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Analysis of Systematic Risk around Firm-specific News in an Emerging Market using High Frequency Data

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JEL Classification

C22, G10, G11, G33

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Abstract

We investigate whether the daily betas of individual stocks vary with the release of firm-specific news in an emerging market. Using intraday prices of all stocks traded on the Borsa Istanbul, Turkey over the period 2005-2013, we find evidence that average market betas increase significantly from two weeks before the earnings announcement day, and then revert to their average levels two weeks after the announcement. The increase in betas is greater for larger, positive surprise earnings announcements than for smaller, negative news. The results are consistent with features of the learning model of Patton and Verardo (2012) but not with a number of their empirical results.

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1. Introduction

The earnings announcement premium is a well-established empirical regularity around the world as shown by Barber et al (2012), amongst others. Explaining why such a premium occurs is less well established, but a leading explanation is that of Patton and Verado (2012) and Savor and Wilson (2016) which attributes it to announcement risk. Their models associate the increase in returns of announcing firms with the covariance between firm-specific and market cash flow news which spikes around announcements, making announcers especially risky. An associated concern is that betas are unlikely to be constant over time (Huang and Litzenberger, 1988). Whist many empirical papers find significant evidence of variation in beta with macroeconomic news or stock fundamentals (Lewellen and Nagel, 2006; Ferson and Harvey, 1991), allowing for short-run variability is key for understanding the impact of announcements. Therefore, here we focus on high frequency data to analyse short run variability in betas around announcement dates and restrict ourselves to examining the behaviour of the daily market beta.

Patton and Verado (2012) examine the behavior of daily betas around announcement dates for the United States. They find significant increases in betas at these times but find that these are short-lived and are symmetric for good and bad news. The generality of these results across markets has not been established. In particular, we know of no comparable evidence for emerging markets, where the transmission of information might be expected to be somewhat different. Difficulties in access and analysis of high-frequency data specifically in emerging markets has restricted the analysis of daily beta behaviours. However, the ability to identify variations in individual betas at higher frequencies is crucial for understanding the impact of information flows on the covariance structure of stock returns, as Patton and Verardo (2012) show. The model that they propose suggests a mechanism whereby investors update their views about the profitability and returns of non-announcing firms and thereby the whole economy with information from the earnings announcements of announcing firms. This produces an increase in the covariance of the returns of announcing firms with the market return at announcement times and thereby an increase in their beta. This process requires that individual firm's earnings have a common, as well as an idiosyncratic component.

Following advances in econometric theory, we investigate whether the daily betas of individual stocks vary with the release of firm-specific news in an emerging market. In this study, we use three-month earnings announcements as firm-specific news. We have a total of 9.273 quarterly earnings announcements for all stocks traded on the Borsa Istanbul over the period 2005-2013 (i.e. for 513 individual firms). Using intraday prices of all stocks traded on Borsa Istanbul, we find that there is a statistically significant increase in systematic risk of individual stocks around earnings announcements days. The average Betas of individual stocks increases from 0.09 15 days before the event date to 0.16 on the event date and then returns to its overall average level 15 days after the announcement. The behaviour of beta that we find is, however, different to the behavior of beta in the United States reported by Patton and Verado (2012) where they find that systematic risk increases exactly on the earnings announcement day and returns to the average level 2 to 5 days later. We find that the increase in beta pre-dates the announcement by several days and is also more persistent following the announcement. Whilst our results continue to support the simple learning model of Patton and Verardo (2012) in which investors use information from announcing firms to extract information on the aggregate economy, the mechanism appears more complicated than they propose. Patton and Verardo (2012) estimate realized betas of single stocks around earnings announcements based on intraday data for S&P 500 over the period 1996-2006. They report a significant increase in the average betas of individual stocks by 12% on earnings announcements date which then returns to their normal level 2-5 days after the announcement. In addition, Patton and Verardo (2012) report that the increase in the beta of individual stocks is larger for earnings announcements with bigger positive and bigger earnings surprises. Furthermore, the increase in individual stocks betas is larger for stocks whose fundamentals are closely linked with the overall market fundamentals. Our results suggest that betas rise partly in anticipation of an earnings announcement and that this effect is more persistent than in Patton and Verado (2012). An explanation for this result, is that announcing firms, with returns correlated with those of other firms announcing at a similar time, achieve higher betas both before and after the announcement date.

In addition to examining the overall response of average beta to announcements on the Borsa Istanbul, we examine the response of beta to earnings announcements of different signs by dividing announcements into good and bad news. Interestingly, we find that betas increase significantly when there is good earnings news but there is no significant reaction of betas to bad earning news. On average, beta increases by 0.14 on good announcement days. Betas drop by 0.08 on the 11 days after the good news before reverting to their average level about 16 days after the announcement. Our results suggest that investors in Turkey only use good information from announcing firms to revise their expectations about the profitability of the aggregate economy which is different to the results for the US in Patton and Verado, where betas react positively and to the same extent to firm-specific announcements whether the news is good or bad.

There is evidence in the literature that large-cap stocks have a heavier weight in the market portfolio than small-cap stocks. Moreover, large-cap stock fundamentals are more correlated with aggregated market fundamentals (see Patton and Verardo, 2012). Therefore, we additionally examine differences in the behaviour of betas around earnings announcements for large and small-cap stocks in Turkey. Our findings show that the increase in the beta of small-cap stocks is slightly greater than that for large-cap stocks (0.17 vs. 0.20) and the rise in the betas of both small and large cap stocks are slightly greater than that for the market portfolio (0.155). Moreover, when we take in to account the sign of the announcement, the results dramatically change; the increase in beta is more concrete in the presence of good earning news for large-cap stocks and for bad earning news for small-cap stocks. Notably, our finding contradicts with findings of Patton and Verardo (2012) for the U.S. where only the betas of large-cap stocks experience a spike around earnings announcements.

The payment of a dividend has been found to have a significant effect on the value of firms (Campbell, Lo, and MacKinlay, 1997). Therefore, we further investigate whether the behavior of beta differs between dividend-paying and non-paying stocks around the times of earnings announcements. We find that the increase in betas of non-dividends stocks on earnings announcements days is greater than the increase in betas of dividend stocks (0.17 vs. 0.10). We hypothesise that this might be due to the fact that firms which do not pay dividends have all of their net profits earned added to their stocks' value while firms which pay a dividend have the impact of profit on firm value diluted. Therefore, we may not see much change in realized betas of dividend stocks around announcement days.

It is well known that the great financial crisis (GFC) affected financial markets in many ways and has left an impact on investors and their decision-making For example, according to a recent study by Alexeeva, Dungey, and Yao (2017), many stocks faced great changes in their market risk during the period September-October 2008, the period when Lehman Brothers collapsed and AIG was rescued. Therefore, in this study, we test the behaviour of beta changes around earnings announcements with respect to market conditions. Thus, we divide our sample data into three periods as pre-crisis, crisis and post crisis. We find a significant increase in beta on earnings announcements days just for the pre crisis period. The increases in betas are 0.16, 0.06 and 0.01 during the pre-crisis, crisis and post-crisis period respectively. Interestingly, the reaction of betas to firm-specific news during the crisis period is statistically insignificant. Our result is robust to controlling for good and bad news, for large and small cap stocks and for dividend and non-dividend stocks. This indicates to us that market conditions have a significant effect on the behavior of market risk for individual stocks in Turkey.

Previous research shows that non-synchronous trading leads the covariance between individual stock and market portfolio returns to be reduced towards zero (Epps, 1979) and thus, we might observe betas of securities that trade less (more) frequently than the index used in their estimation are downward (upward) biased (Fowler et. al., 1980; Fowler et. al., 1980; Kadlec and Patterson, 1999) and for this effect to be more pronounced where non-synchronous trading is more prevalent, which is predominantly outside of the US.

Moreover, some studies report that the variation in realized betas may be driven by jumps in stock returns (Patton and Verardo, 2012). We check for these potential biases in our results by performing robustness checks. Robustness checks are used to test how certain "*core*" regression coefficient estimates behave when the regression specification is modified by adding or removing regressors. We adjust our regression specification by including controls for trading volume and realized variation and show that they are little altered by these additions. We further consider the impact of the presence of possible jumps in stocks returns on our realized beta estimates and finally we confirm that the results of this study are robust to the clustering of firm-specific news on announcements dates.

Earlier empirical papers that study the changes in the covariance of stocks returns around firm-related events include Ball and Kothari (1991) who study cross-sectional average beta around earnings announcements for the period of eight years. They find that there is an increase of 6.7% in beta over a 3-day window. Vijh (1994) and Barberis et al. (2005) investigate the changes in the covariance of returns across stocks added to S&P 500 index. Vijh (1994) finds that beta increase on average by 0.08 during the period 1975-1989 where Barberis et al. (2005) report an increase of 0.15 in beta during the period of 1976-2000. Unlike these papers, this study allows us to obtain an accurate estimate of daily beta for all individual stocks.

This paper is also related to the literature of information spillovers. Wang (2003) studies return comovement across markets in respect of changes in macroeconomic conditions. Barberis et al. (2005) suggest that comovements in stock prices are due to common news of fundamentals and information asymmetry. Our research appends to this literature connecting return comovement to earnings announcements through numerous disaggregated results on comovement.

Lastly, this study relates to early researchers' work on price discovery using high-frequency data (Andersen et al., 2003a, 2007; Faust et al., 2007). Our analysis differs as we focus on the impact of firm-specific news on individual stocks betas rather than on the impact of macroeconomic announcements on prices and volatility in aggregate indices or other asset returns. To our knowledge, this is the first paper to test whether the beta of all individual stocks traded on the Borsa Istanbul react to firm-specific news and therefore provides evidence for an emerging market.

The reminder of paper is structured as follows: Section 2 reviews the data and the econometric theory underlying our estimation of daily firm-level beta using high-frequency data. Section 3 presents our empirical results. Section 4 presents a variety of robustness tests, and Section 5 concludes. Appendix 1 presents the estimated daily betas.

2. Methodology

2.1 Data

The sample data used in our study includes intraday prices for every stock traded on Borsa Istanbul during the period of January 2005 and December 2013. The data is obtained from Borsa Istanbul in the format of real tick prices (597,265,185 tick prices). Tick prices were then converted to every 15-minute prices (29 obs. per trading day, plus the overnight return, a total number of 33,741,036 obs.). We follow Hansen and Lunde (2006) procedure in the data cleaning process, i.e. deleting the prices related to lunch break, weekends, public holidays, and the days when Borsa Istanbul does not trade full day. The daily routine session at Istanbul stock exchange market opens at 9:15 and close 17:40. The lunch break is one and half hour, from 12:30-14:00. In order to avoid the microstructure noises biases that rise from 1-minute price intervals, we choose a 15-minute sampling frequency for our intra-daily returns[2].

