What determines return risks for bank equities in Turkey?

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Abstract

By using data from thirteen publicly traded commercial and deposit banks this paper estimates the determinants of market risk for banks' equities in the case of an emerging market economy, Turkey. The analysis reveals that maturity composition of banks' loans, share of trading income in banks' overall revenue stream and its foreign-ownership structure are important indicators of the volatility of its equity returns. Banks with shorter loan maturity positions are regarded by investors as safer companies to invest in while increases in trading income as a source of banks' overall revenue increases the volatility of its equity returns. Foreign ownership of a bank also lowers its equity return risk.
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1. Introduction

Banking and financial sector performance is crucial to economic growth as evidenced by literature (Levine, 1997 among others). Studies have shown that this causality usually runs from the financial sector to growth (Rousseau & Wachtel, 1998). In that regard performance of the financial intermediaries is also important for economic growth. As the 2008 Global Financial Crisis has shown, banks' balance sheet problems may lead to a contraction of credit to the real sector eventually triggering a recession with serious consequences. Moving from this premise, in this paper we evaluate the drivers of equity returns for financial intermediaries in an emerging market setting such as Turkey. In doing so we are the first in literature to use equity returns as a risk factor for

evaluating bank activities in Turkey. We are also among the first in literature to study the impact of maturity composition as well as diversification of income sources for banks in Turkey on their overall equity risk. We believe our results are important in understanding the *Turkish economic miracle* (Turkey has demonstrated a phenomenal average growth rate of 5.72% between 2002 and 2009 mostly fueled by extension of credit by the banking system.) of the last decade and can be used by other researchers who study banking and equity market in general in Turkey for the same period.

Another aim of this paper is to check whether in Turkey foreign ownership leads to lower risk for the banking system. There are conflicting views on this issue and the verdict is not yet out. While there is research by economists such as Micco, Panizza, and Yanez (2004) that has shown that in developing countries in general foreign banks usually have higher profitability and lower overhead costs compared to local ones, there are also recent studies that argue this relationship may not hold. For instance, by using stochastic frontier analysis for a sample of 2095 commercial banks in 105 countries Lensink, Meesters, and Naaborg (2008) showed that foreign ownership negatively affects bank efficiency.

In the case of Turkey, most studies suggest foreign banks are usually more efficient and less risky. Among these Akin,

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Bayyurt, and Zaim (2013) recently showed that foreign banks are more efficient than domestic ones and even were so during the Global Financial Crisis.[1] Based on their results, we can also expect to see lower equity volatility for banks held in foreign ownership compared to domestic ones. In that regard, we believe our study brings an important contribution to this debate both in Turkey and in emerging markets in general.

The paper is organized in the following fashion: in the next section we highlight some of the changes in the Turkish economy during the study period; Section 3 reviews previous research on this issue; in Section 4 the dataset is presented; Section 5 provides the empirical estimation; Section 6 provides our main findings and Section 7 concludes.

2. Developments in the Turkish economy and on the stock exchange during the study period

As mentioned earlier Turkey has achieved an average growth rate of 5.72% between 2002 and 2009 which corresponds to our study period of Turkish banking stocks. During the same period Turkish export volume increased 60%[2] and the foreign direct investment (FDI) flows into the country increased from less than 1 billion US Dollars (2002) to over 6.8 billion US dollars (2009). In terms of relative size to GDP this corresponds to an increase from 0.46% of GDP to 1.2%. Turkish stock market performance is also noteworthy during this period. As shown in Fig. 1 the ISE 100 returns have increased more than six-fold between 2002 and 2008 (from a reading of $318.47 on October 1, 2002 to over $2600 on Jan 8, 2008) before falling in 2008 as the Global Financial Crisis spread to Emerging Markets. The subsequent rise in the US Dollar to Turkish Lira (TL) exchange rate can be seen in the same figure. The Global Financial Crisis brought with it sudden portfolio reversals from all emerging markets, causing depreciation of the local currencies. The exchange rate went up from 1.15 TL per USD in the first week of August 2008 to over 1.69 TL per USD in the last week of October 2008 as shown in the Figure. This sharp increase in such a short period is directly the outcome of crisis. The exchange rate stabilized as the effects of the crisis faded over time, and by the end of our study period (June 2009) the TL/USD had stabilized in the 1.5—1.6 TL/USD range. Economic management by the Turkish Central Bank was instrumental in this stabilization.

