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SCIENCES BUSINESS DEPARTMENT**

**THE IMPACT OF AN EARTHQUAKE IN ISTANBUL ON THE
CAPITAL ADEQUACY RATIO OF THE BANKS**

MASTER'S THESIS

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ABSTRACT

The purpose of this study is to directly examine the effects of the expected Marmara earthquake, which may cause a huge financial shock in terms of non-performing loans and failure of collaterals on the Capital Adequacy Ratios (CAR) of the banks. In this direction, considering the real estate collaterals, what level of risk exposure banks will face on their CAR is examined and whether the earthquake has a significant effect on CARs.

In this respect, the study consists of five parts. In the first part, information is given about the historical process of the Basel agreement and the capital adequacy ratio and theoretical determinations about the subject. In the second part, various studies in the related literature are summarized. In the third part, the analysis methods (how and from where the data was retrieved and used in the analysis) of the relevant data are explained. In the fourth part, the findings of the analysis are discussed, and the last part consists of a general evaluation.

As a result of those shocks, retail and corporate loans and mortgage loans are subject to risk arising from the failure of the collaterals because of the earthquake. CAR of the banks may decrease dramatically, based on the proportion of those risk classes in banks' capital adequacy structure. Although banks are affected due to the shocks, all can preserve their CAR over the regulatory limit of %8.

Key words: Earthquake, Capital Adequacy Ratios, Basel Agreement, Real Estate Collaterals

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LIST OF ABBREVIATIONS

CAR: Capital Adequacy Ratio

NPL: Non-performing Loans

RWA: Risk Weighted Assets

TBAOF: The Banks Association Of Turkey

COSACB: Claims On Sovereigns And Central Banks

CORGOLA: Claims On Regional Governments Or Local Authorities

COABAONCU: Claims On Administrative Bodies And Other Non-Commercial Undertakings

COMDB: Claims On Multilateral Development Banks

COIO: Claims On International Organizations

COBAII: Claims On Banks And Intermediary Institutions

COC: Claims On Corporates

CORP: Claims On Retail Portfolios

CSWREMFR: Claims Secured With Real Estate Mortgage For Residence

CSBRP: Claims Secured By Residential Property

PDL: Past Due Loans

HRCDBTB: Higher Risk Categories Decided By The Board

SBM: Secured By Mortgages

STCASTCCOBAIL: Short-Term Claims And Short-Term Corporate Claims On Banks And Intermediary Institutions

UFCIIMF: Undertakings For Collective Investments In Mutual Funds

SI: Share Investment

OR: Other Receivables

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1.INTRODUCTION AND PURPOSE

In the first part, information is given about the historical process of the Basel Accord, and the Capital Adequacy Ratio. Theoretical determinations on the subject were emphasized.

Before the Basel I accord, banks were using the capital-to-assets ratio. Capital -to-assets ratio was not sufficient in terms of analyzing the risks which arise from the off-balance sheets in which banks booked over-the-counter transactions, including swaps (currency and interest rate) and options. Also, there was not a globally agreed calculation method for the ratio. Subsequently, banks started to maintain less capital and be oblivious to the rising risk of off-balance sheet transactions. These country-specific practices and definitions were worsened with the development of globalization due to risks that banks encountered among different countries. In 1974, The Basel Committee (Basel, Switzerland) was established with representatives from the countries listed (Please see the list of the countries attended with a representative for 1974 Basel Committee appendix-1). "International Convergence of Capital Measurement and Capital Standards" also known as "The 1988 BIS Accord" or "Basel I Accord" was produced by the Basel Committee.

After "Basel I Accord" Banks which are the member of the Basel committee have to comply with two obligatory terms below:

1-Assets/capital has to be 20 (minimum)

2- Cooke Ratio: "The Cooke ratio was used to compute minimum capital that a bank was required to keep vis-à-vis the risk associated to its on & off-balance-sheet assets called risk-weighted assets (RWA), a measure of the bank's total credit exposure".

With the Basel I guidelines, banks started to maintain a predetermined capital ratio to analyze the risk which comes out of their assets and off-balance sheet transactions. Moreover, in terms of general definition for the capital and risk-weighted assets, evenness and regularity among the member countries are implemented. To uniform the capital structure of the banks, "Tier 1 capital" and "Tier 2 capital" definitions were introduced as below.

- Tier 1 Capital consists of bank equity and non-cumulative preferred shares. The bank's goodwill is deducted from its equity.
- Tier 2 Capital is also referred to as supplementary capital. The main constituents of Tier 2 capital are cumulative perpetual preferred stock², certain types of 99-year debt issues,

and subordinated debt (i.e., debt subordinated to depositors) with an original life of more than five years.

For the first time, a standard as a minimum capital ratio (8% of RWA) is mentioned. Since the Basel I Accord, regulators recommend higher ratios over 8% to maintain sane and robust risk management for banks that are the most dominated actors in the financial industry.

As follows, nonstandard definitions which occur from each country regarding the calculation of capital/assets ratio are prevented.

As it is clear from the definitions, Tier-1 capital contains more reliable and less risky capital in comparison to Tier-2 capital. Consequently, 50% of the capital should consist of Tier 1 capital fundamentally.

Despite the fact that Basel I Accord (1998) was crucial for capital calculations with a uniformed approach, it has its shortcomings, especially on separation of risks arising from different risk ratings and analyzing and distinguishing the default correlations to calculate RWA.

In June 1999, Basel II was announced by the Basel committee. However, it took five years more to be agreed on by all members and finalize the revisions. As a result, it was produced in June 2004. After further revisions in 2005, it was finally implemented in 2007. With Basel II, three pillars are introduced to the banks of the member countries.