Our quarterly earnings announcements are consisting of 9,273 firm-announcements obtained from Public Disclosure Platform database website "www.kap.org.tr". We use earnings announcement dates for which a timestamp is available, to be able to identify the

[2]Because at one minute or higher frequencies, microstructure noise affects our results due to the presence some kind of bias which at the end leads to imprecisely estimation of variance and beta. One example of such biases is the non-synchronous trading effect that leads to downward bias in the covariance of individual stock returns and market returns. This type of bias is also known as the "Epps effect" due to which the covariance of individual stock returns and market returns goes down to zero (Patton and Verardo, 2012). The easiest way to evade this type of bias is to use the returns sampled at a lower frequency such as 15 minutes or 30 minute. Todorov and Bollerslev (2010) have found a way to get rid of this issue, so we follow their approach in this study. We also follow Bollerslev et al., (2008) approach in computing our market portfolio return.

announcements days more precisely. On average, we have 19 announcements per firm. Quarterly earnings that are announced on weekends are re-labeled as next following trading day's date to reflect the reality that stocks response to such news on the next trading day only. In other words, our event date "day 0" in our event window is the day in which traders show a reaction to the earnings announcements on Borsa Istanbul.

2.2 Realized Beta

We follow Andersen, et al. (2003) and Barndorff-Nielsen and Shephard (2004) econometrics to obtain firm-level estimates of day to day betas using high-frequency data. Andersen et al. (2003) with Barndorff-Nielsen and Shephard (2002) have developed high-frequency based empirical measurements to estimate volatility. Volatility is defined as realized volatility expressed in the sum of the squares of day-to-day returns. The realized beta is measured as realized covariance between the market and stocks divided over the market's realized volatility (Andersen et al., 2006). Through following their approach, the intraday return is calculated as followings:

$$r_{jt} = \log p\left(\mathrm{t} - 1 + \frac{\mathrm{j}}{\mathrm{J}}\right) - \log p\left(\mathrm{t} - 1 + \frac{\mathrm{j} - 1}{\mathrm{J}}\right) - \quad (5)$$

In the above equation, j is an intraday interval price and M sampling frequency are the number of the sample at time t. j = 1, 2, 3, …, j. Borsa Istanbul operates on normal weekdays from 9.15 to 17.40, therefore, for a 15-minute interval, we will have 29 observations per day. The overnight return of an asset for the period T and T+1 is the difference between the logarithmic opening price at t+1 and the logarithmic closing price at t.

$$r_t^{ON} = \log\ p°(\mathrm{t} + 1) - \log\ p°(\mathrm{t}) \quad (6)$$

RV is measured as a total sum of intraday squared returns.

$$RV_{mt} = \sum_{j=1}^{J} r_{mjt}^2 \quad (7)$$

And when we include the overnight return of an asset to realized variance, we get the following equation:

$$RV_{mt} = \sum_{j=1}^{J} r_{mjt}^2 + \ (r_t^{ON})^2 \quad (8)$$

The realized covariance ($RCOV_{imt}$) between a stocks returns of and a market portfolio returns is measured as follows:

$$RCOV_{mt} = \sum_{j=1}^{J} r_{ijt}\, r_{mjt} \tag{9}$$

$$\hat{\beta}_{it} = \frac{RCOV_{imt}}{RV_{mt}} \tag{10}$$

2.3 Panel Estimation Method

In order to detect whether the betas of individual stocks react to earnings announcements, we follow the existent literature by using panel estimation model (Petersen, 2009; Patton, Verrardo, 2012). In this study, we perform panel regression for an event window of 81 days (announcement day ± 40 days).

$$\begin{aligned} R\beta_{it} = \delta_{-40} I_{i,t-40} + \cdots + \delta_0 I_{i,t} + \cdots + \delta_{40} I_{i,t+40} + \hat{\beta}_{i_1} D_{1t} \\ + \hat{\beta}_{2t} D_{2t} + \cdots + \hat{\beta}_{i,41} D_{41,t} + \varepsilon_{it} \end{aligned} \tag{11}$$

where $R\beta_{it}$ are our daily realized beta for stock *i* on day *t*, and $I_{i,t}$ are our dummy variables. $I_{i,t}$ = 1 if day *t* is an earnings announcement day for stock *i* or $I_{i,t}$= 0 otherwise. In order to capture the changes and the differences in beta across stocks over our sample period, we add firm-year fixed effects to our regression model. The daily betas are regressed on dummy variables for every 81 days surrounding event days. Event "day 0" represents the date of the quarterly earnings announcement; t-statistics are estimated from standard errors which are robust to heteroscedasticity and to arbitrary intraday correlation.

We can capture the variation in realized betas during earnings announcements by analyzing the coefficients on the announcement day indicator variables, $\delta_j, j = -40, -39, \ldots, 40$. The average beta beyond our specified window is detected by the firm-year fixed effects and the δ_j parameters capture the divergence of beta from its normal level on every announcement day. The estimated t-statistic for every δ_j coefficients can be used to determine if a change in beta is statistically significant or not.

2.4 Determination of Good News and Bad News

Like in developed markets, there are no expert estimates for quarterly earnings of companies in emerging markets that can be obtained readily. In markets where there is no consensus forecast for quarterly earnings, researchers use good and bad earnings news concept to determine if an earnings news is Good or Bad. Several empirical studies state that U.S. stocks react positively to good news and negatively to the bad news (Griffin, 1976; Landsman and Maydew, 2002). Saleem and Yalaman (2017) witness discrete jumps in stock price around earnings news with both good and bad earnings sign in emerging markets. Moreover, they report that the abnormal returns are negative for earnings news with a bad earnings sign and positive for earnings news with a good earning sign. In a study by Patton and Verardo (2012) on the behavior of betas of each constituent of S&P 500 around earnings announcements, they find that Betas increase greater with larger positive and negative earnings surprises around earnings announcements. Therefore, in this study, we also would like to analyze the changes in the behavior of betas with respect to types of earnings announcements in emerging markets and compare our results with studies from developed markets.

We follow Iqbal and Farooqi (2011) methodology to divided earnings news into good earnings news and bad earnings news. The “Good earnings news” is defined as actual earning > 10% of median earnings and the “Bad earnings news" is defined as actual earnings < 10% of median earnings. The median of earnings is calculated from previous quarterly earnings of individual firms.

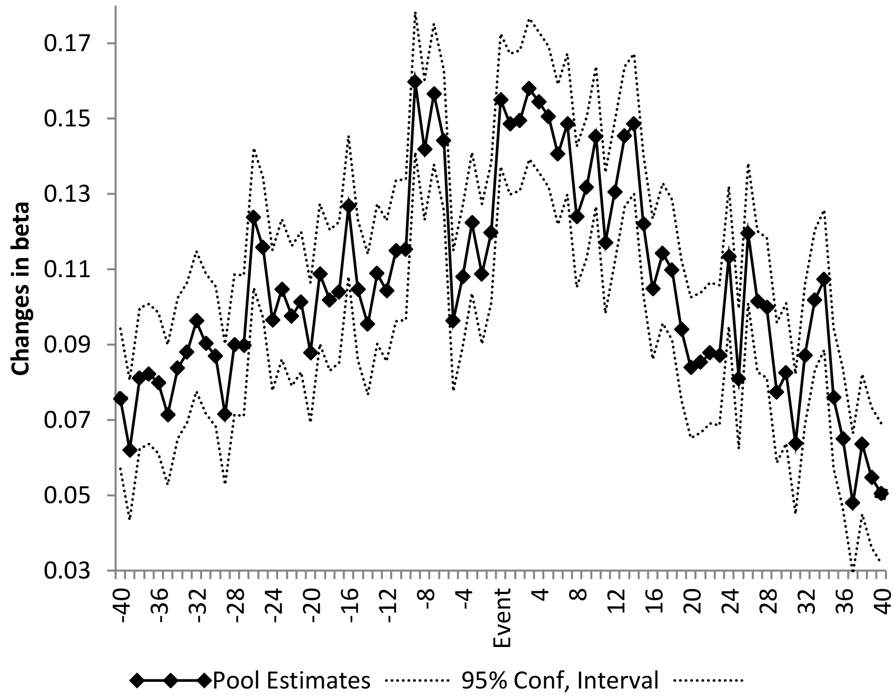
Good Earnings News = Actual Earnings > 10% of Median Earnings
Bad Earnings News = Actual Earnings < 10% of Median Earnings
Stable News = Actual Gain ± 10% of Median Earnings

3. Empirical Results

We test whether the daily systematic risk of individual stocks varies around firm-specific news announcement through understanding whether the investors use information from announcing firm to extract information on the aggregate economy. If this happens, this drives up the covariance of the returns of the announcing stock with other stocks, leading to an increase in the market beta of the announcing stocks.

Figure 1 reports estimate of changes in betas for 513 individual stocks traded on Borsa Istanbul. The estimates are obtained from a panel regression of daily realized betas on dummy variables for each of 81 days around quarterly earnings announcements, as described above. The regressions account for firm and year fixed effects; t-statistics and 95% confidence intervals for the estimates are computed from standard errors that are robust to heteroscedasticity and to arbitrary intra-day correlation.