3. Literature review

One of the earliest papers in literature that examines the relationship between volatility of equity returns and diversification of market value was written by Templeton and Severiens (1992) who find that increases in diversification of bank activities result in diminishing marginal decreases in risk and that diversification of bank activities does not appear to
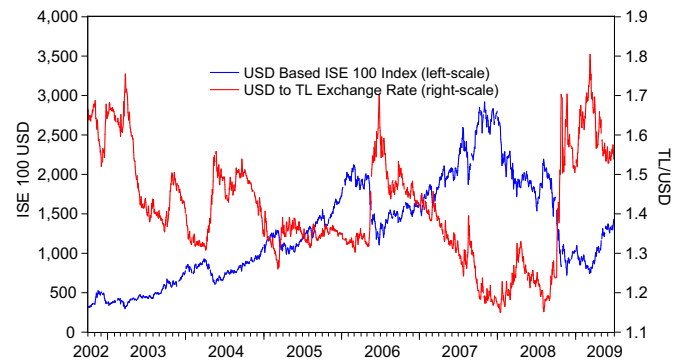

Fig. 1. ISE 100 USD-based index. The figure shows the daily closing values of the USD-based ISE 100 Index for the study period and the Central Bank of the Republic of Turkey's (CBRT) daily USD buying rates. Exchange rates prior to January 1, 2005, have been reduced by one million to reflect the elimination of the six zeros at the end of the currency. Source: Istanbul Stock Exchange and the Central Bank of the Republic of Turkey.

have an important effect on measures of systematic risk. Saunders and Walter (1994) simulate mergers between bank holding companies and non-bank firms and show that there are risk-reduction benefits of diversification. In more recent papers, Reichert and Wall (2000) examine return on equity for US banks from 1991 to 1997 and find substantial potential gains for from diversification in support of the 1999 Gramm—Leach—Bliley legislation in the US.

However, there also studies that fail to support these findings. For instance; Demsetz and Strahan (1997) follow the work of Templeton and Severiens (1992) and show that although large bank holding companies (BHCs) are better diversified than small BHCs, there is not necessarily any significant difference in terms of their risk reduction. They attribute the higher risk potential of larger BHCs to their lower capital ratios and larger commercial and industrial loan portfolios.

DeYoung and Roland (2001) examine the impact of deregulation in the US in the 90s and the subsequent shift in banks' sales mix toward non-interest income such as fee-based financial services and securitization on their equity risk and income. They find that as the average bank tilts "its product mix toward fee-based activities and away from traditional lending activities … the bank's revenue volatility; its degree of total leverage, and the level of its earnings all increase [which implies]… increased earnings volatility (because earnings volatility is the product of revenue volatility and the degree of total leverage) and … a possible risk premium." In another related study, Stiroh (2006) uses equity data on BHCs to evaluate the effects of BHCs' loan and revenue composition on their risk. His contribution to the literature is unique in the sense that it emphasizes market-based assessment of risk and return rather than accounting data assessment as most of previous literature has done. As argued by Stiroh (2006) market-based assessment provides forward looking perspective in terms of expected returns while accounting data is backward-looking. His results reaffirm those of DeYoung and Roland (2001) in the sense that "investment banking, servicing, securitization income, gains from loan sales … are

particularly volatile activities" for banks and increase risk for their equities. In a more recent paper Hirtle and Stiroh (2007) examine the impact of banks' retail intensity on performance from 1997 to 2004 and find that "an increased focus on retail banking across U.S. banks is linked to significantly lower equity market and accounting returns for all banks but lower volatility for only the largest banking companies". Baele, De Jonghe, and Vander Vennet (2007) analyze whether or not "functionally diversified banks have a comparative advantage in terms of long-term performance/risk profile compared to their specialized competitors." Their study uses a dataset of European banks and analyzes the return/risk trade-off as a result of diversification. They find that "diversification of revenue streams from distinct financial activities increases the systematic risk of banks while the effect on the idiosyncratic risk component is non-linear and predominantly downward-sloping."

All of the studies mentioned above focus on the case of developed banking systems (the US and Europe.) Literature that studies the relationship between risk in equity returns and diversification of bank activities is limited in an emerging market setting and especially from a Turkish perspective. Among papers that evaluate banking systems outside the US we can mention Landskroner, Ruthenberg, and Zaken (2005) who study the Israeli banks' investments across business units to evaluate whether consolidation in the Israeli banking industry led to efficiency gains due to diversification. Their results suggest that there are gains to diversification and that risk adjusted performance is mostly consistent with optimal portfolio choice. Sanya and Wolfe (2010) uses a panel dataset of 226 listed banks across 11 emerging economies to show the effect of revenue diversification on bank performance and risk. Their findings highlight the positive impact of diversification in banks' activities on the insolvency risk and profitability. As the measure of risk in their research they use bank performance measures such as return on assets (ROA) and return on equity (ROE) adjusted for risk as opposed to a stock price measure.

With regards to Turkish banks' diversification and risk, literature is even more limited. Among the few studies that we found that focus on banks' activities we can mention Ozyildirim and Ozdincer (2011) who analyze whether banks' deviation from the mainstream in terms of asset and liability allocation increases their performance. In a study released in 2013, Gurbuz, Yanik, and Ayturk (2013) analyze the performance of Turkish deposit banks (measured by ROA and ROE) as a result of non-interest income generating activities (income diversification) for the period of 2005–2011. Their results show that income diversification increases risk-adjusted financial performance of Turkish deposit banks. The authors of this study also point out to the lack of literature that focuses on the relationship between income diversification and financial performance of Turkish banks.

