091	0.28	AKBNK	0.1004	0.1477	-0.7073	0.48	AKGRT	0.3165	0.0941	3.3248	0.00***
ECBYO	0.365	0.2792	1.2935	0.2	ALNTF	0.3502	0.1523	2.9583	0.00***	ANHYT	0.2842	0.1216	2.4303	0.015***
ECZYT	0.1768	0.1273	0.7467	0.46	ASYAB	0.3546	0.2067	2.2101	0.02**	ANSGR	0.2396	0.0987	2.1055	0.035**
EGCYO	0.2704	0.224	0.6997	0.48	DENIZ	0.3738	0.2185	2.3228	0.02**	AVIVA	0.342	0.1618	2.6942	0.007***
EMBYO	0.0584	0.1637	-1.5876	0.11	FINBN	0.3797	0.1849	2.9126	0.003***	GU.S.GR	0.2936	0.1815	1.6753	0.09*
EVNYO	0.1976	0.1511	0.7007	0.48	FORTS	0.388	0.2111	2.6453	0.008***	YKSGR	0.2971	0.1095	2.8041	0.005***
FNSYO	0.2083	0.0968	1.6803	0.09*	GARAN	0.3364	0.0472	4.3252	0.000***	REITS				
GDKYO	0.2272	0.1599	1.0137	0.31	ISCTR	0.1949	0.0503	2.1621	0.03**	AGYO	0.1139	0.0575	0.8446	0.4
GLDTR	0.2567	0.1742	1.2434	0.21	SKBNK	0.3547	0.116	3.569	0.000***	AKMGY	0.1421	0.0564	1.2834	0.2
GRNYO	0.1165	0.131	-0.2184	0.83	TEBNK	0.3851	0.14	3.6647	0.000***	ALGYO	0.1381	0.0784	0.8941	0.37
HDFYO	0.2499	0.2041	0.6904	0.49	TEKST	0.3406	0.1787	2.4213	0.015**	DGGYO	0.1645	0.1177	0.7014	0.48
IBTYO	0.1181	0.1347	-0.2505	0.8	TKBNK	0.3439	0.1055	3.5649	0.000***	EGYO	0.2787	0.1187	2.3985	0.016**
INFYO	0.1951	0.1598	0.5321	0.59	TSKB	0.3245	0.2117	1.6876	0.09*	ISGYO	0.0921	0.0473	0.6719	0.5
ISGSY	0.1922	0.2244	-0.4852	0.63	VAKBN	0.2205	0.0808	2.0877	0.036**	NUGYO	0.3019	0.157	2.171	0.029**
ISYAT	0.1962	0.1088	1.3175	0.19	YKBNK	0.3142	0.1561	2.3631	0.018**	OZGYO	0.1646	0.1261	0.5771	0.56
METYO	0.2913	0.0677	3.3706	0.000***						PEGYO	0.057	0.0702	-0.1971	0.84
MIPAZ	0.214	0.0756	2.0858	0.037**						VKGYO	0.3484	0.0497	4.4753	0.000***
MRBYO	0.2633	0.104	2.4012	0.016**						YKGYO	0.2195	0.0998	1.7932	0.07*
MYZYO	0.0517	-0.0576	1.6466	0.09*						YYGYO	0.1491	0.056	1.3955	0.16
NFIST	0.227	0.1721	0.8267	0.41										
TACYO	0.1298	0.1855	-0.84	0.4										

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Table 5. Regression of Turkish Mutual Fund Returns against U.S. Mutual Fund Returns