1.1 Minimum Capital Requirements:

The 8% capital requirement, which was introduced with the Basel I accord, is continued with the exact calculation of Market Risk in Basel II. However, for the computation of RWA, besides Credit risk and Market risk, a third risk is added, "Operational risk." To enhance the shortcomings of credit risk calculations, the credit rating of the counterparties started to take a significant role in the computation. With Basel II, the calculation of the capital adequacy ratio has its recent method as follows "Total Capital = 0.08 x (Credit Risk RWA + Market Risk RWA + Operational Risk RWA)."

Supervisory Review: The purpose of the Pillar 2 is to define the guidelines for the supervisory banks to execute the "supervisory review process." With Pillar 2, the expectations from the regulators of the member countries went beyond that the banks under supervision are maintaining the minimum CAR. Banks are suggested and informed to have better and proper computation methods by the regulators to keep robustness and evenness in the risk management.

The four main principles for Pillar II are as follows:

Banks should have a risk profile evaluation framework for their overall capital sufficiency and a capital level maintenance plan.

- Supervisors can evaluate and analyze internal evaluation and strategies for capital adequacy of the banks and their capacity to track and ensure that regulatory capital ratios are respected.

If the outcome of this process is not satisfied, the supervisors should take necessary supervision measures.

- Supervisors should presume not only banks are operating above the required regulatory capital but also they should be able to demand that banks retain their capital beyond that minimum.
- Supervisors should pursue early intervention in order to avoid a risky condition in which the capital of the bank falls below the minimum necessary threshold.

The Basel Committee recommended that regulators track the interest rate risk, credit risk, and operational risk, in particular in the banking book. Stress testing, the use of default concepts, the concentration of credit risk, and the risk of collateral, guarantees, and credit derivatives are the main questions relating to credit risk.

- The Basel Committee emphasizes that the processes used by bank managers should be transparent and accountable. This is critical when a controller exercises discretion or sets capital requirements above the minimum laid down in Basel II.

Market Discipline and Third Pillar:

To increase transparency, the third pillar indicates banks to explain more details about how they allocate their capital and the risks that banks encountered. Such details are disclosed by the banks in a prescribed form from regulatory bodies. Detailed information required to be disclosed by banks:

- Organization and management of the risk management function, including its strategies.
- Detailed information about its capital structure and capital requirements for Credit, Market and Operational Risks.

The different methods for computation of credit risk are introduced by Basel II Accord, which are Standardized Approach, Comprehensive Approach, Internal Ratings Basel (IRB) Approach. In this thesis, regarding the nature of the Turkish Banking System, only Standardized Approach will be explained in detail, since all of the banks under analysis are not using either Comprehensive Approach or Internal Ratings Basel (IRB) Approach Standardized Approach.

Standardized Approach - Banks that are not advanced and do not possess technological skills are obliged to apply the standardized risk management approach when designing their own models. For the calculation of the credit risk of the bank, there are many similarities between Basel II and Basel I. Basel II, also contains a variety of new rules. Please see the implementation of the credit ratings in the calculation which were not part of the calculation according to Basel I, as below.

Customer type/ Rating	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Below B-	Unrated
Country	0	20	50	100	100	150	100
Banks	20	50	50	100	100	150	50
Corporations	20	50	100	100	150	150	100

Problem: Consider the assets of a bank consist of \$200 million of loans to corporations rated A, \$20 million of government bonds rated AAA and \$100 million of residential mortgages. Calculate the total risk-weighted assets under Basel II standardized approach.

Solution: Assigning risk weight to each exposure:

Amount - \$200 million

Customer type - Corporation

Rating – AAA

Hence, Risk Weight = 50% or 0.5

Similarly risk weight to government bonds and residential mortgage loan will be 0 and 35% (0.35).

$$RWA = 0.5 * 200 + 0.0 * 20 + 0.35 * 100 = 135$$

Total RWA = \$135 Million

1.2 Treatment of Collaterals

The asset of the borrower to the loan, which the bank can use to mitigate the risks in the event of default, is a financial or non-financial asset. With collateral, the bank may minimize or nullify its losses. Some of the valid collaterals in Basel are cash, gold, shares, bonds, mutual funds, etc. The guarantee of collateral allows the client to borrow at a lower rate, and the bank, in turn, benefits from less RWA, which decreases the regulatory capital requirement thereafter. In Basel I, the approach covered for collateral treatment is the Simple Approach only. In the Simple Approach, risk weights are designated for each collateral type, subject to a floor of 20 percent.

Banks can replace the risk weight of the exposure (loan) with the risk weight of the collateral up to the level where exposure is covered by the collateral value.

Collateral worth 60\$ will only cover the exposure up to 60\$. The risk, calculated by the original consumer risk weight, would be the residual amount of exposure.

The Simple Approach requires banks to revalue all the collaterals bi-annually, and the collaterals should be pledged for the lifetime of the exposure.

1.3 Basel III

The Basel III Agreement reflects a substantial reform of the banking risk management guidelines and contains the lessons learned from the chaos of the 2008 crisis. The Basel committee realized the need for increased risk minimum capital and the need to adjust the banks' capital structure. The consequence was a total elimination of Tier 3 capital from the banks' capital structure.

Consequently, the total capital of a bank, as per Basel III guidelines, consists of components as below.

- Tier 1 Equity Capital
- Additional Tier 1 Capital
- Tier 2 Capital

Tier 1 capital primarily consists of common stocks and retained earnings. Tier 1 equity capital (also known as core Tier 1 capital) includes shares and retained earnings but does not include goodwill or deferred tax assets. The additional Tier 1 capital category consists of items, such as non-cumulative preferred stock that were previously Tier 1 but are not common equity. Tier 2 capital includes debt that is subordinated to depositors with an original maturity of five years. It is also referred to as "gone-concern capital," implying that the bank has negative capital and the loss has to be absorbed by the Tier 2 capital.