We can find more studies that focus on emerging market equity returns in general. Among those Chen and Lee (2013) showed that equity returns on the Taiwanese stock market can be explained to a certain degree by the companies' default risk.

Table 1
Return summary statistics.

Quarter	No of banks	Std of monthly returns	Average monthly returns
2002q4	10	32.58	8.72
2003q1	10	18.72	−0.26
2003q2	10	15.02	5.31
2003q3	10	11.42	2.59
2003q4	10	17.88	18.47
2004q1	10	14.60	4.68
2004q2	10	10.36	−2.14
2004q3	10	9.83	8.63
2004q4	11	17.18	10.65
2005q1	11	19.02	11.17
2005q2	11	10.77	5.57
2005q3	11	12.47	9.54
2005q4	11	18.38	7.23
2006q1	12	17.76	2.50
2006q2	12	13.87	−4.95
2006q3	12	6.89	2.75
2006q4	12	13.46	1.37
2007q1	12	9.70	2.30
2007q2	12	8.36	1.64
2007q3	13	10.94	5.24
2007q4	13	7.36	0.40
2008q1	13	14.15	−14.60
2008q2	13	22.59	−6.36
2008q3	13	29.33	8.74
2008q4	13	16.46	−8.92
2009q1	13	14.54	−2.36
2009q2	13	19.36	21.84
2009q3	13	11.84	11.01
2009q4	13	15.83	4.96
2010q1	13	11.49	1.92

This table shows the median standard deviation of monthly returns and the median of the monthly returns per quarter. Monthly return data is obtained from Istanbul Stock Exchange (ISE). The data spans from the fourth quarter of 2002 to the first quarter of 2010.

4. Data

We use data on the average monthly returns of thirteen publicly traded commercial and investment banks in Turkey.[3] This data comes from the Istanbul Stock Exchange (ISE) and is only available on a monthly basis. Our analysis excludes the Turkish Banking Crisis (2001–2002) mainly because previous research has shown that bank stock returns are not proportional to their loan exposure and are not based on their fundamentals during crisis periods (Lau & McInish, 2003). For this reason, we start our analysis in the first quarter of 2003 following the restructuring and consolidation of the banking system in Turkey. Some of the variables in our estimations (i.e. breakdown of loans in terms of maturity) are only available for the 2003–2006 period.

Table 1 provides the summary statistics of equity returns for the banks in the sample. Fig. 2 shows the median value of the monthly returns and of the standard deviation of these returns for the bank stocks under study. The figure and the data reported in the table suggest a relatively non-volatile risk for

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[3] From now on we refer about the average monthly returns simply as monthly returns.
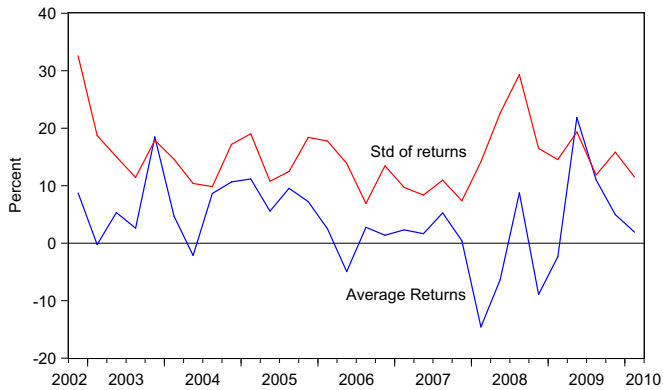
Fig. 2. Bank risk and returns. This figure shows the median of the average monthly returns (return variable) in a quarter as well as the standard deviation of the average monthly returns in the same quarter (risk variable). Data was obtained from Istanbul Stock Exchange (ISE) and the Turkish Banks Association (TBB).

the banking industry except for the 2008−2009 period which corresponds to the Global Financial Crisis. We also see that the monthly returns fell continuously between the first quarter of 2008 until the second quarter of 2009 at a rate of over 14%, 6% and around 9% in the first, second and fourth quarter of this year respectively. The standard deviation of the average monthly returns during this period jumps to a high of 29.33% during the third quarter of 2008. Although this is not an all time high in the sample, the duration of the high volatility is a record for our sample period.[4]

Balance Sheet and Income Statement data are obtained from the Banks Association of Turkey (TBB). This dataset covers a period of 30 quarters (2002q4−2010q1) and is unbalanced due to the unavailability of full data for some of the banks in the sample. Some of the balance sheet variables pertaining to maturity composition of bank loans can only be obtained until the third quarter of 2006 limiting our ability for analysis in terms of banks' loans term composition. Table 2 provides the summary statistics of balance sheet and income statement variables for the banks in the sample. The mean of total assets for the banks in the sample is 28.5 billion TL which corresponds to around 19 billion USD (based on an exchange rate of 1.5 TL per USD). In terms of size, the sample includes a good range of small and big banks in Turkey with assets ranging from 428 million TL to 134 billion TL as Table 2 shows. The wide range allows us to better reflect the effects of diversification taking into account banks' size.