Figure 1. Changes in Betas for all Stocks Traded on Borsa Istanbul



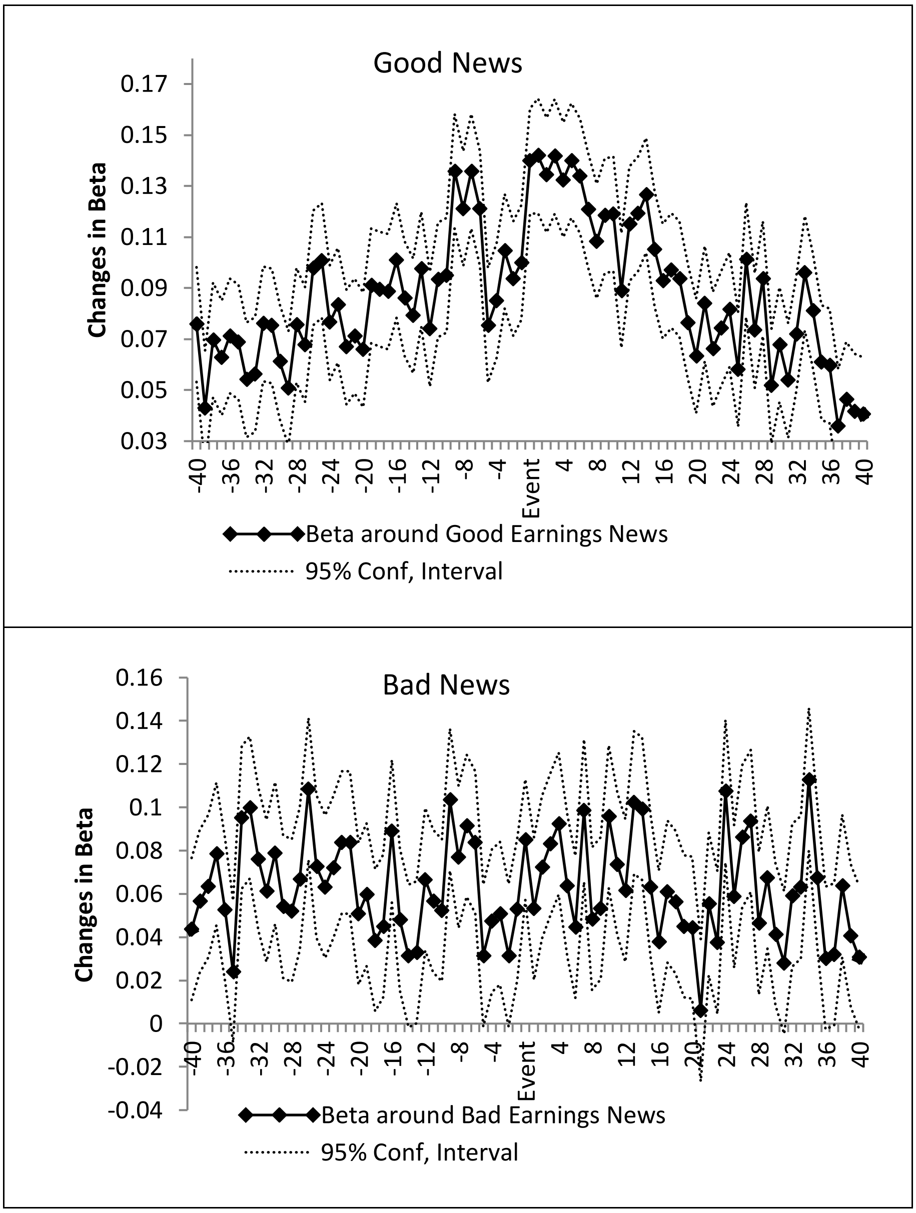
The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement (where event day 0 is the announcement day) for 513 individual stock traded on Borsa Istanbul. Point estimates are market with solid black line. Robust confidence intervals are shown with dotted lines.

Using intraday prices of all stocks traded on Borsa Istanbul, we find that individual stocks betas increase by a statistically significant amount on earnings announcement day. Betas of individual stocks increase on average from 0.10 fifteen days before the event date to 0.16 (t = -17.26) on the event date and then return to the average level fifteen days after the announcement. This persistent effect is strikingly different to that for the US where the beta drops immediately after the earnings announcement days before reverting to its average level about 3 to 5 days later (see Patton and Verardo, 2012). An explanation for this result, in the context of the Patton/Verardo learning model, is that announcing firms with returns correlated with those of other firms announcing at a similar time achieve higher betas both before and after the announcement date.

3.1 The Sign of News

We start our cross-sectional analysis of changes in betas around earnings announcements by examining the link between the behavior of betas and the sign of the earnings news. To examine the response of betas to earnings announcements with a different information contents, we divided earnings announcements into good news and bad news. Figure 2 reports estimate of changes in betas for all stocks traded on Borsa Istanbul for good and bad news.

Figure 2. Changes in Betas for Good News and Bad News



The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement (where event day 0 is the announcement day) for 513 individual stock traded on Borsa Istanbul for good news and bad news.

The results show that there is no significant reaction of betas to bad earnings news, but betas increase significantly for good news. On average, beta increases by 0.14 on good announcement days. Betas drop by 0.08 on the 11 days after the good news before reverting to their average level about fifteen days after the announcement. It is clear that investors in Turkey only use good information from announcing firms to revise their expectations about the profitability of the aggregate economy which is different from the US where betas react to firm specific announcement whether the news is good or bad (see Patton and Verardo, 2012).

3.2. Firm Characteristics: Large-cap vs. Small-cap Stocks

There is evidence in the literature for large-cap stock fundamentals being more correlated with aggregated market fundamentals (see Patton and Verardo, 2012). Therefore, we analyze the behavior of betas whose fundamentals may have different degrees of connectedness with market-wide fundamentals. Thus, we examine differences in the behavior of betas around earnings announcements in respective of the large-cap stocks and small-cap stocks. Figure 3 reports estimates of changes in betas for large-cap stocks and small-cap stocks.

Our findings show that the spikes in the beta of large-cap stocks and small-cap stocks are 0.17 ($t = 7.48$) and 0.20 ($t = 5.17$), respectively. Betas continue increasing to 0.18 ($t = 7.88$) for two days after the event before reverting to the long average level for large-cap stocks. The betas of small-cap stocks increases to 0.22 ($t = 5.58$) in the days before the event day before reverting to the long average level for these stocks.

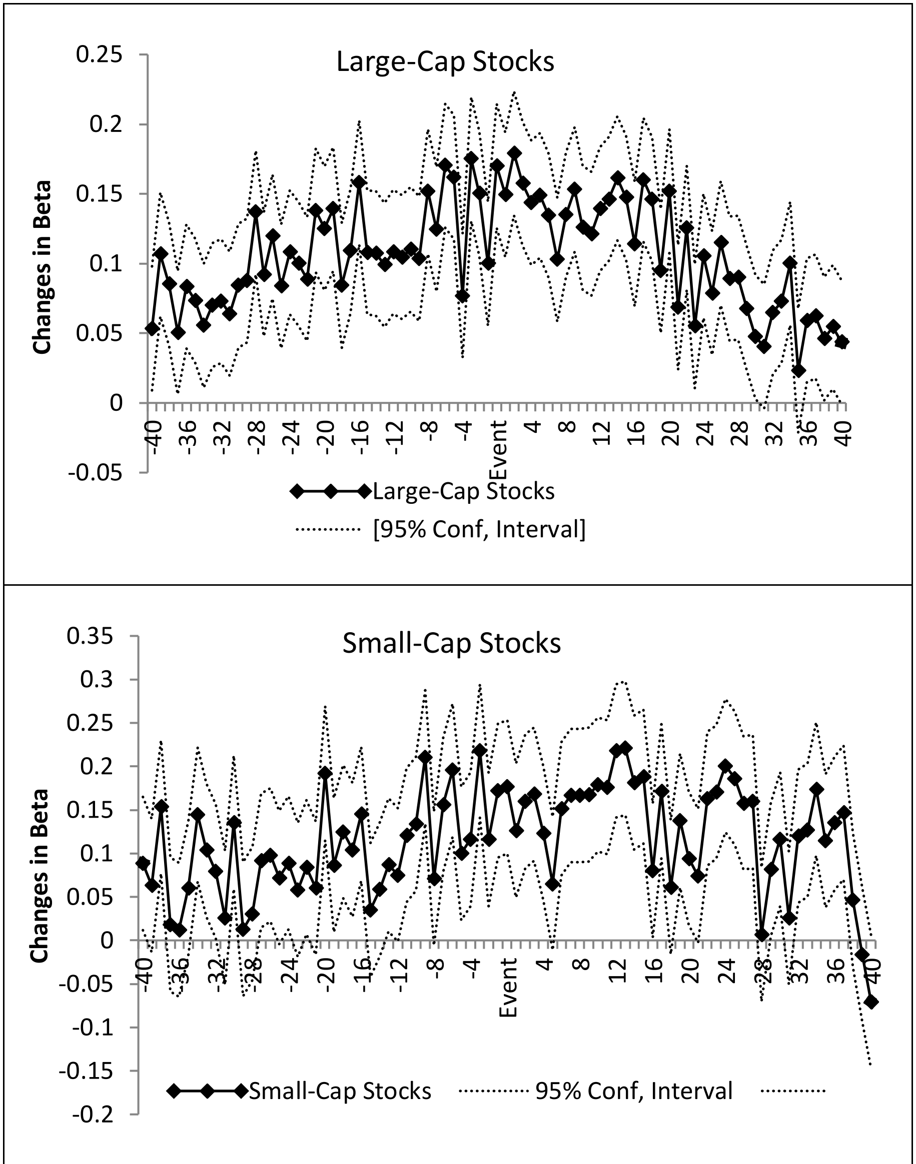
It is clear that the reaction of betas for small-cap is slightly greater than the reaction of large-cap stocks to the earning announcement and moreover, the spike in the beta of both small and large cap stocks are slightly greater than the spike in the beta of the market portfolio (compare Figure 1).

When we take in to account a different information contents as good news and bad news, the results dramatically change. Figure 4 reports estimate of changes in betas for good news and bad news in respect of large and small-cap stocks.

Our findings now show that the spike in the beta of large-cap stocks and small-cap stocks are 0.18 ($t = 7.52$) and 0.12 ($t = -0.21$) for good earning news respectively. For the good earning news, the spike of betas reverting to their average levels.