1.4 Earthquake Sources and Selected Scenario Earthquake

Tectonic structures controlling the earthquake hazard of Istanbul are expected to be in the northern branch segments of the North Anatolian Fault, also called the Main Marmara Fault, which is located in the Marmara Sea. "Turkey Active Fault Database," updated in 2018, includes the latest data compiled regarding the possible earthquake sources in Turkey.

The part of this database covers the Marmara Region. The western part of the north branch of the North Anatolian Fault in the Marmara Sea was broken in the 1912 Şarköy - Mürefte

earthquake and the eastern part in the 1999 Kocaeli earthquake. Therefore, it is thought that the Marmara Sea earthquake, which affects Istanbul, will occur on one or more of the unbroken middle segments of this branch. Tectonic structures affecting the earthquake hazard of Istanbul are in the northern branch segments of the North Anatolian Fault located in the Marmara Sea, also called the Main Marmara Fault.

Various estimates have been made on the possible casualties by using earthquake ground motions, which have been found by using the "probabilistic earthquake hazard" method performed by the Department of Earthquake Engineering, Boğaziçi University Kandilli Observatory, and Earthquake Research Institute. The expected recurrence frequency of this earthquake is one in 475 years. While the difference between damages below this earthquake level and deterministic damages (scenario earthquake) is 3-4 times in the level of heavy and hefty damage, it closes as it decreases to low damage levels. The estimated recurrence period of a major earthquake that may occur in the Marmara Sea corresponds to approximately 250-300 years in parallel with the deterministic damage levels calculated in the study of the Observatory and Earthquake Research Institute.

1.4 Financial Losses Due to Structural Damages

Financial losses due to structural damage can be expected to be 68 billion TL on average. Considering the losses due to non-structural damages, the financial loss is predicted as 120 billion TL. This estimate is valid for the $M_w = 7.5$ scenario earthquake.

2. VARIOUS STUDIES IN THE RELATED LITERATURE ARE SUMMARIZED BELOW

2.1 Macro Stress Testing and an Application on Turkish Banking Sector

The significance and application of stress testing have risen to track financial risks, especially in the aftermath of the recent financial crisis, which started in mortgage markets and spread to international markets. From a supervisory standpoint, the study analyzed and discussed top-down macro stress tests. Following that, potential effects on the capital adequacy of the Turkish banking sector, specifically baseline and adverse lending, interest rates, exchange rates, and contagious risks, were addressed. Initially, separate econometric models for corporate and retail loans were used to predict credit growth and ineffective loans. Secondly, those models used the results to forecast the effect of macroeconomic scenarios on the Turkish banking system under

Basel standards. The findings revealed that growth and interest rate changes had a significant impact on business lending, while the unemployment rate had a significant impact on retail lending when combined with these variable rates.

Furthermore, economic growth, exchange rates, and the unemployment rate all had a substantial impact on nonperforming corporate lending, while economic growth and unemployment rates had little effect on nonperforming retail lending. According to the study's findings, the main effect on capital adequacy through the reassessment of foreign currency-denominated risk-weighted assets was not significantly affected by exchange rates on the sector's net income due to the sector's low net foreign current positions. The robust capital base of the Turkish banking sector was found to be critical in the sector's resilience against financial shocks.

2.2 Risk management and capital adequacy in Turkish participation and conventional banks: A comparative stress testing analysis

In this study, researchers analyze improvements in the capital adequacy of banks (CARs) under various stress scenarios by comparing conventional and participation banks. Their findings suggest that considering the stress situations, the banks' capital adequacy ratio decreases significantly.

Researchers find that participation banks suffer more than traditional banks in a decreased capital adequacy ratio. Their findings show that Turkish participation banks are more vulnerable to abrupt shifts in currency exchanges and increased non-performing loans. But in terms of capital adequacy, this sensitivity is not a benefit.

2.3 Defining Influential Factors on CAR: An Examination of Turkish Banking Sector

In this study, researchers aim to define factors that have an effect on the CAR. The Turkish banking sector's capital adequacy ratio dropped sharply from 30.9% in 2003 to 17.1% in May 2019. This figure suggests that while the Turkish Banking Sector is still relatively large in terms of capital sufficiency, there is a decline in trends compared to many other countries. Because of the credit limits, a downward trend in Capital adequacy is a danger. The Capital Adequacy Ratio level is, therefore, necessary to contribute positively to sustainable economic growth. Thus, it is first necessary to evaluate the influential factors of the equity ratio. For the period 2006/Q1-2019/Q1, the Multivariate Adaptive Regression Splines approach, 14 explanatory variables, and quarterly data are used. Credits/total assets ratio, RWA, NPL, legal equities, NPL/total credits ratio, and credit/deposit ratio are calculated to be clear indicators of capital adequacy ratio in Turkey.

3. DATA SOURCES AND ANALYSIS METHODS

In this section, it is explained how and where the data used in the analysis of the study are obtained and the analysis methods used are emphasized.

Regarding the expected earthquake scenario, in terms of the severity of the earthquake and the damage, it may cause, "Istanbul Metropolitan Municipality, Updating the Probable Earthquake Loss Estimation Project for Istanbul Province" was taken as a basis, which was carried out by Boğaziçi University Kandilli Observatory and Earthquake Research Institute Earthquake Engineering Department.

"The Common Data Sets" for 15 banks are used to determine what is the exact effects of a severe earthquake in the North Anatolian Fault Line, which can affect İstanbul and the Turkish banking sector dramatically. Data (for 2019 December) regarding independent and dependent variables are obtained from the database of the banks association of Turkey. "The Common Data Set" prepared by TBAOF (Please see the Official gazette 10 Feb. 2007, no.26430, the communique financial statements and related explanation and footnotes disclosed to the public.) In this data set, the "KR5- Standardized approach - Claims in accordance to risk classifications and risk weighs" table is used in order to calculate the ratio of the credit risks arising from different risk classes, which consist of banks' risk-weighted assets. An example table is below. With this table, it can be seen how much real estate collateral is used within the scope of capital adequacy of each bank. (9. Claims which covered with collateral such as a real estate mortgage for residence, 10. Claims secured by residential property). It can also be seen how much risk it poses for retail customers (8. Claims on retail portfolios).