5. Empirical estimation

We follow an empirical model on evaluating risk of bank holding companies (BHCs) proposed by Stiroh (2006) who uses balance sheet and income statement variables. In the first part of our estimation, we evaluate the effect of banks' diversification on their loan portfolios in terms of maturity by using the following specification[5]:

$$risk_{i,t} = \beta_0 + \beta_1 \ln(ta_{i,t-1}) + \beta_2 \ln(ta_{i,t-1})^2 + \beta_3 shloans_{i,t-1}$$
$$+ \beta_4 hhi(mat)_{i,t-1} + \beta_5 bank_{i,t-1} + \beta_6 foreign_t$$
$$+ \beta_7 fincrisis_t + \varepsilon_{i,t}$$

$$(1)$$

where $risk_{i,t}$ is the risk for bank i in period t measured by the standard deviation of monthly returns on the Istanbul Stock Exchange during that period. We use two different calculations of $risk$ in our estimations: first the three-month average of the standard deviations of the monthly returns and also the 12 month average of the standard deviations of the monthly returns. $ta_{i,t-1}$ is total assets for bank i in period $t − 1$. We use one period lagged variables in the estimation since investors make their portfolio decisions regarding each bank's stock based on last period's financial information available. The variable $shloans_{i,t-1}$ represents the ratio of the bank's short term loan portfolio to its overall loans, $hhi(mat)_{i,t-1}$ is the calculated Herfindahl Hirschmann Index (HHI) value for the bank's loan composition in terms of maturity (the higher this value, the more concentrated the bank's loan portfolio is in terms of maturity. See below for the calculation of this ratio) $bank_{i,t-1}$ is a vector of other bank specific variables obtained from the balance sheets and income statements of the banks in the sample and $foreign_t$ is a dummy variable based on bank's ownership structure.[6] We do not use a lagged value for $foreign$ dummy since ownership change in banks is more readily available information than bank specific variables and investors will make their decisions regarding buying or selling a bank stock based on ownership information at time t as opposed to $t − 1$. Finally, $fincrisis$ represents a dummy variable for the Global Financial Crisis of 2008. It takes on the value of 1 for the third quarter of 2008 and onwards till the first quarter of 2010. We believe this is an important variable to include in our estimation since previous research (such as Hacihasanoglu, Simga-Mugan, & Soytas, 2012) has shown that global risk perceptions have an important effect in explaining emerging market return volatilities.[7]

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[4] The highest volatility in the sample is recorded for the first observation (the fourth quarter of 2002) where the standard deviation of the average monthly volatility reaches 32.58%. The high volatility in this period could be considered a residual of the Turkish Banking Crisis of 2000−2001 during which Savings Deposit Insurance Fund (TMSF) closed down eleven banks and the Turkish Lira was devalued by 40% against the USD Tanyeri (2010).

[5] Stiroh (2006) uses revenue composition as a measure of his analysis, yet in the case of Turkey preliminary estimations using revenue composition does not necessarily yield any significant results. The same could be said for the currency composition of the banks' loan portfolio. Preliminary results regarding this variable also suggested no statistical significance and redundant variable testing proved this measure not to be a significant explanatory variable in the case of Turkish banks.

[6] We define a bank "foreign" if the share of the foreign owner exceeds 50. 01% following IFRS standards. A redundancy test shows that $foreign_t$ is an important variable in the estimations that cannot be considered redundant.

[7] There are also studies that suggest the Global Financial Crisis had no impact on the efficiency scores of Turkish banks (such as Gunay, 2012). However as shown in Section 6 this variable becomes highly significant in the estimation results.

Table 2
Descriptive statistics for bank specific variables.

	Mean	Median	Maximum	Minimum	Std. dev.	Skewness	Kurtosis
Assets (ta)	28,528.75	18,981.19	134,018.20	428.40	29,597.33	1.34	4.14
Loans (loans)	13,333.29	8026.68	57,978.95	155.23	14,336.26	1.33	3.78
FX Loans (fxloans)	4946.19	2874.67	26,793.77	45.50	5632.23	1.69	5.54
Short Term Loans (stloans)	3450.79	2656.84	12,868.65	8.94	2962.39	1.07	3.62
Nonint Income (nonii)	695.43	266.16	6392.15	−1.28	1030.27	2.65	10.89
Operating Inc (oprinc)	1526.04	780.43	11,122.20	8.30	1870.36	2.06	7.70
Trading Inc (trainc)	68.67	16.07	1726.01	−378.33	203.37	3.17	19.68
Dividend Inc (divinc)	8.74	1.22	408.46	0.00	32.07	8.36	91.17
Net Fee Inc (feeinc)	259.04	125.31	1725.07	0.69	329.06	1.99	6.89
Other Nonint Inc (othnonii)	361.08	94.86	5054.30	−372.67	736.12	3.42	15.43
Deposits (deposits)	18,999.51	13,692.45	75,362.54	625.10	17,553.44	1.11	3.40
Equity (equity)	3330.79	1829.47	15,597.51	0.00	3573.20	1.43	4.37
Nonperforming Loans (npl)	661.72	390.36	3010.83	1.77	657.33	1.17	3.89
Offbalance Sheet Rev (offbal)	44,812.24	23,820.03	297,938.88	340.42	53,791.18	1.79	6.25
Operating Profit (profit)	389.48	164.53	3099.60	−2603.75	551.94	1.40	8.72

The table shows the descriptive statistics of variables for 13 publicly traded banks used in estimations. Data is obtained from the Turkish Banks Association. The number of observations is 381. All data is in terms of 1 million Turkish Lira (TL).