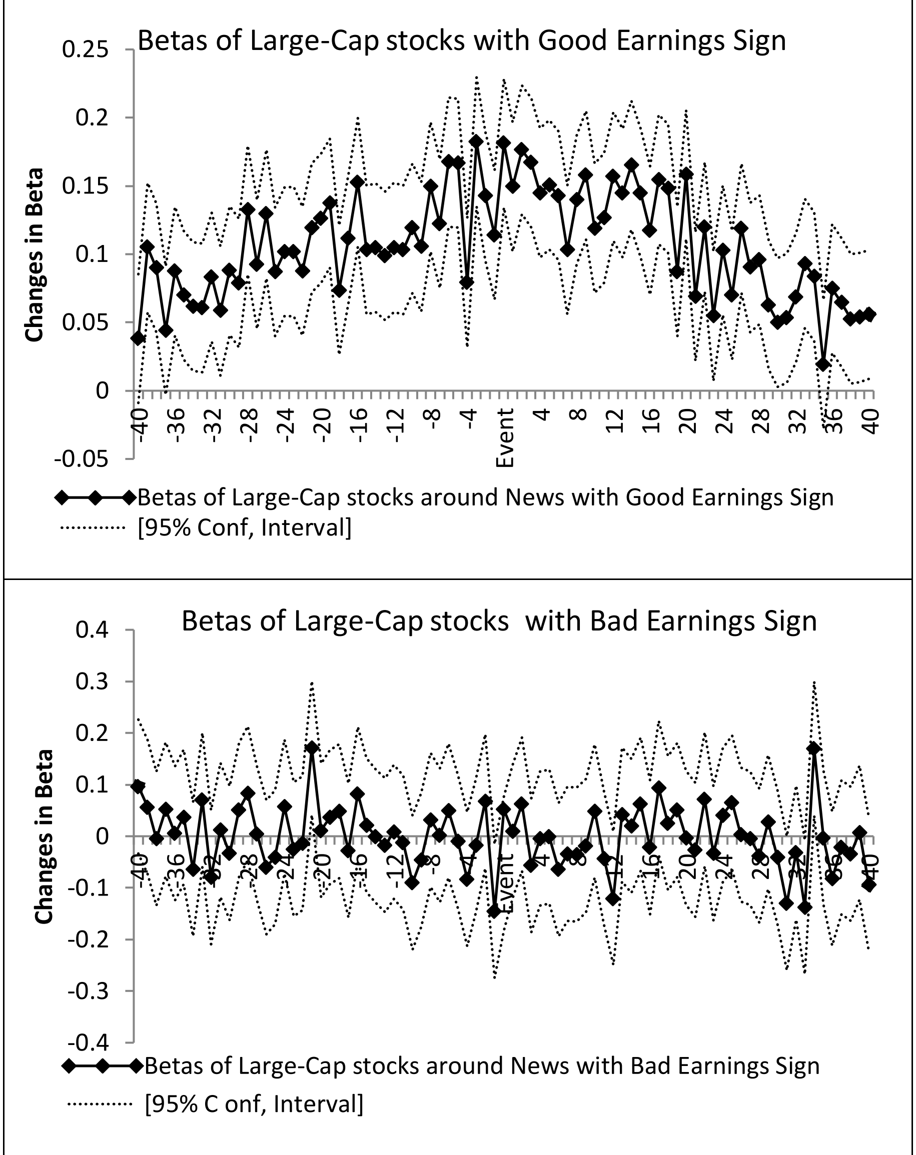
The spike in the beta of large-cap stocks and small-cap stocks are -0.05 ($t = 0.79$) and 0.18 ($t = 3.64$) for bad earning news respectively and the betas reverting to their average, about 10 days later for large-cap stocks and, 15 days later for the small-cap stocks. It is clear that the beta of small-cap stocks around good news, and beta of large-cap stocks around bad news are not statistically significant. It can be concluded that the spike in betas is more concrete in the presence of good earning news for large-cap stocks, while the spike in betas are better established in the presence of bad earning news for small-cap stocks. Notably, our finding contradicts that of Patton and Verardo (2012) for the US where only the betas of large-cap stocks experience a spike around earnings announcements.

Figure 3. Changes in Betas for Large-cap Stocks and Small-cap Stocks



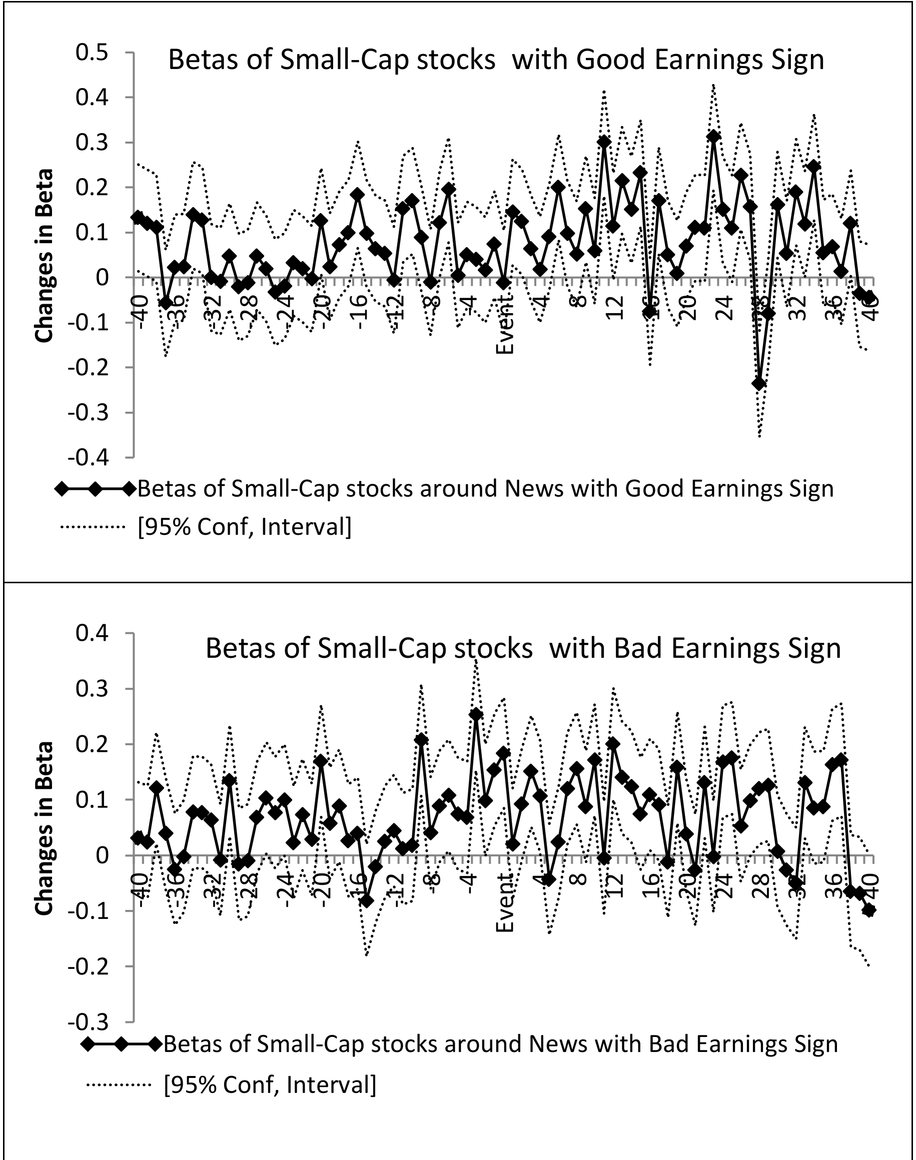
The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement (where event day 0 is the announcement day) for large-cap stocks and small-cap stocks.

Figure 4a. Changes in Betas for Good News in respective of Large-cap Stocks



The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement with Good and Bad earnings sign (where event day 0 is the announcement day) for large-cap stocks around news.

Figure 4b. Changes in Betas for Bad News in respective of Small-cap Stocks



The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement with Good and Bad earnings sign. (where event day 0 is the announcement day) for small-cap stocks around news.

3.3 Dividend Payment Strategy: Dividend Stocks vs. Non-Dividend Stocks

The payment of dividends has a significant effect on the value of firms. Therefore, we further investigate whether the behaviour of betas varies between dividend and non-dividend stocks around earnings announcements. To define dividend and non-dividend stocks, we consider each constituent of the BIST Dividend Stock index. For example, if any of the individual stocks is included in the BIST Dividend Stock index, then the stock is defined as a dividend stock and otherwise is defined as non-dividend stock.

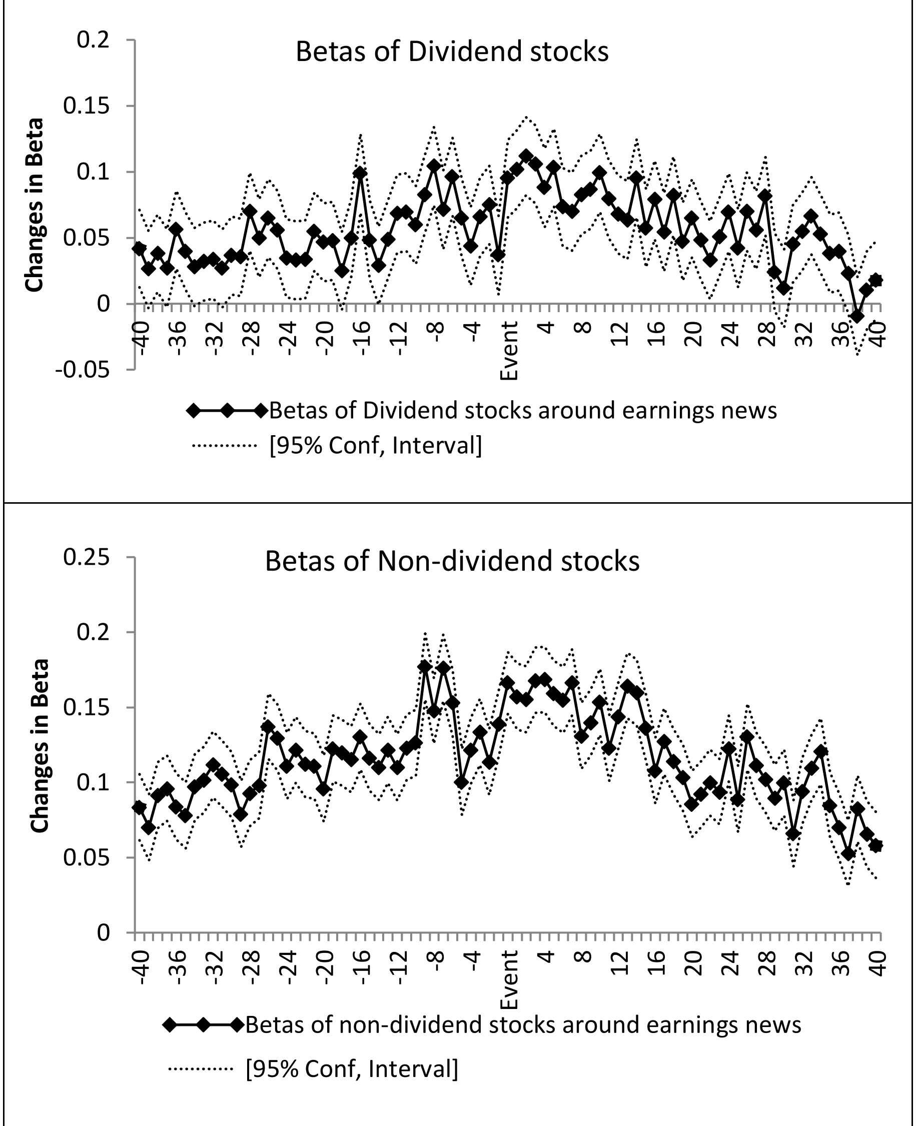
Figure 5 reports estimate of changes in betas for dividend and non-dividend stocks. Our findings show that the spike in the beta of dividend and non-dividend stocks are 0.10 (t = 6.35) and 0.17 (t = 15.96), respectively. Betas revert to their average level about ten days after the announcement for dividend and fifteen day after the announcement for non-dividend stocks.