KR5- Standardized approach - Claims in accordance to risk classifications and risk weighs – Table -1

Risk classifications	Total Risk Amount
1. Claims on sovereigns and Central Banks	
2. Claims on regional governments or local authorities	
3. Claims on administrative bodies and other non-commercial undertakings	
4. Claims on multilateral development banks	
5. Claims on international organizations	

6. Claims on banks and intermediary institutions	
7. Claims on corporates	
8. Claims on retail portfolios	
9. Claims secured with real estate mortgage for residence	
10. Claims secured by residential property	
11. Past due loans	
12. Higher risk categories decided by the Board	
13. Secured by mortgages	
14. Short-term claims and short-term corporate claims on banks and intermediary institutions	
15. Undertakings for collective investments in mutual funds	
16. Share investment	
17. Other receivables	

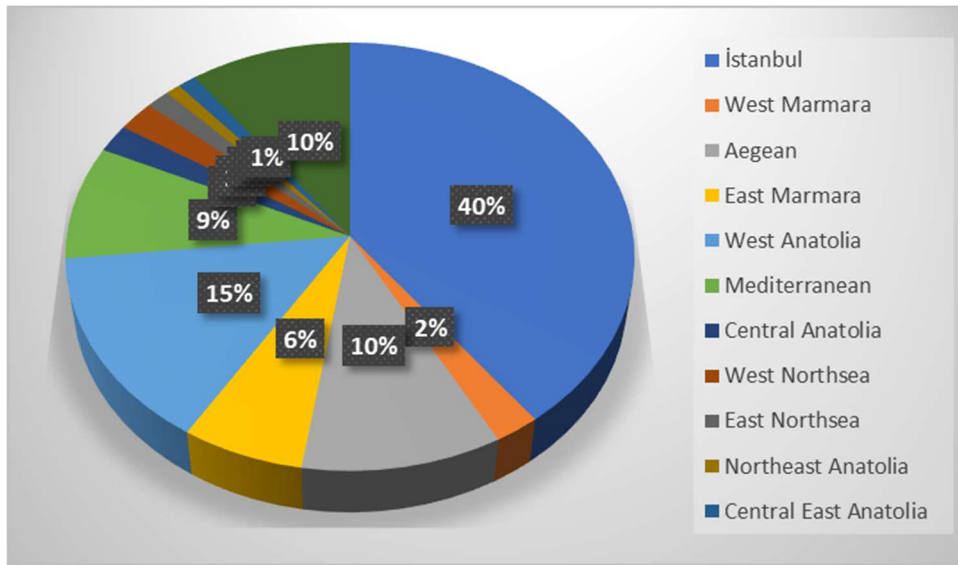
The "Loans by Provinces and Regions (31.12.2019)" table for loans from the database of the banks association of Turkey is used to determine the proportion of the risk arising from Istanbul.

Table-2

Provinces and Regions	Loan Amounts (mio-TL)	%
İstanbul	1.031.747,63	39,69%
West Marmara	60.999,63	2,35%
Aegean	271.663,00	10,45%
East Marmara	165.800,97	6,38%
West Anatolia	376.253,55	14,47%
Mediterranean	223.835,68	8,61%
Central Anatolia	55.211,70	2,12%
West Northsea	60.207,85	2,32%
East Northsea	37.930,48	1,46%
Northeast Anatolia	24.174,41	0,93%
Central East Anatolia	29.909,95	1,15%
Southeastern Anatolia	261.881,70	3,74%

Total	2.599.622,55	100%
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Figure-1



To determine the risk arising from retail customers, "The percentage of people having installments or loans was 71.1% from" "Income and Living Conditions Survey, 2019" of Turkish Statistical Institute is used. According to the Turkish Statistical Institute, "71.1% of the population had installments or loans (other than the mortgage -for the main dwelling- and housing cost), 0,7 points higher than last year. While these payments did not burden at all to 9.6% of the population, it was a heavy burden to 19.0%. 58.7% of the households reported that they could not afford to pay for a one-week annual holiday away from home, 33.6% of them cannot afford a meal with meat, chicken, or fish every second day, 29.7% of them cannot afford unexpected financial expenses, 19.2% of them cannot afford to keep home adequately warm, and 56.6% of them cannot afford to replace worn furniture."

Based on the explained percentages, a shock consists of percentages with loan proportion based on the geography and percentage of the population who cannot afford unexpected financial expenses $(0,3969) \times (0,297)$ for "Claims on retail portfolios" and "Claims on corporates" and a shock $(0,3969)$ for "Claims secured with real estate mortgage for residence" and "Claims secured by residential property" are applied.

An example of the shocks among the KR5 table rows is below (TC Garanti Bank A.Ş.). Please see the appendix for all of the bank's credit shocks.