The bank specific vector of $bank_{i,t-1}$ includes the following variables that come from the bank's balance sheet and income statement in period $t-1$:

- Liability composition, measured by the ratio of deposits to total assets (Deposits/Assets).
- Bank's loans measured by total loan to total assets ratio (Loans/Assets).
- Loan quality measured by the ratio of bank's non-performing loans to overall loan portfolio (Nonperforming Loan Ratio.)
- Off balance sheet activities measured by the ratio of bank's offbalance sheet income to its overall operating profit (Offbalance Sheet Rev/Opr. Profit).
- Cost efficiency measured by the ratio of interest income net of interest expense to bank's equity (Cost Efficiency).

To capture the impact of banks' diversification in loan maturity we compute the Herfindahl Hirschmann Index (HHI) for maturity structure as follows:

$$HHI(mat) = \left(\frac{stloans}{loans}\right)^2 + \left(\frac{ltloans}{loans}\right)^2 \qquad (2)$$

where,

$$loans = stloans + ltloans \qquad (3)$$

and *stloans* represents short-term loans. Similarly *ltloans* stands for long term loans in the bank's loan portfolio (*loans*). *HHI (mat)* ranges between 0.50 and 1. An increase in this variable indicates an increase in the concentration of a particular type of loan in terms of maturity. The median value for this ratio in the sample is 0.57 indicating that the loan portfolios of the banks in the sample are fairly balanced. The availability of loan data in terms of its maturity composition is limited to 2002–2006 as indicated in Section 4.

In the second part of our estimation, we evaluate the effect of banks' revenue composition on their overall risk. For this analysis, we breakdown total revenue into two and five categories respectively. In the two category breakdown, we evaluate banks' revenues in terms of:

1. Interest Income
2. Non-interest Income

and in the five-category breakdown, where we breakdown the non-interest income further into its components as:

1. Interest income
2. Net fee income
3. Trading income
4. Dividend income
5. Other non-interest income

The estimation takes the following form for the two-component breakdown:

$$risk_{i,t} = \beta_0 + \beta_1 \ln(ta_{i,t-1}) + \beta_2 \ln(ta_{i,t-1})^2 + \beta_3 nonii_{i,t-1}$$
$$+ \beta_4 hhi(rev2)_{i,t-1} + \beta_5 bank_{i,t-1} + \beta_6 foreign_t + \varepsilon_{i,t} \quad (4)$$

we do not include the *fincrisis* dummy in the above equation since the regression period ends in the fourth quarter of 2006 prior to the onset of the Global Financial Crisis. The five-component revenue breakdown takes the following form:

$$risk_{i,t} = \beta_0 + \beta_1 \ln(ta_{i,t-1}) + \beta_2 \ln(ta_{i,t-1})^2 + \beta_3 feeinc_{i,t-1}$$
$$+ \beta_4 trainc_{i,t-1} + \beta_5 divinc_{i,t-1} + \beta_6 othnonii_{i,t-1}$$
$$+ \beta_7 hhi(rev5)_{i,t-1} + \beta_8 bank_{i,t-1} + \beta_9 foreign_t$$
$$+ \beta_{10} fincrisis_t + \varepsilon_{i,t} \qquad (5)$$

where $nonii_{i,t-1}$ is the non-interest income as a ratio of operating revenue for bank i at time $t-1$, $feeinc_{i,t-1}$ is the ratio of

the bank's total net fee income to operating revenue; *trainc* is the trading income as a ratio of operating revenue and similarly *divinc*, *othnonii* are the bank's dividend and other non-interest income calculated as a ratio of its operating revenue respectively. The variable *hhi(rev2)* is the calculated Herfindahl Hirschmann Index (HHI) value for the bank's revenue composition based on two-component categorization (interest and non-interest income). The higher this value is, the more concentrated the bank's revenue becomes in terms of its source (see below for the calculation of this ratio.) Similarly, *hhi(rev5)* is the same ratio calculated as five-component breakdown of the bank's revenue sources.