It is clear that the betas of both types of stocks increase on earnings announcements days but the spike in the beta of non-dividend stocks is greater than that for the dividend stocks. Moreover, when we take in to account a different information contents as good news and bad news, the results dramatically chance. Figure 6 reports estimates of changes in betas for good news and bad news in respective of dividend and non-dividend stocks.

Our findings now show that the spike in the beta of dividend and non-dividend stocks are 10.51 (t = 6.76) and 14.74 (t = 11.58) for good earning news respectively and the betas reverting to their average, about 5 days later for dividend stocks and, 15 days later for the non-dividend stocks.

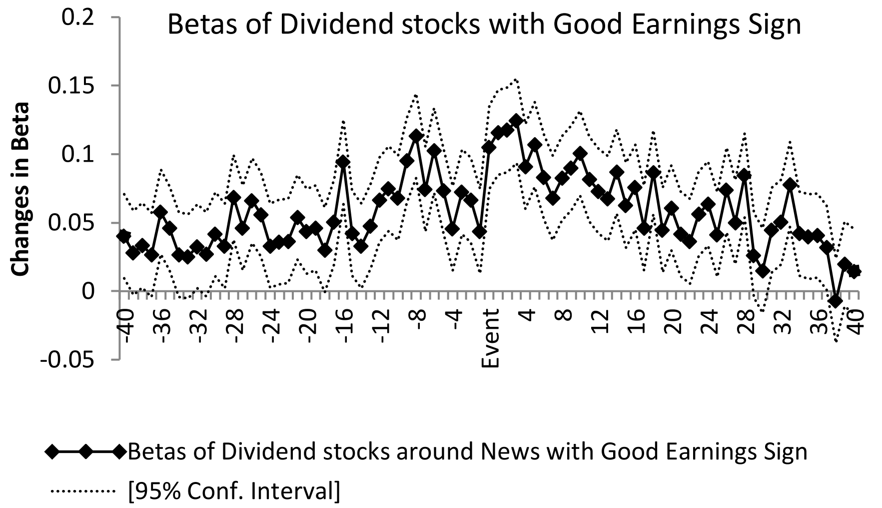
The spike in the beta of dividend stocks and non-dividend stocks are -0.07 (t = -0.66) and 0.10 (t = 6.33) for bad earning news respectively and the betas reverting to their average, about 5 days later for non-dividend stocks. Interesting the reaction of beta around the news with bad earning sign for dividend stocks are not significant.

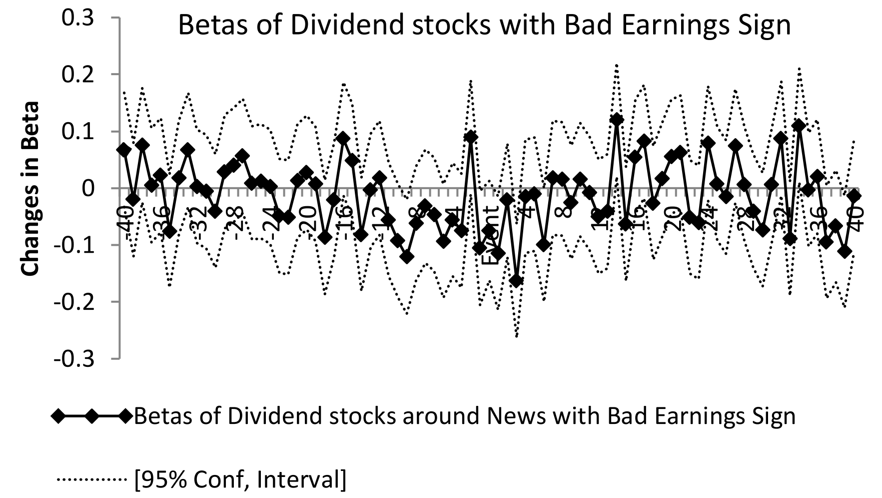
Figure 5. Changes in Betas for Dividend and Non Dividend Stocks



The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement (where event day 0 is the announcement day) for Dividend stocks and Non-dividend stocks.

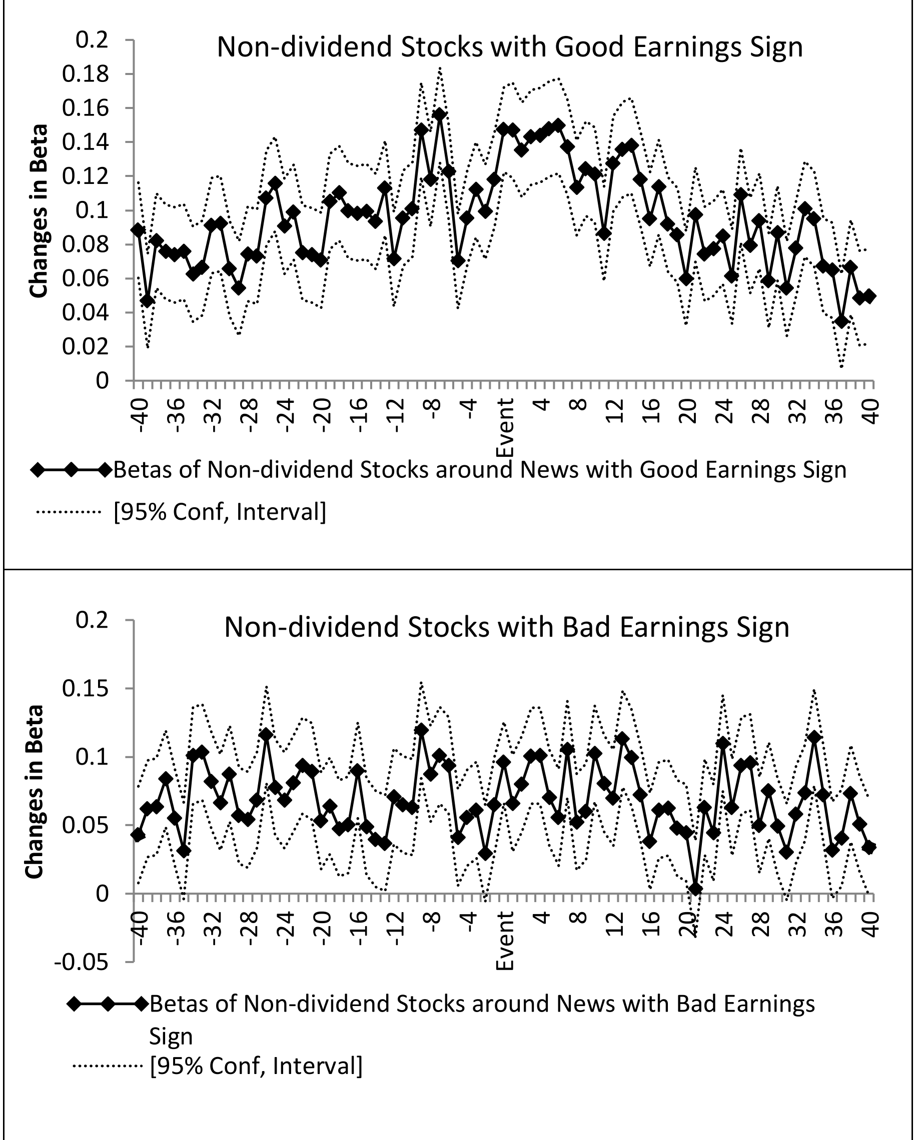
Figure 6a. Changes in Betas for Good News in Respect of Dividend and Non Dividend Stocks





The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement with Good and Bad earnings sign (where event day 0 is the announcement day) for Non-Dividend stocks.

Figure 6b. Changes in Betas for Bad News in Respect of Dividend and Non Dividend Stocks



The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement with Good/Bad earnings sign (where event day 0 is the announcement day) for Non-dividend stocks.

3.4 The behaviour of beta around the financial crisis

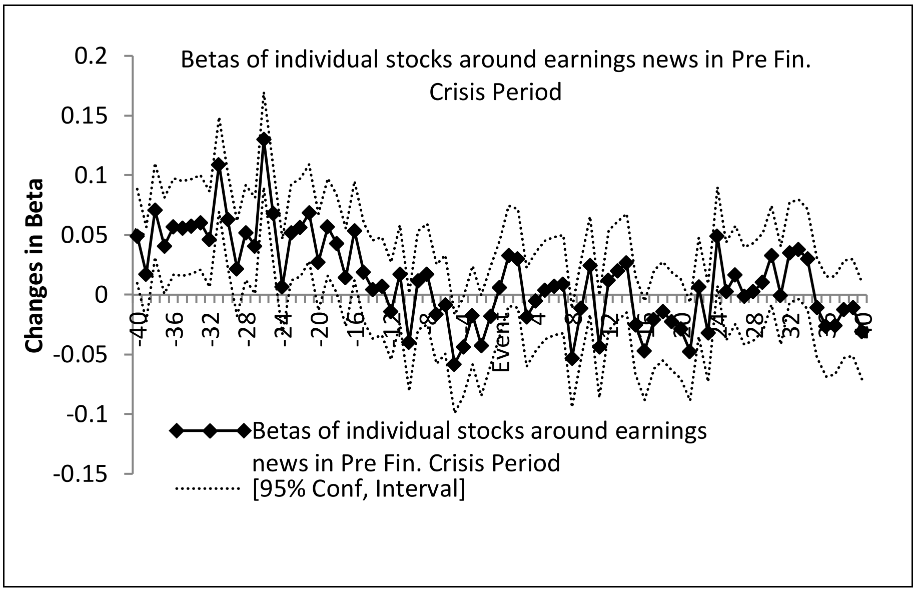
We also examine the behaviour of individual stocks' betas around earnings announcement during the financial crisis period. We divide our sample period into three pre-crisis, crisis and post crisis period.