Before the shocks

Table-3

Current period	Total Risk Amount
Risk classifications	
1. Claims on sovereigns and Central Banks	208.686.564
2. Claims on regional governments or local authorities	1.227.448
3. Claims on administrative bodies and other non-commercial undertakings	545.616
4. Claims on multilateral development banks	2.806.338
5. Claims on international organizations	0
6. Claims on banks and intermediary institutions	39.374.770
7. Claims on corporates	285.472.606
8. Claims on retail portfolios	174.761.414
9. Claims secured with real estate mortgage for residence	13.560.474
10. Claims secured by residential property	29.936.742
11. Past due loans	12.468.530
12. Higher risk categories decided by the Board	1.590.154
13. Secured by mortgages	0
14. Short-term claims and short-term corporate claims on banks and intermediary institutions	0
15. Undertakings for collective investments in mutual funds	0
16. Share investment	18.446.600
17. Other receivables	31.172.302

Total	820.049.558
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Table-4

Shareholders' Equity	-
Total shareholders' equity	61.861.863
Total risk weighted items	316.152.290
CAPITAL ADEQUACY RATIOS	
Core Capital Adequacy Ratio (%)	17,00%
Tier 1 Capital Adequacy Ratio (%)	17,00%
Capital Adequacy Standard Ratio (%)	19,57%

After shocks

Table-5

Current period	Total Risk Amount
Risk classifications	
1. Claims on sovereigns and Central Banks	208.686.564

2. Claims on regional governments or local authorities	1.227.448
3. Claims on administrative bodies and other non-commercial undertakings	545.616
4. Claims on multilateral development banks	2.806.338
5. Claims on international organizations	0
6. Claims on banks and intermediary institutions	39.374.770
7. Claims on corporates	319.123.917
8. Claims on retail portfolios	195.362.167
9. Claims secured with real estate mortgage for residence	18.942.626
10. Claims secured by residential property	41.818.635
11. Past due loans	12.468.530
12. Higher risk categories decided by the Board	1.590.154
13. Secured by mortgages	0
14. Short-term claims and short-term corporate claims on banks and intermediary institutions	0
15. Undertakings for collective investments in mutual funds	0
16. Share investment	18.446.600
17. Other receivables	31.172.302
Total	820.049.558

Table-6

Shareholders' Equity	-
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Total shareholders' equity	61.861.863
Total risk weighted items	387.668.399
CAPITAL ADEQUACY RATIOS	
Core Capital Adequacy Ratio (%)	13,86%
Tier 1 Capital Adequacy Ratio (%)	13,86%
Capital Adequacy Standard Ratio (%)	15,96%

4. FINDINGS

Considering the losses that may occur after a possible earthquake, it is observed that the risk-weighted assets for the risk classes of the retail and the commercial customers and of the real estate loans in the banking sector have increased. Due to increases in RWA, the capital adequacy ratio of the banks has decreased.

Table-7

	Increase in RWA	Decrease in CAR (bps)
Halkbank	58.432.019	-218,56
ING	4.950.017	-258,35
Odea	3.412.786	-255,89
İşbankası	47.244.463	-194,22
QNB	15.913.539	-147,05
Şekerbank	3.943.604	-200,48
TEB	12.224.222	-213,95
Vakıf	50.707.287	-232,83
YKB	37.737.203	-195,33
Ziraat Bankası	70.676.612	-214,01
Garanti Bankası	71.516.109	-360,97
Fibabank	2.321.315	-215,34
Denizbank	16.557.266	-192,17
Burgan	3.012.277	-322,73
Akbank	31.902.697	-201,55

Although there is a dramatic decrease in capital adequacy ratios, none of the banks are going below the regulatory limit of %8. Aftershock CAR values are listed below.

Table-8	CAR After Shock
Halkbank	12,15%
ING	24,24%
Odea	19,18%
İşbankası	15,92%
QNB	14,26%
Şekerbank	11,40%
TEB	14,81%

Vakıf	14,29%
YKB	15,86%
Ziraat Bankası	14,88%
Garanti Bankası	15,96%
Fibabank	17,39%
Denizbank	15,76%
Burgan	18,04%
Akbank	18,96%

5. CONCLUSION

The effects of a major earthquake in Istanbul have crucial results on the capital adequacy ratios of the banks regarding financial sustainability. Banks are the backbone of the Turkish economy with their strong capital structure, which reformed after the 2001 Banking Crisis. Thence, the banking industry is under strong regulation to protect the whole economy. However, decreases in the capital adequacy ratio can cause the prevention of new credit lending for the banks whose capital adequacy is below %8.

This study aimed to calculate and analyze the impact of the expected major Istanbul earthquake in Turkey. In this respect, 15 banks are selected, representing a large part of the Turkish Banking system. Also, 31.12.2019 data for "KR5- Standardized approach - Claims according to risk classifications and risk weights" is obtained and shocked.

As a result of those shocks, retail and corporate loans and mortgage loans are subject to risk arising from the earthquake. CAR may decrease dramatically, based on the proportion of those risk classes in banks' capital adequacy structure.

Evaluating the structures formed after the shocks, it is possible to observe that tremendous credit risks related to Istanbul for all risk classes generate a high concentration risk for the banks. To prevent this risk, exposures should be distributed to other geographical regions. The share of Istanbul in the total should be reduced

relatively, and a more balanced and sustainable capital and credit structure should be provided with the development of other regions.

Although after the shocks all the banks in this study can preserve their CAR over the regulatory limit of %8, any decrease in the CAR can be harmful to the banking sector since banks are trust institutions, and it is extremely important for the entire economy that the public and investors trust banks. As one of the most important indicators of this trust, it is important to protect CAR.

In addition, banks and regulatory authorities may establish new safeguards in the future. Naturally, such precautions must be implemented in due course in order to support the Turkish banking sector. Thus, banks could provide more loans for Turkey's financial and economic development.

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APPENDICES

1-List of the countries attended with a representative for 1974 Basel Committee

Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States.