The HHI ratios are calculated as follows:

$$HHI(rev2) = \left(\frac{intinc}{oprinc}\right)^2 + \left(\frac{nonii}{oprinc}\right)^2 \qquad (6)$$

where,

$$oprinc = intinc + nonii \qquad (7)$$

for the two-component breakdown and,

$$HHI(rev5) = \left(\frac{intinc}{oprinc}\right)^2 + \left(\frac{feeinc}{oprinc}\right)^2 + \left(\frac{trainc}{oprinc}\right)^2$$
$$+ \left(\frac{divinc}{oprinc}\right)^2 + \left(\frac{othnonii}{oprinc}\right)^2 \qquad (8)$$

where,

$$oprinc = intinc + feeinc + trainc + divinc + othnonii \qquad (9)$$

for the five component breakdown: *oprinc* represents bank's operating income; *feeinc* is the ratio of the bank's total net fee income to operating revenue; *intinc* is the bank's interest income; *trainc* is the trading income as a ratio of operating revenue and similarly *divinc*, *othnonii* are the bank's dividend and other non-interest income calculated as a ratio of its operating revenue respectively.

In the panel estimation we use a joint cross-section and period effects model. While each bank is different, each quarter also is different in the sense that there are changes within each bank's loan portfolio and financial statement variables.[8] Even though period fixed effect methodology is favored by Stiroh (2006), for the Turkish case we find that the residuals are serially correlated using only a period-effects model.

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[8] Results of redundant fixed effects tests for the equation reveal the joint significance of all of the effects, respectively. The cross-section/period *f* test with 25 and 116 degrees of freedom has a critical value of 4.58 and a chi-square critical value with 25 degrees of freedom of 104.48. Both these tests have 0% probability which reject the null hypothesis that the restricted model in which there is only a single intercept holds. In addition, in estimations of the above equation using only a period effects model, we find that the residual error terms are serially correlated and the Durbin—Watson Statistic is 1.37.

6. Findings

Tables 3 and 4 show the results of estimations for both maturity and revenue composition breakdowns using a list of bank specific variables that aim to measure a bank's liability composition, liquidity level, loan quality, off-balance sheet activities, cost efficiency and the nature of its ownership. Additionally we also include a time dummy for the Global Financial Crisis starting in the third quarter of 2008. In Table 3 the "risk" variable is calculated using the three-month average of the standard deviation of a bank's monthly equity return while in estimations listed on Table 4 we use the 12-month average of the standard deviations.[9]

The estimation results suggest that maturity composition of a bank's loan portfolio has a significant impact on its risk factor when risk is calculated as the three month average of the standard deviation of its monthly equity returns. The coefficient equals −26.8 which means for every one percent increase in a bank's short term loan ratio (calculated as the ratio of short terms loans to the banks' overall loan portfolio), the three-month risk measure decreases 27%. However, we must add that this should not be considered as conclusive evidence since we only observe this significance at ten percent level and only in one of the four estimations we run.

Of all the revenue components evaluated, we observe that a bank's trading income is a highly significant source of risk; the higher the ratio of this variable in the bank's overall revenue composition, the riskier is the bank's equity return. The coefficient of this variable ranges from 13 to 17 meaning a percentage increase in a bank's trading income relative to its operating income increases the average standard deviation of its monthly equity returns by 13% as shown in Table 4 to 17% as shown in Table 3. This result may suggest that investors price a bank's trading activity into their investment decisions. Trading is seen by Turkish equity investors as a riskier activity performed by banks as opposed to more traditional banking activities such as lending.

Another revenue source that appears significant in some of our estimations is the ratio of banks' other non-interest income to their operating income. The coefficient of this variable is significant and positive in our estimations when we use the 12 month-average based risk measure. A coefficient of 10 suggests a 10 percent increase in the 12-month average of the standard deviation of a bank's monthly equity return in the face of a percentage increase in this ratio.

Among bank specific variables that we use in our estimations, we find that the relative size of banks' deposits is an important risk mitigating factor. The coefficient of this variable which is measured as the ratio of total deposits to banks' assets in the previous period ranges from −49 to −65 suggesting a percentage increase in bank deposits relative to total assets lowers equity risk by almost half-a-standard deviation. That is a significant impact given the magnitude. Equity enters our estimations as highly significant and with a negative sign suggesting that banks with higher equity have lower equity return risks. Also and as highly expected, an increase in the ratio of banks' non-performing loans

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[9] We thank the referee for this suggestion.

Table 3
Determinants of bank risk in Turkey — revenue and maturity breakdown using risk calculation in a 3-month rolling window.