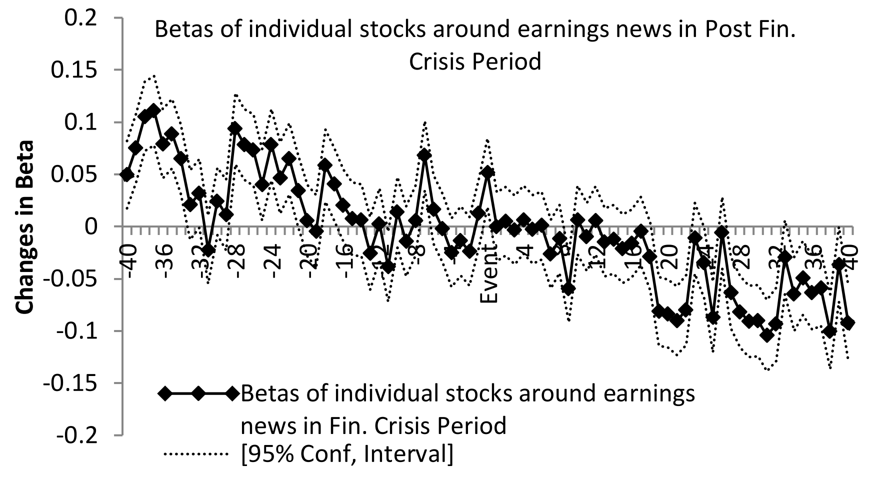
Figure 7 reports estimate of changes in betas during the crisis and non-crisis period. Our findings show that the spike in the beta for pre-crisis, crisis and post crisis period are 0.006 (t = 0.47), 0.051 (t = 3.06) and 0.153 (t = 12.75), respectively.

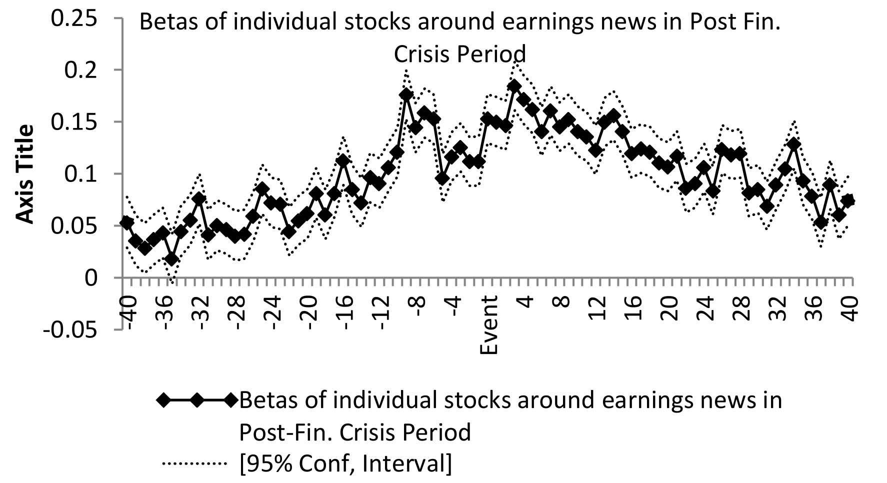
But interesting the reaction of beta around the announcement days are not significant for pre-crisis period. Interestingly it is significant for crisis and post crisis period. This indicates that the betas of individual stocks do not experience any spike prior to financial crisis around earnings announcements.

It is clear that the betas of stocks for the crisis and post crisis are significantly increase on earnings announcements days.

Figure 7. Changes in Betas for pre-crisis, crisis and post crisis period





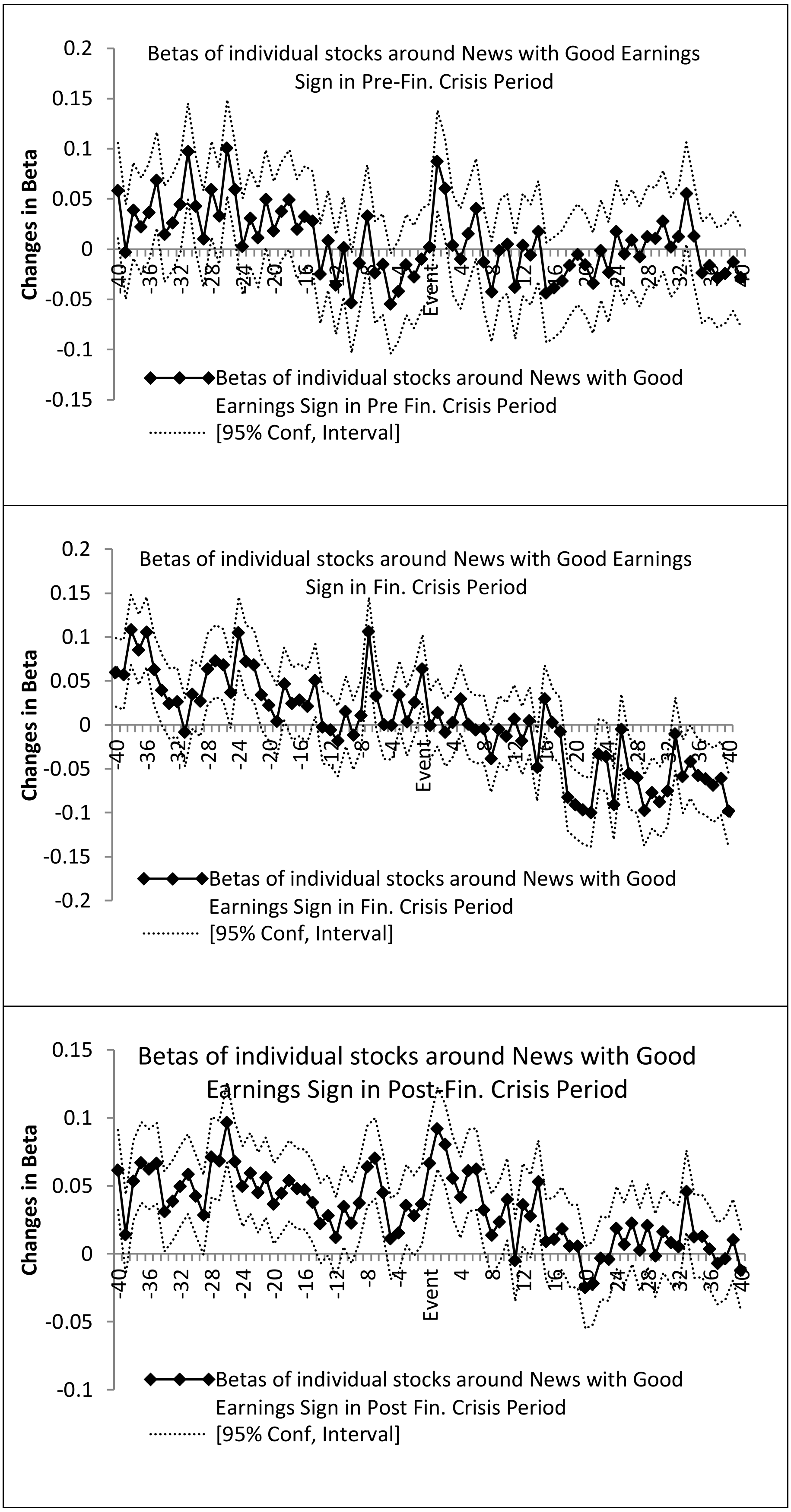


The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement (where event day 0 is the announcement day) for 513 individual stock traded on Borsa Istanbul in the periods of pre-financial crisis, financial crisis, and post-financial crisis.

Moreover, when we take in to account a different information contents as good news and bad news, the results dramatically chance.

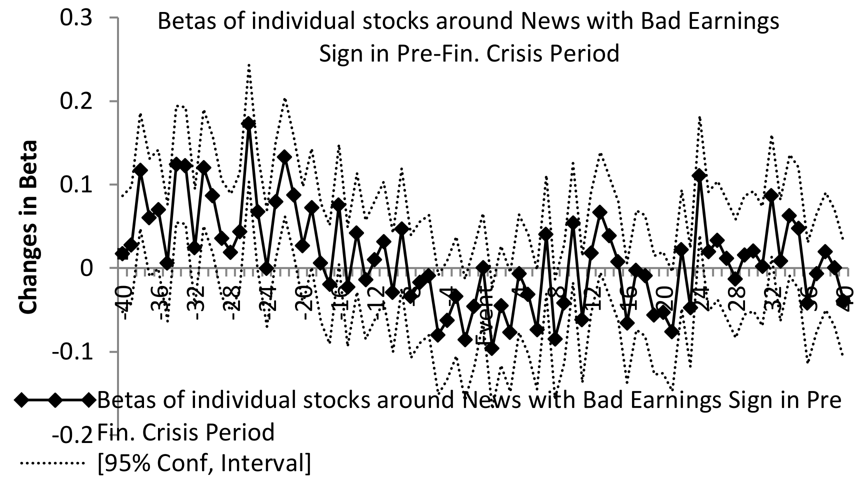
Figure 8 shows estimates of changes in betas for good news and bad news in respect of crisis and non-crisis period.