2- List of banks KR5 Reports before and after shocks and Capital Adequacy Ratio tables

2.1

Akbank	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	97.174.002,00	97.174.002,00
2. CORGOLA	46.956,00	46.956,00
3. COABAONCU	61.946,00	61.946,00
4. COMDB	308.019,00	308.019,00
5. COIO	0,00	0,00
6. COBAII	46.049.482	46.049.482
7. COC	150.132.083,00	167.829.547,85
8. CORP	59.162.859,00	66.136.935,40
9. CSWREMFR	8.223.761,00	11.487.771,74
10. CSBRP	9.995.326,00	13.962.470,89
11. PDL	5.788.591,00	5.788.591,00
12. HRCDBTB	121.440,00	121.440,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00

15. UFCIIMF	309.776,00	309.776,00
16. SI	6.988.179,00	6.988.179,00
17. OR	10.316.599,00	10.316.599,00
Total	394.679.019,00	426.581.715,89

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	62.933.513	62.933.513
Total risk weighted items	300.070.001	331.972.698
CAR		
CCAR (%)	18,09%	16,35%
Tier-1 CAR (%)	18,09%	16,35%
CASR (%)	20,97%	18,96%

2.2

Burgan	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	3.227.814,00	3.227.814,00
2. CORGOLA	198.532,00	198.532,00
3. COABAONCU	0,00	0,00
4. COMDB	7.543,00	7.543,00
5. COIO	0,00	0,00
6. COBAII	975.939	975.939
7. COC	8.912.259,00	9.962.829,85
8. CORP	463.682,00	518.340,51
9. CSWREMFR	539.111,00	753.084,16
10. CSBRP	4.265.746,00	5.958.820,59

11. PDL	557.225,00	557.225,00
12. HRCDBTB	0,00	0,00
13. SBM	0,00	0,00
14. STCASTCCOBAIL	0,00	0,00
15. UFCIIMF	0,00	0,00
16. SI	0,00	0,00
17. OR	1.306.506,00	1.306.506,00
Total	20.454.357,00	23.466.634,11

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	3.580.806	3.580.806
Total risk weighted items	16.837.504	19.849.781
CAR		
CCAR (%)	11,65%	9,88%
Tier-1 CAR (%)	11,65%	9,88%
CASR (%)	21,27%	18,04%

2.3

Denizbank	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	40.214.126,00	40.214.126,00
2. CORGOLA	2.775.900,00	2.775.900,00

3. COABAONCU	0,00	0,00
4. COMDB	0,00	0,00
5. COIO	0,00	0,00
6. COBAII	8.465.586	8.465.586
7. COC	47.897.753,00	53.543.906,60
8. CORP	44.455.145,00	49.695.486,37
9. CSWREMFR	3.234.916,00	4.518.854,16
10. CSBRP	11.052.742,00	15.439.575,30
11. PDL	5.599.863,00	5.599.863,00
12. HRCDBTB	0,00	0,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	6.365,00	6.365,00
16. SI	13.374.148,00	13.374.148,00
17. OR	5.081.915,00	5.081.915,00
Total	182.158.459,00	198.715.725,43

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	24.019.049	24.019.049
Total risk weighted items	135.814.656	152.371.922
CAR		
CCAR (%)	13,09%	11,67%
Tier-1 CAR (%)	13,09%	11,67%

CASR (%)	17,69%	15,76%
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2.4

Fibabank	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	3.589.913,00	3.589.913,00
2. CORGOLA	0,00	0,00
3. COABAONCU	0,00	0,00
4. COMDB	0,00	0,00
5. COIO	0,00	0,00
6. COBAII	2.508.203	2.508.203
7. COC	11.249.554,00	12.575.643,55
8. CORP	3.344.800,00	3.739.082,68
9. CSWREMFR	268.366,00	374.880,47
10. CSBRP	1.245.726,00	1.740.154,65
11. PDL	356.201,00	356.201,00
12. HRCDBTB	54.222,00	54.222,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	83.713,00	83.713,00
16. SI	0,00	0,00
17. OR	988.747,00	988.747,00
Total	23.689.445,00	26.010.760,35

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	3.664.995	3.664.995
Total risk weighted items	18.749.737	21.071.052
CAR		
CCAR (%)	8,90%	7,92%
Tier-1 CAR (%)	10,38%	9,24%
CASR (%)	19,55%	17,39%

2.5

Garanti	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	208.686.564,00	208.686.564,00
2. CORGOLA	1.227.448,00	1.227.448,00
3. COABAONCU	545.616,00	545.616,00
4. COMDB	2.806.338,00	2.806.338,00
5. COIO	0,00	0,00
6. COBAII	39.374.770	39.374.770
7. COC	285.472.606,00	319.123.916,96
8. CORP	174.761.414,00	195.362.167,15
9. CSWREMFR	13.560.474,00	18.942.626,13
10. CSBRP	29.936.742,00	41.818.634,90
11. PDL	12.468.530,00	12.468.530,00
12. HRCDBTB	1.590.154,00	1.590.154,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00

15. UFCIIMF	0,00	0,00
16. SI	18.446.600,00	18.446.600,00
17. OR	31.172.302,00	31.172.302,00
Total	820.049.558,00	891.565.667,14

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	61.861.863	61.861.863
Total risk weighted items	316.152.290	387.668.399
CAR		
CCAR (%)	17,00%	13,86%
Tier-1 CAR (%)	17,00%	13,86%
CASR (%)	19,57%	15,96%

2.6

Halkbank	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	124.049.755,00	124.049.755,00
2. CORGOLA	3.097.478,00	3.097.478,00
3. COABAONCU	683.403,00	683.403,00
4. COMDB	61.820,00	61.820,00
5. COIO	0,00	0,00

6. COBAII	8.657.377	8.657.377
7. COC	159.760.536,00	178.592.996,15
8. CORP	86.993.317,00	97.248.028,31
9. CSWREMFR	43.874.538,00	61.288.342,13
10. CSBRP	30.060.577,00	41.991.620,01
11. PDL	6.746.506,00	6.746.506,00
12. HRCDBTB	0,00	0,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	0,00	0,00
16. SI	3.494.455,00	3.494.455,00
17. OR	21.622.273,00	21.622.273,00
Total	489.102.035,00	547.534.053,61

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	46.543.894	46.543.894
Total risk weighted items	324.748.061	383.180.080
CAR		
CCAR (%)	9,84%	8,34%
Tier-1 CAR (%)	11,67%	9,89%
CASR (%)	14,33%	12,15%