Firm	β_{pre}	p value	β_{post}	p value	β_{dum}	p value	$\beta_{post} - \beta_{pre}$	p value
AKYO	0.0412	0.0023***	0.1242	<.0001***	-0.0002	0.7755	0.0830	0.0024***
ARFYO	0.0933	<.0001***	0.1772	<.0001***	-0.0003	0.7038	0.0840	0.0132**
ATAYO	0.0573	<.0001***	0.1208	<.0001***	-0.0002	0.7484	0.0634	0.0195**
ATLAS	0.0555	<.0001***	0.0663	<.0001***	-0.0001	0.8518	0.0108	0.6265
ATSYO	0.0515	0.0002***	0.0819	<.0001***	0.0000	0.9848	0.0304	0.2455
AVRSY	0.0468	0.0023***	0.0775	<.0001***	-0.0002	0.7630	0.0308	0.2462
BNKTR	0.1200	<.0001***	0.2760	<.0001***	-0.0002	0.7663	0.1560	<.0001***
BSKYO	0.0344	0.0069***	0.0528	0.0102***	0.0001	0.9359	0.0184	0.4742
BUMYO	0.0398	0.001***	0.0864	<.0001***	0.0000	0.9555	0.0466	0.0578*
DNZYO	0.0445	0.0012***	0.0259	0.0473**	0.0001	0.9310	-0.0186	0.4310
ECBYO	0.0855	<.0001***	0.2007	<.0001***	-0.0004	0.6309	0.1152	0.0006***
ECZYT	0.0695	<.0001***	0.1643	<.0001***	-0.0002	0.7934	0.0948	0.0029***
EGCYO	0.0331	0.0018***	0.0831	<.0001***	0.0000	0.9631	0.0500	0.0253**
EMBYO	0.0324	0.0007***	0.0255	0.1972	0.0001	0.9416	-0.0070	0.7499
EVNYO	0.0229	0.0421**	0.0375	0.0254**	0.0000	0.9794	0.0146	0.5064
FNSYO	0.0143	0.1623	0.1280	<.0001***	0.0003	0.7169	0.1136	<.0001***
GDKYO	0.0344	0.0087***	0.0837	<.0001***	0.0000	0.9513	0.0493	0.0626*
GLDTR	-0.0998	0.0003***	-0.2028	<.0001***	0.0004	0.6337	-0.1030	0.0542*
GRNYO	0.0592	<.0001***	0.1217	<.0001***	-0.0001	0.9225	0.0625	0.016**
HDFYO	0.0348	0.001***	0.0512	0.003***	0.0000	0.9885	0.0164	0.4444
IBTYO	0.0176	0.0319**	0.1228	<.0001***	-0.0001	0.8865	0.1052	<.0001***
INFYO	0.0188	0.1186	0.0894	<.0001***	0.0000	0.9798	0.0706	0.003***
ISGSY	0.0659	0.001***	0.1260	<.0001***	-0.0002	0.8305	0.0601	0.0986*
ISYAT	0.0529	0.0002***	0.1910	<.0001***	-0.0002	0.8385	0.1380	<.0001***
METYO	0.0383	0.0004***	0.0807	<.0001***	-0.0001	0.9354	0.0424	0.0424*
MIPAZ	0.0458	0.0001***	0.1003	<.0001***	0.0001	0.9427	0.0545	0.0138**
MRBYO	0.0365	0.0055***	0.0541	0.0092***	0.0001	0.9438	0.0176	0.5029
MYZYO	0.0541	0.0001***	0.0486	0.0042***	0.0000	0.9954	-0.0055	0.8290
NFIST	0.1442	<.0001***	0.3651	<.0001***	-0.0003	0.6381	0.2210	<.0001***
TACYO	0.0346	0.0041***	0.1009	<.0001***	0.0000	0.9747	0.0663	0.0073***
TCRYO	0.0511	0.0003***	0.1105	<.0001***	-0.0001	0.9453	0.0595	0.0253**
TEKFK	0.0474	<.0001***	0.1046	<.0001***	-0.0001	0.8795	0.0572	0.0065***
TKSYO	-0.0115	0.2346	0.02	0.2541	0.0001	0.9044	0.0333	0.1214
TSKYO	0.0395	0.0068***	0.1714	<.0001***	-0.0001	0.9251	0.1319	<.0001***
VARYO	0.0148	0.0248**	0.0644	<.0001***	-0.0001	0.9422	0.0497	0.0016***
VKFRS	0.0199	0.0707	0.0375	0.0021***	-0.0001	0.9301	0.0175	0.3684
VKFYT	0.0200	0.0458**	0.0757	<.0001***	-0.0001	0.9380	0.0557	0.0059***
YKRYO	0.1148	<.0001***	0.2189	<.0001***	-0.0004	0.5804	0.1042	0.0046***

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Table 6. Regression of Turkish Bank Returns against U.S. Bank Index Returns

Firm	β_{pre}	p value	β_{post}	p value	β_{dum}	p value	$\beta_{post} - \beta_{pre}$	p value
AKB	0.1	<.0001**	0.4	<.0001**	-	0.9		0.0002*
NK	773	*	694	*	0.0001	538	0.2921	**
ALN	0.1	0.0003**	0.4	<.0001**	0.0	0.8		0.0002*
TF	726	*	903	*	004	823	0.3177	**
ASY	0.0		0.4	<.0001**	0.0	0.8		<.0001*
AB	419	0.3370	787	*	003	931	0.4368	**
DEN	0.1	0.0027**	0.1		0.0	0.8		
IZ	000	*	116	0.0269**	005	387	0.0117	0.8561
FINB	0.0		0.2	<.0001**	0.0	0.8		0.0031*
N	433	0.3057	894	*	004	829	0.2462	**
FOR	0.1	<.0001**	0.4	<.0001**	0.0	0.9		0.0012*
TS	839	*	416	*	003	019	0.2576	**
GAR	0.1		0.4	<.0001**	-	0.9		<.0001*
AN	183	0.002***	673	*	0.0002	356	0.3490	**
ISCT	0.1	<.0001**	0.5	<.0001**	-	0.9		<.0001*
R	886	*	496	*	0.0003	022	0.3610	**
SKB	0.1	0.0044**	0.5	<.0001**	0.0	0.8		<.0001*
NK	005	*	293	*	005	307	0.4288	**
TEB	0.0		0.4	<.0001**	0.0	0.9		<.0001*
NK	977	0.0184**	462	*	001	596	0.3486	**
TEK	0.0		0.4	<.0001**	0.0	0.6		<.0001*
ST	822	0.0319**	082	*	011	400	0.3260	**
TKB	0.0		0.2	<.0001**	0.0	0.9		0.0008*
NK	708	0.1*	795	*	001	723	0.2087	**
TSK	0.1	0.0015**	0.5	<.0001**	-	0.8		<.0001*
B	498	*	109	*	0.0006	144	0.3612	**
VAK	0.1	0.0002**	0.5	<.0001**	-	0.9		<.0001*
BN	551	*	250	*	0.0003	023	0.3699	**
YKB	0.1	<.0001**	0.5	<.0001**	0.0	0.9		<.0001*
NK	877	*	461	*	000	861	0.3584	**