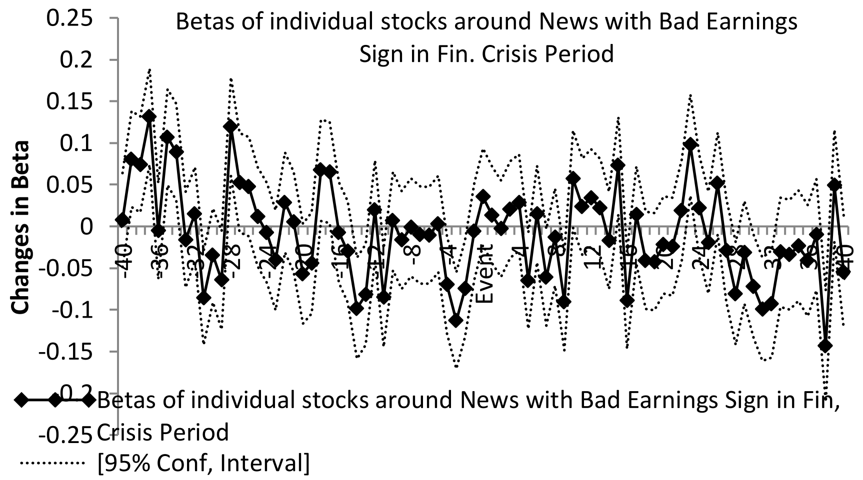
Figure 8a. Changes in Betas for pre-crisis, crisis and post crisis period in respect of Good News

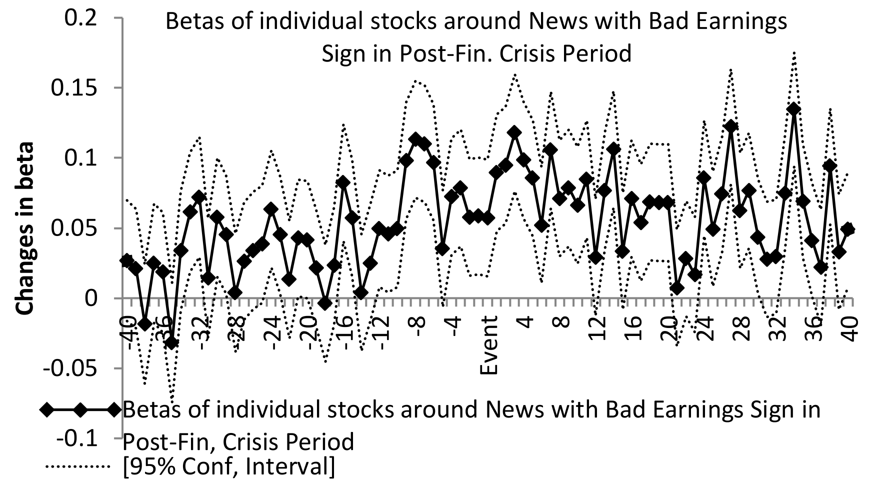


The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement with Good earning sign (where event day 0 is the announcement day) for 513 individual stock traded on Borsa Istanbul in the periods of pre-financial crisis, financial crisis, and post-financial crisis.

Figure 8b. Changes in Betas for pre-crisis, crisis and post crisis period in respect of Bad news







The figure represents the estimate changes in beta for 81 days around quarterly earnings announcement with Bad earning sign (where event day 0 is the announcement day) for 513 individual stock traded on Borsa Istanbul in the periods of pre-financial crisis, financial crisis, and post-financial crisis.

For good news, our findings show that the spike in the beta for pre-crisis, crisis and post crisis period are 0.003 (t = -0.11), 0.064 (t = 3.22) and 0.067 (t = 4.36), respectively. For bad news, our findings show that the spike in the beta for pre-crisis, crisis and post crisis period are 0.0008 (t = 0.02), 0.0353 (t = 1.20) and 0.057 (t = 2.69), respectively.

It is clear that the betas of stocks for the post crisis are significantly increase on earnings announcements days wheather the news is positive or negative. This behavior of beta may indicate that individual stocks betas react stronger to good earnings news in any economic conditions.

4. Robustness Tests

In this section we perform a number of robustness tests of the changes in beta that we report in Section 3. Past research shows that non-synchronous trading leads to a downward bias in realized covariances (Epps, 1979, Scholes and Williams, 1977, Dimson, 1979, Hayashi and Yoshida 2005 and BNHLS 2008). Thus, we may observe an increase in realized beta at the time of announcements due to the reduced non-synchronous trading associated with increased volume of trading at that time.

Moreover, some studies report that the variation in realized betas maybe driven by jumps in stock returns (Patton and Verardo, 2012). Therefore, we need to check for these biases in our panel regression model by performing robustness checks. Robustness checks are used to test how certain "core" regression coefficient estimates behave when the regression specification is modified by adding or removing regressors. We modify our regression specification to include controls for trading volume and realized variation. Furthermore, we consider the impact of potential jumps in prices on our estimates of realized betas. We verify that our results are robust to the clustering of earnings announcements on event days.

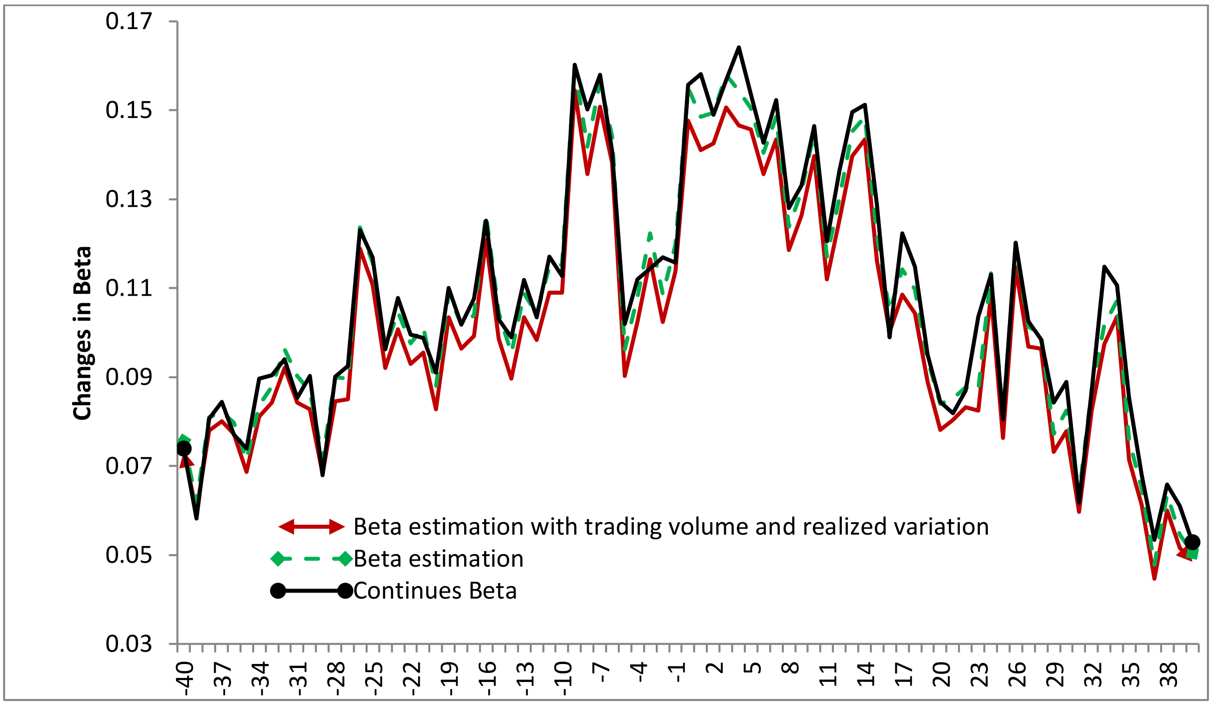
4.1 Adding control variables

We control for firm variation given the existing empirical evidence that variation can affect covariance estimates (Forbes and Rigobon, 2002). We also control for volume. Since non-synchronous trading is less important on days with high trading intensity, and given that earnings announcement dates are generally characterized by greater than average trading volume, it may be important to account for the possibility that an observed increase in realized beta on announcement dates is due to a decrease in the bias related to non-synchronous trading (see also Denis and Kale, 1994). We control for this effect by including stock's trading volume in our regression specification. Figure 9 presents robustness results for the estimated beta around quarterly earnings announcements. In the first regression (15-min Beta) the dependent variable is the realized daily beta computed from 15-minute returns as in Figure 2. In the second regression (2 Controls) the dependent variable is the 15-minute realized beta; the specification adds controls variables which include realized firm variation and trading volume. The regressions account for firm and year fixed effects, t - statistics are computed from standard errors that are robust to heteroscedasticity and to arbitrary intra-day correlation. Figure 9 (2 Controls) shows estimates of the betas which are slightly smaller than in the base results. These confirm that non-synchronous trading biases beta estimates down a little. However, the estimates of beta are very similar to our base specification (with a day 0 change of 0.14), providing further confidence in our empirical results.

4.2 Possible jumps in prices

According to Saleem and Yalaman (2017), earnings announcements cause jumps in stock prices. The variation in realized betas could be driven by jumps in stock prices (Patton and Verrardo, 2012). We use the recent work of Todorov and Bollerslev (2010) to test the impact of potential jumps in stocks prices on our main findings. Like us, Todorov and Bollerslev (2010) consider a one-factor model, and they decompose the factor return into a part attributable to a continuous component and a part attributable to jumps. In the most general case, each of the factor components has a separate loading, β^c and β^d, and when these two loadings are equal, the model simplifies back to a standard one-factor model. Todorov and Bollerslev (2010) provide a method for estimating the continuous and jump betas, which we implement here. The first step in their analysis is to test for the presence of a jump in the market price on each day, and we do so using the same test (the "ratio" jump test of Barndorff-Nielsen and Shephard (2006)), sampling frequency (15 minutes), and critical value (3.09) as Todorov and Bollerslev (2010). On days with no jumps in the market, the usual realized beta is an estimate of the continuous beta. On days with jumps in the market, one can use the estimator in Todorov and Bollerslev (2010) to estimate the jump and continuous betas separately, and then look at the reaction in each of these around earnings announcements. In our sample, however, we have too few jump days that intersect with earnings announcement days (less than one per firm on average) and so we do not attempt to estimate reactions in "jump betas". In contrast, we have sufficient observations to study the reactions in "continuous betas". The test for jumps in the market factor reveals that on 5.06% (58,953 jumps / 1,163,484 days) of days we find a significant jump. Excluding these days from our analysis, and estimating the reaction of "continuous betas" around announcements yields results where we see that the estimates excluding jump days are very similar to our baseline results, with the spike in beta on announcement days estimated at 0.155 t= 16.36. Thus we conclude that our findings are not driven by the presence of jumps.

Figure 9. Beta estimation with/without trading volume and realized variation and jumps



5. Conclusions

In this paper, we investigate the variations in daily individual stocks' betas around the release of firm-specific news in Turkey. In other words, we test whether the daily systematic risk of individual stocks varies around firm-specific news announcement through understanding if investors use information from announcing firms to extract information on the aggregate economy. If so, it means that the covariance of the returns of the announcing stock with other stocks rises and thus leads to an increase in the market beta of the announcing stocks.