Time period	Bank risk					
	Maturity composition of loans		Two-part revenue breakdown		Five-part revenue breakdown	
	2003q1—2006q4	2003q1—2006q4	2003q1—2010q1	2003q1—2010q1	2003q1—2010q1	2003q1—2010q1
Dependent variable:						
ln (Assets)	−1.85 (1.82)	52.39 (35.91)	−5.51** (2.69)	−2.14 (20.17)	−7.42** (3.25)	−48.17 (33.81)
ln (Assets)^2		−1.47 (1.09)		−0.10 (0.60)		1.17 (0.97)
Short Term Loans/Loans	−2.58 (11.27)	−26.78* (16.50)				
Loan Maturity HHI	−1.72 (13.34)	12.30 (16.55)				
Nonint inc/Opr. Rev	4.52 (4.39)	0.59 (5.83)	40.81 (36.75)	41.16 (36.87)		
Revenue HHI (Two component)			−4.59 (5.48)	−4.87 (5.74)		
Net Fee Inc/Operating Rev					3.87 (10.95)	2.48 (10.99)
Trading Inc/Operating Rev					16.33** (7.39)	17.06** (7.40)
Dividend Inc/Operating Rev					−104.67 (121.58)	−107.21 (121.45)
Other Nonint Inc/Operating Rev					10.88 (7.41)	11.47 (7.42)
Revenue HHI (Five Component)					−11.09 (7.93)	−7.09 (8.58)
Bank specific variables:						
Deposits/Assets	5.27 (18.48)	−24.37 (25.26)	−49.53** (15.20)	−49.12*** (15.41)	−62.07*** (17.64)	−64.57*** (17.74)
ln (Equity/Assets)	5.77 (4.01)	−1.49 (5.51)	−6.75*** (2.87)	−6.99 (3.21)	−8.76*** (3.66)	−7.17* (3.88)
Loans/Assets	17.69* (10.05)	14.29 (15.73)	9.50 (10.59)	9.24 (10.72)	15.15 (13.89)	18.83 (13.71)
Nonperforming Loan Ratio	52.22*** (18.85)	50.29 (41.85)	19.08 (22.78)	18.66 (22.95)	15.70 (29.89)	14.12 (29.89)
Offbalance Sheet Rev/Opr. Profit	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.001)	−0.00 (0.001)	−0.00 (0.00)	−0.00 (0.00)
Cost Efficiency	8.57** (4.31)	6.75 (6.89)	2.61 (3.64)	2.53 (3.68)	7.26 (4.41)	7.07 (4.41)
Foreign Bank Dummy	−3.99 (2.88)	−8.80* (5.12)	−8.75*** (3.63)	−8.63*** (3.63)	−4.54 (3.98)	−4.73 (3.97)
Financial Crisis Dummy			6.57*** (1.73)	6.67*** (1.81)	8.68*** (2.07)	8.29*** (2.09)
Adj. R^2	0.16	0.48	0.36	0.36	0.46	0.46
Number of banks	11	11	11	11	10	10
Number of observations	152	152	295	295	223	223

This table presents the results of estimations on bank risk by using Equations (1), (4) and (5). Bank risk is measured by the standard deviation of average monthly returns in a quarter. All variables except Foreign Bank Dummy are lagged one period. Robust standard errors are reported in parenthesis. *significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

to their overall loan portfolio increases the risk factor; this relationship is robust in almost all of our estimations and its coefficient ranges from 33 to 51 suggesting that a one percent increase in the NPL ratio will raise the average standard deviation of monthly equity returns by 30—50 percent. We cannot however find any conclusive evidence that suggests that cost efficiency which is measured by the ratio of banks' net interest income to their equity lowers equity risk. On the other hand, the foreign ownership dummy seems to have a significant and robust effect with a negative coefficient in almost all of the estimations suggesting that investors foresee foreign owned banks as relatively safer than locally owned banks in Turkey. Alternatively, this suggests that locally owned banks have higher risk associated with them as opposed to foreign owned ones. This finding is in line with existing literature.

Regarding the impact of the Global Financial Crisis we observe that as expected the volatility of bank returns were higher during this crisis period compared to other periods. The fact that the significance of this dummy variable is high and robust in all estimations suggest that it was an important risk factor for the equity returns of Turkish banks after the third quarter of 2008.

The estimations however fail to find any robust significant relationship regarding the HHI concentration ratios we have utilized in the study. This finding suggests concentration in terms of maturity of loans or revenue breakdown is not necessarily considered by investors as a significant risk factor in the equity pricing of Turkish banks.

7. Conclusion

By using data from thirteen publicly traded commercial and deposit banks in Turkey, in this paper we estimate the determinants of risk for bank equities in the case of an emerging market setting, Turkey. Our analysis is the first according to our knowledge that studies risk from an equity return perspective in Turkey as applied to the banking sector. Our findings suggest important conclusions regarding the nature of risk for Turkish banks.

We find that maturity composition of a bank's loans is a good indicator of the volatility of its equity returns. The rationale here is that banks with shorter loan maturity positions carry less maturity mismatch risk and are regarded by investors as safer companies to invest in. In the case of Turkish bank stocks, a one percent increase in the short term maturity composition of a bank's loans lowers its average return volatility by almost a quarter standard deviation. Another important conclusion we can arrive from the analysis presented here is that the source of revenue for banks also serves as a good predictor of their equity volatility in the case of Turkey. In that regard, we see that increases in trading income as a source of banks' overall revenue increases the volatility of their equity returns. This finding suggests that for investors banks' income statements are as important as their balance sheets and the volatile nature of banks' trading revenue is regarded as a source of risk for profitability. This

Table 4

Determinants of bank risk in Turkey − revenue and maturity breakdown using risk calculation in a 12-month rolling window.