Table 7. Regression of Turkish Real Estate Returns Against U.S. Real Estate Index Returns

Firm	β_{pre}	p value	β_{post}	p value	β_{dum}	p value	$\beta_{post}-\beta_{pre}$	p value
AKM	0.06		0.14		-	0.76		
GY	12	0.2413	53	0.011***	0.0007	23	0.0842	0.3868
ALG	0.05		0.20	0.0017**	-	0.69		
YO	46	0.2502	74	*	0.0009	91	0.1528	0.1038
NUG	0.05		0.18	0.0023**	-	0.65		
YO	67	0.1101	04	*	0.0010	79	0.1237	0.0994
VKG	0.09		0.19	0.0003**	-	0.64		
YO	41	0.0166**	98	*	0.0010	39	0.1057	0.1740
AGY	0.09		0.39	<.0001**	-	0.71		0.0003**
O	59	0.0157**	18	*	0.0008	80	0.2959	*
OZG	0.02		0.06		-	0.80		
YO	65	0.3356	47	0.0418**	0.0006	28	0.0382	0.4603
ISGY	0.13	0.0014**	0.42	<.0001**	-	0.58		0.0005**
O	42	*	81	*	0.0012	86	0.2939	*
DGG	0.10	0.0103**	0.21	0.0003**	-	0.62		
YO	31	*	47	*	0.0011	37	0.1116	0.1678
EGY	0.03		0.06		-	0.81		
O	42	0.1528	23	0.2073	0.0005	77	0.0282	0.6144
PEGY	0.02		0.36	<.0001**	-	0.88		<.0001**
O	25	0.3108	57	*	0.0003	60	0.3432	*
YKG	0.06		0.26	<.0001**	-	0.83		0.0059**
YO	91	0.042**	20	*	0.0005	14	0.1929	*
YYG	0.03		0.14		-	0.74		
YO	27	0.2540	68	0.001***	0.0007	05	0.1141	0.052**

Table 8. Regression of Turkish Leasing Returns against U.S. Leasing Index Returns

Firm		β_{pre}	p value	β_{post}	p value	β_{dum}	p value	$\beta_{post} - \beta_{pre}$	p value
	VAK	0.0		0.1		-	0.8		
FN		247	0.4346	791	0.002***	0.0004	955	0.1544	0.02**
	ISFI	0.0	0.0145*	0.3	<.0001**	-	0.7		0.001**
N		969	*	732	*	0.0007	901	0.2763	*
	CRD	0.1		0.2	0.0007**	-	0.9		
FA		423	0.038**	606	*	0.0001	587	0.1182	0.3290
	FFK	0.0		0.1		0.0	0.9		
RL		188	0.6085	382	0.049**	000	991	0.1195	0.1349
	YKF	0.0		-		-	0.9		
IN		920	0.032**	0.0200	0.7671	0.0002	520	-0.1120	0.1910
	FON	-		0.1		0.0	0.9		0.011**
FK		0.0251	0.5454	830	0.005***	000	881	0.2081	*
	GAR	0.0		0.1		-	0.8		
FA		793	0.0766*	459	0.0131**	0.0004	846	0.0666	0.4225

Table 9. Regression of Turkish Insurance Returns against U.S. Insurance Index Returns

Firm	β_{pre}	p value	β_{post}	p value	β_{dum}	p value	$\beta_{post} - \beta_{pre}$	p value
	0.05		0.36		0.00	0.81		<.0001**
ANHYT	73	0.0559*	14	<.0001***	04	62	0.3041	*
	0.06		0.27		0.00	0.53		<.0001**
YKSGR	12	0.0135**	46	<.0001***	11	41	0.2135	*
	0.05		0.24		0.00	0.74		0.0005**
AVIVA	10	0.0449**	63	<.0001***	06	53	0.1953	*
	0.08		0.33		0.00	0.74		<.0001**
AKGRT	63	0.001***	75	<.0001***	06	14	0.2512	*
	0.11		0.37		0.00	0.74		0.0003**
ANSGR	93	0.0002***	61	<.0001***	06	70	0.2569	*
	0.06		0.33		0.00	0.47		<.0001**
GUSGR	01	0.0261**	47	<.0001***	13	02	0.2746	*