We use intraday prices data of all firms traded on Borsa Istanbul and their quarterly earnings announcements over the period 2005-2013. We have a total number of 33,741,036 15-minute interval prices and a total of 9,273,036 announcements. Our findings show that individual stocks betas increase statistically significant amount on earnings announcement day. On average, beta increase by 0.155 (t = -17.26) on event days, but the betas drop by 0.11 on the 11 days after the earnings announcements (t = -12.31) before reverting to their average level about 16 days after the announcement. Some parts of our findings are consistent with studies from the US where individual stock betas also increase on earnings announcement day. But in the

US, individual stocks betas drop immediately after the earnings announcements while in Turkey, it takes betas 2-11 days for betas to drop to their normal level.

The variations that we document are short-lived and thus difficult to be detected using the lower frequency methods employed in most previous studies. Therefore, we use high-frequency econometric theory of Andersen et al., (2003), which enables us to uncover a large degree of cross-sectional heterogeneity in the behavior of betas.

To understand the channels that link firm-specific information flows to market-wide comovement in stock returns, further test are carried out. We show that, in the presence of intermittent earnings announcements and cross-sectional correlation in earnings innovations, good (bad) news for an announcing firm is interpreted as partial good (bad) news for non-announcing firms and, in general, for the entire economy. This signal extraction process by investors raises the average covariance of the returns of the announcing firm with the returns on the other firms in the market, leading to an increase in its beta. Our model can match the aggregate result and generates several cross-sectional predictions. The increase in beta is strongest for good earnings news (0.14 vs 0.08) indicating that investors are learning from the newly released information and revising their expectations about non-announcing stocks and the rest of the economy. In contrast, earnings announcements with bad news cause a smaller change in the degree of covariation of returns across stocks in the market index.

If investors indeed use a firm's earnings announcement to revise their expectations about the prospects of the other non-announcing firms in the market, and thus about the entire economy, then firms with stronger links to market-wide fundamentals provide investors with a greater opportunity to learn. We analyze the behavior of betas of stocks whose fundamentals have different degrees of connectedness with market-wide fundamentals. We find that the spikes in realized betas on earnings announcements days are greater for small-cap firms whose fundamentals are less correlated with aggregate fundamentals (0.16 vs 0.21). This indicates that in contrast to the US, the connectedness of stocks to market-wide fundamentals has no impact on the behavior of betas around earnings announcements.

We also examine the behaviour of individual stocks' betas around earnings announcement in financial crisis periods. We divide our sample period into two pre- and post-global financial crisis periods. Interestingly, we find that the spikes in realized betas on earnings announcements days in the period of post global financial crisis are greater than the spikes in realized beta in the pre global financial crisis (0.159 vs 0.0526).

With dividend stocks, the value of stocks of those firms that don't pay their retained earnings as dividend to their stockholders appreciates while the value of stocks that distribute their retained earnings as dividends to their stockholders may not change so much. As a result, we might suspect that the behavior of beta dividend stocks and non-dividend stocks could be the same around earnings announcement. We further examine if the behavior of betas with respect to dividend payment and no dividend payment. Interestingly, we find that the spikes in realized beta of non-dividends stocks on earnings announcements days are greater than the spikes in realized beta of dividend stocks (0.162 vs 0.0963).

Our findings are robust to using alternative measures of beta that address potential market microstructure biases, and are also robust to controlling for changes in firm variation, trading volume and for jumps in prices around announcements. Our robustness tests conform that the results in this research are free of non-synchronous trading effect and they are neither driven by the firm variation nor by the presence of jumps in stock prices.

The patterns of time-variation in betas that we uncover in this study are relevant for portfolio management applications that involve hedging risks at daily frequencies. The analysis in this research establishes that firm-specific information flows have a significant impact on the covariance structure of stock returns, thus contributing to our understanding of learning by investors, return movement, and time-varying systematic risk.

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Appendices

Table 1. Robustness Tests Results

Event day	Beta estimation	t-value	Continuous Beta	t-value	Beta estimation with trading volume and realized variation	t-value	Event day	Beta estimation	t-value	Continues Beta	t-value	Beta estimation with trading volume and realized variation	t-value
-40	0.075635	7.97	0.07387	7.79	0.073295	7.74	**0**	0.1549255	17.26	0.15581	16.36	0.14769	16.5
-39	0.0619358	6.52	0.058135	6.1	0.059888	6.33	**+1**	0.1485561	15.63	0.158201	16.58	0.141002	14.87
-38	0.0810404	8.53	0.080673	8.48	0.077905	8.23	**+2**	0.1494907	15.72	0.148931	15.64	0.142477	15.03
-37	0.0821811	8.65	0.084388	8.86	0.080097	8.46	**+3**	0.1579421	16.61	0.156796	16.53	0.150638	15.89
-36	0.0798207	8.4	0.077061	8.1	0.077225	8.15	**+4**	0.1544184	16.24	0.164154	17.17	0.146612	15.46
-35	0.0713235	7.51	0.073933	7.78	0.068729	7.25	**+5**	0.1504803	15.83	0.153599	16.15	0.145624	15.36
-34	0.0836942	8.81	0.089627	9.39	0.08119	8.57	**+6**	0.1404739	14.78	0.142645	14.98	0.135714	14.31
-33	0.0879213	9.26	0.090433	9.48	0.084318	8.9	**+7**	0.1485641	15.63	0.152219	15.98	0.1435	15.14
-32	0.0962254	10.13	0.094003	9.87	0.092076	9.72	**+8**	0.1238856	13.03	0.12806	13.46	0.118566	12.51
-31	0.0903028	9.51	0.085261	8.99	0.084249	8.9	**+9**	0.1317361	13.86	0.133138	13.99	0.12635	13.33
-30	0.086848	9.14	0.090324	9.5	0.082763	8.74	**+10**	0.1452493	15.28	0.146456	15.4	0.139704	14.74
-29	0.071474	7.52	0.067977	7.13	0.068211	7.2	**+11**	0.1170226	12.31	0.120471	12.66	0.111958	11.81
-28	0.089964	9.47	0.090102	9.49	0.084582	8.93	**+12**	0.1304813	13.72	0.136527	14.34	0.125402	13.22
-27	0.0897196	9.44	0.092567	9.75	0.084945	8.97	**+13**	0.1452639	15.27	0.149535	15.68	0.139705	14.73
-26	0.1236781	13.02	0.123088	12.94	0.118807	12.54	**+14**	0.1485888	15.62	0.151309	15.88	0.143462	15.12
-25	0.115728	12.18	0.116861	12.26	0.110859	11.7	**+15**	0.1218792	12.81	0.128773	13.5	0.116162	12.25
-24	0.0964439	10.15	0.096262	10.09	0.092015	9.71	**+16**	0.1047644	11.01	0.098925	10.38	0.100173	10.56
-23	0.1046617	11.01	0.107841	11.33	0.100743	10.63	**+17**	0.1142498	12.01	0.122389	12.81	0.108561	11.45
-22	0.09758	10.26	0.099552	10.46	0.092998	9.81	**+18**	0.1098049	11.55	0.114788	12.01	0.104415	11.01
-21	0.101272	10.65	0.098795	10.37	0.095552	10.08	**+19**	0.0938965	9.87	0.095095	9.96	0.088842	9.37
-20	0.087809	9.24	0.090972	9.54	0.082844	8.74	**+20**	0.0838973	8.82	0.084476	8.87	0.0781	8.24
-19	0.1087378	11.44	0.109988	11.56	0.103457	10.91	**+21**	0.0852125	8.96	0.081881	8.6	0.080407	8.48
-18	0.1018032	10.7	0.101775	10.67	0.096383	10.16	**+22**	0.087772	9.23	0.086911	9.14	0.083261	8.78
-17	0.1038863	10.92	0.10762	11.29	0.099266	10.47	**+23**	0.087132	9.17	0.103614	10.85	0.082416	8.69
-16	0.1267155	13.32	0.125102	13.13	0.120861	12.74	**+24**	0.1133132	11.92	0.113005	11.86	0.108555	11.45
-15	0.1045369	10.99	0.102922	10.79	0.098582	10.39	**+25**	0.0809466	8.52	0.080558	8.47	0.076291	8.05
-14	0.0953497	10.02	0.098943	10.37	0.089643	9.45	**+26**	0.1195232	12.58	0.12022	12.61	0.114705	12.11

-13	0.1087785	11.44	0.111834	11.74	0.103468	10.91	**+27**	0.1014152	10.67	0.102521	10.76	0.096897	10.23
-12	0.1042548	10.96	0.103377	10.87	0.098419	10.38	**+28**	0.0997476	10.5	0.098454	10.35	0.096331	10.17
-11	0.1148588	12.08	0.117151	12.29	0.109039	11.5	**+29**	0.0772955	8.14	0.08428	8.85	0.0732	7.73
-10	0.1152173	12.12	0.112737	11.83	0.108979	11.5	**+30**	0.082427	8.68	0.088953	9.36	0.077894	8.22
-9	0.1597171	16.8	0.160246	16.8	0.154492	16.3	**+31**	0.0636338	6.7	0.061827	6.49	0.059683	6.3
-8	0.1417592	14.91	0.150248	15.76	0.135729	14.32	**+32**	0.0871145	9.17	0.086968	9.16	0.08253	8.72
-7	0.1565194	16.46	0.157951	16.53	0.150785	15.9	**+33**	0.1017864	10.72	0.114889	12.03	0.097487	10.3
-6	0.1441768	15.17	0.140932	14.81	0.138223	14.58	**+34**	0.1071926	11.28	0.11057	11.63	0.103658	10.94
-5	0.0962906	10.13	0.101964	10.71	0.090206	9.51	**+35**	0.0758386	7.98	0.085299	8.94	0.071354	7.53
-4	0.1079522	11.36	0.111922	11.75	0.102373	10.8	**+36**	0.0649552	6.84	0.067937	7.11	0.061228	6.46
-3	0.122298	12.86	0.114344	12.04	0.116526	12.29	**+37**	0.0478358	5.04	0.053374	5.6	0.044659	4.71
-2	0.1087119	11.43	0.11687	12.26	0.102459	10.81	**+38**	0.0635682	6.69	0.065854	6.92	0.060063	6.34
-1	0.1197163	12.59	0.115784	12.11	0.113782	12	**+39**	0.0546764	5.76	0.061043	6.41	0.051577	5.45
							+40	0.0504367	5.31	0.052872	5.55	0.048388	5.11