ING	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	12.386.649,00	12.386.649,00
2. CORGOLA	1.019.827,00	1.019.827,00
3. COABAONCU	0,00	0,00
4. COMDB	0,00	0,00
5. COIO	0,00	0,00
6. COBAII	6.651.153	6.651.153
7. COC	20.268.297,00	22.657.509,66
8. CORP	12.942.789,00	14.468.475,91
9. CSWREMFR	1.044.716,00	1.459.363,78
10. CSBRP	1.563.289,00	2.183.758,40
11. PDL	253.061,00	253.061,00
12. HRCDBTB	1.114.344,00	1.114.344,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	0,00	0,00
16. SI	2.609.829,00	2.609.829,00
17. OR	92.674,00	92.674,00
Total	59.946.628,00	64.896.644,75

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	12.458.250	12.458.250
Total risk weighted items	46.444.698	51.394.715

CAR		
CCAR (%)	17,83%	16,11%
Tier-1 CAR (%)	17,83%	16,11%
CASR (%)	26,82%	24,24%

2.8

Odeabank	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	6.953.506,00	6.953.506,00
2. CORGOLA	0,00	0,00
3. COABAONCU	0,00	0,00
4. COMDB	168.014,00	168.014,00
5. COIO	2,00	2,00
6. COBAII	4.544.602	4.544.602
7. COC	12.210.991,00	13.650.414,07
8. CORP	728.967,00	814.897,12
9. CSWREMFR	0,00	0,00
10. CSBRP	4.755.437,00	6.642.869,95
11. PDL	800.261,00	800.261,00
12. HRCDBTB	14.730,00	14.730,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00

15. UFCIIMF	0,00	0,00
16. SI	0,00	0,00
17. OR	1.585.767,00	1.585.767,00
Total	31.762.277,00	35.175.063,14

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	5.558.945	5.558.945
Total risk weighted items	25.575.654	28.988.440
CAR		
CCAR (%)	14,08%	12,42%
Tier-1 CAR (%)	14,08%	12,42%
CASR (%)	21,74%	19,18%

2.9

İşbankası	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	143.667.258,00	143.667.258,00
2. CORGOLA	144.922,00	144.922,00
3. COABAONCU	428.064,00	428.064,00
4. COMDB	331,00	331,00
5. COIO	0,00	0,00

6. COBAII	26.069.632	26.069.632
7. COC	204.233.221,00	228.308.090,13
8. CORP	77.240.762,00	86.345.848,96
9. CSWREMFR	14.259.232,00	19.918.721,18
10. CSBRP	21.176.664,00	29.581.681,94
11. PDL	8.557.443,00	8.557.443,00
12. HRCDBTB	503.903,00	503.903,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	1.273.213,00	1.273.213,00
16. SI	21.504.378,00	21.504.378,00
17. OR	15.576.032,00	15.576.032,00
Total	534.635.055,00	581.879.518,21

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	69.198.849	69.198.849
Total risk weighted items	387.338.812	434.583.275
CAR		
CCAR (%)	14,97%	13,34%
Tier-1 CAR (%)	14,97%	13,34%
CASR (%)	17,87%	15,92%

QNB	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	49.934.775,00	49.934.775,00
2. CORGOLA	83.158,00	83.158,00
3. COABAONCU	226.521,00	226.521,00
4. COMDB	0,00	0,00
5. COIO	0,00	0,00
6. COBAII	7.719.882	7.719.882
7. COC	62.028.318,00	69.340.172,71
8. CORP	54.967.943,00	61.447.525,64
9. CSWREMFR	2.662.222,00	3.718.857,91
10. CSBRP	2.684.468,00	3.749.933,35
11. PDL	2.094.568,00	2.094.568,00
12. HRCDBTB	237.398,00	237.398,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	0,00	0,00
16. SI	1.682.670,00	1.682.670,00
17. OR	7.829.812,00	7.829.812,00
Total	192.151.735,00	208.065.273,61

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	24.280.307	24.280.307
Total risk weighted items	154.338.272	170.251.811

CAR		
CCAR (%)	11,13%	10,09%
Tier-1 CAR (%)	13,15%	11,92%
CASR (%)	15,73%	14,26%

2.11

Şekerbank	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	6.296.207,00	6.296.207,00
2. CORGOLA	35.032,00	35.032,00
3. COABAONCU	36.286,00	36.286,00
4. COMDB	0,00	0,00
5. COIO	0,00	0,00
6. COBAII	2.485.809	2.485.809
7. COC	9.886.142,00	11.051.513,50
8. CORP	6.954.905,00	7.774.744,33
9. CSWREMFR	925.770,00	1.293.208,11
10. CSBRP	4.008.454,00	5.599.409,39
11. PDL	929.283,00	929.283,00
12. HRCDBTB	220.398,00	220.398,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00

15. UFCIIMF	0,00	0,00
16. SI	0,00	0,00
17. OR	2.998.604,00	2.998.604,00
Total	34.776.890,00	38.720.494,34

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	3.003.714	3.003.714
Total risk weighted items	22.415.724	26.359.328
CAR		
CCAR (%)	8,07%	6,86%
Tier-1 CAR (%)	9,18%	7,81%
CASR (%)	13,40%	11,40%

2.12

TEB	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	22.823.692,00	22.823.692,00
2. CORGOLA	1.244.288,00	1.244.288,00
3. COABAONCU	0,00	0,00
4. COMDB	0,00	0,00
5. COIO	0,00	0,00
6. COBAII	12.538.427	12.538.427