Time period	Bank risk					
	Maturity composition of loans		Two-part revenue breakdown		Five-part revenue breakdown	
	2003q1−2006q4	2003q1−2006q4	2003q1−2010q1	2003q1−2010q1	2003q1−2010q1	2003q1−2010q1
Dependent variable:						
ln (Assets)	−1.69* (0.89)	90.66*** (18.17)	8.41*** (1.48)	11.94 (10.94)	−9.41*** (1.77)	−20.46 (18.60)
ln (Assets)^2		−2.52*** (0.54)		−0.61* (0.32)		0.31 (0.53)
Short Term Loans/Loans	−3.15 (5.50)	−10.47 (8.49)				
Loan Maturity HHI	1.54 (6.50)	5.44 (8.38)				
Nonint inc/Opr. Rev	0.75 (2.09)	1.13 (2.96)	17.30 (20.03)	19.38 (19.97)		
Revenue HHI (Two component)			4.74* (3.00)	3.07 (3.12)		
Net Fee Inc/Operating Rev					0.18 (5.90)	−0.15 (5.94)
Trading Inc/Operating Rev					12.63*** (4.04)	12.76*** (4.05)
Dividend Inc/Operating Rev					−13.11 (65.67)	−13.71 (65.79)
Other Nonint Inc/Operating Rev					10.38*** (4.00)	10.38*** (4.01)
Revenue HHI (Five Component)					5.04 (4.35)	6.07 (4.68)
Bank specific variables:						
Deposits/Assets	12.770 (9.03)	1.30 (12.84)	−48.66*** (8.30)	−46.29*** (8.36)	−53.61*** (9.54)	−54.23*** (9.61)
ln (Equity/Assets)	−0.38 (1.93)	−4.33* (2.79)	−7.32*** (1.74)	−8.78*** (1.75)	−7.56*** (1.98)	−7.11*** (2.12)
Loans/Assets	6.93 (4.89)	19.15** (8.13)	12.88** (5.89)	11.31** (5.93)	16.72** (7.57)	17.64** (7.74)
Nonperforming Loan Ratio	(4.89) (9.06)	50.47** (21.14)	42.94*** (12.48)	40.55*** (12.45)	33.26** (16.25)	32.53** (16.32)
Offbalance Sheet Rev/Opr. Profit	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.00 (0.00)	−0.00 (−0.00)	−0.00 (0.00)
Cost Efficiency	−1.87 (2.07)	1.84 (3.50)	−2.15 (1.98)	−2.63 (1.99)	0.35 (2.37)	0.29 (2.38)
Foreign Bank Dummy	−0.01 (1.39)	−3.54 (2.60)	−10.35*** (1.94)	−9.65*** (1.96)	−8.65*** (2.14)	−8.69*** (2.14)
Financial Crisis Dummy			9.89*** (0.95)	10.44*** (0.98)	10.30*** (1.12)	10.21*** (1.13)
Adj. R^2	0.37	0.53	0.56	0.57	0.63	0.63
Number of banks	11	11	11	11	10	10
Number of observations	146	146	289	289	218	218

This table presents the results of estimations on bank risk by using Equations (1), (4) and (5). Bank risk is measured by the standard deviation of average monthly returns in a year. Cost efficiency is calculated by the ratio of net interest income (interest income after interest expense) to equity; Financial Crisis Dummy represent the Global Financial Crisis Dummy and takes the value of 1 from 2008Q3 to 2010Q1 and is omitted from regressions that do not include this time frame. All variables except Foreign Bank Dummy are lagged one period. Robust standard errors are reported in parenthesis. *significant at 10 percent; **significant at 5 percent; ***significant at 1 percent.

finding has important implications for bank managers and regulators; bank managers who rely on trading revenue as a significant contributor of their bank's overall revenue inadvertently cause their bank stock to become more volatile; from regulators' perspective it suggests banks' trading activity is a source of risk to banks' overall health and thus needs to be more closely watched.

In terms of other bank specific variables used in our analysis, our results reaffirm our expectations regarding sources of equity return risk: an increase in Turkish banks' deposits and equity relative to their assets are all risk mitigating factors that lower equity volatility while the ratio of non-performing loans to banks' overall loan portfolio increase the volatility of equity returns. We also empirically show that the Global Financial Crisis had an observable and significant impact on equity returns in Turkey. Our findings also show that there is a robust and significant link between a bank's ownership status and its equity return volatility in Turkey. It is observed that Turkish equity investors consider foreign owned banks as less risky. This finding strengthens the limited number of studies in literature for Turkey and other emerging market banking systems.[10]

The findings in this paper can be used to extend the study of banks in Turkey and in other emerging markets. Further research can study the reasons why equity investors perceive foreign owned banks as less risky as opposed to domestic ones. Future research can also look at if indeed as perceived more trading activity as suggested by this paper leads to lower or more volatile profitability in Turkish banking sector. As we conducted our literature survey we realized that the field still suffered from a lack of studies regarding these questions.

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[10] Such as Isik and Hassan (2003), Micco et al. (2004).

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