7. COC	31.953.880,00	35.720.581,01
8. CORP	30.102.777,00	33.651.271,28
9. CSWREMFR	5.619.543,00	7.849.939,62
10. CSBRP	6.748.879,00	9.427.509,08
11. PDL	1.870.668,00	1.870.668,00
12. HRCDBTB	0,00	0,00
13. SBM	0,00	0,00
14. STCASTCCOBAIL	0,00	0,00
15. UFCIIMF	0,00	0,00
16. SI	132.920,00	132.920,00
17. OR	4.337.761,00	4.337.761,00
Total	117.372.835,00	129.597.056,98

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	14.339.636	14.339.636
Total risk weighted items	84.609.081	96.833.303
CAR		
CCAR (%)	12,14%	10,61%
Tier-1 CAR (%)	12,14%	10,61%
CASR (%)	16,95%	14,81%

Vakifbank	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	132.777.153,00	132.777.153,00
2. CORGOLA	10.782.706,00	10.782.706,00
3. COABAONCU	460.599,00	460.599,00
4. COMDB	11.952,00	11.952,00
5. COIO	0,00	0,00
6. COBAII	16.238.469	16.238.469
7. COC	153.694.238,00	171.811.607,19
8. CORP	70.130.612,00	78.397.559,45
9. CSWREMFR	28.893.457,00	40.361.270,08
10. CSBRP	32.388.907,00	45.244.064,19
11. PDL	5.133.585,00	5.133.585,00
12. HRCDBTB	197.804,00	197.804,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	0,00	0,00
16. SI	3.086.724,00	3.086.724,00
17. OR	13.930.882,00	13.930.882,00
Total	467.727.088,00	518.434.374,91

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	51.694.358	51.694.358
Total risk weighted items	311.140.871	361.848.158

CAR		
CCAR (%)	10,48%	9,01%
Tier-1 CAR (%)	13,59%	11,69%
CASR (%)	16,61%	14,29%

2.14

YKB	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	101.579.432,00	101.579.432,00
2. CORGOLA	0,00	0,00
3. COABAONCU	103.390,00	103.390,00
4. COMDB	10.915,00	10.915,00
5. COIO	0,00	0,00
6. COBAII	37.947.395	37.947.395
7. COC	161.449.944,00	180.481.550,38
8. CORP	74.138.956,00	82.878.404,24
9. CSWREMFR	10.686.535,00	14.928.020,74
10. CSBRP	14.423.437,00	20.148.099,15
11. PDL	6.497.024,00	6.497.024,00
12. HRCDBTB	186.525,00	186.525,00
13. SBM	0,00	0,00
14. STCASTCCOBAII	0,00	0,00
15. UFCIIMF	4.997,00	4.997,00
16. SI	8.309.081,00	8.309.081,00
17. OR	13.753.425,00	13.753.425,00
Total	429.091.056,00	466.828.258,51

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	54.589.297	54.589.297

Total risk weighted items	306.434.651	344.171.854
CAR		
CCAR (%)	13,33%	11,87%
Tier-1 CAR (%)	14,59%	12,99%
CASR (%)	17,81%	15,86%

2.15

Ziraat Bankası	Before Shocks	After Shocks
Current period	Total Risk Amount	
Risk classifications		
1. COSACB	182.801.985,00	182.801.985,00
2. CORGOLA	486.285,00	486.285,00
3. COABAONCU	1.582.405,00	1.582.405,00
4. COMDB	0,00	0,00
5. COIO	0,00	0,00
6. COBAII	83.185.932	83.185.932
7. COC	225.352.081,00	251.916.426,56
8. CORP	144.887.685,00	161.966.943,89
9. CSWREMFR	59.450.082,00	83.045.819,55
10. CSBRP	8.660.292,00	12.097.561,89
11. PDL	3.172.906,00	3.172.906,00
12. HRCDBTB	4.100.991,00	4.100.991,00

13. SBM	0,00	0,00
14. STCASTCCOBAIL	0,00	0,00
15. UFCIIMF	4.582.901,00	4.582.901,00
16. SI	153.641,00	153.641,00
17. OR	27.127.401,00	27.127.401,00
Total	745.544.587,00	816.221.198,89

Shareholders' Equity	Before Shocks	After Shocks
Total shareholders' equity	83.636.178	83.636.178
Total risk weighted items	491.404.718	562.081.330
CAR		
CCAR (%)	14,10%	12,33%
Tier-1 CAR (%)	15,98%	13,97%
CASR (%)	17,02%	14,88%

CURRICULUM VITAE

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Budapest-Hungary

Professional Summary

Dynamic banking professional adept at directing complex projects and leading high-performance teams to complete key financial initiatives.

Meticulous banking professional, excellent at juggling multiple tasks and working under pressure.

Experience

Risk Process Validation - Associate (09.2019 –Currently)

Morgan Stanley (Budapest-Hungary)

- Conducting independent validation of global Firm Risk Management processes, including Credit, Market and Operational Risk processes and controls by applying internal audit methodology
- Executing independent validation of the Firm's annual CCAR submission to the Federal Reserve
- Validating risk-based data, documenting and reporting review results, preparing review memos
- Evaluating design and operating effectiveness of internal controls, including ongoing monitoring and outcome analysis of Risk Management processes

Internal Auditor (07.2015 –09.2019)

BBVA (Istanbul-Turkey)

- Provide capital adequacy ratio auditing on credit risk, market risk and operational risk.
- Provide liquidity, market risk and business model risk audits.
- Expert in retail banking products (i.e., mortgages, business loans, consumer loans, Market and Structural Risks (Liquidity & IRRBB))
- Provide ICAAP report (Solo & Consolidated) audits
- Provide Market and Liquidity stress test audits

Education

Turkish-German University-MSc (Istanbul, Turkey)

Master of Science | International Finance – 3,27 (2021)

TOBB University of Economics and Technology-BA (Ankara, Turkey)

Bachelor of Arts | Major in Business Administration – 3,28 (2015)

Universidad Católica de Ávila (Avila, Spain)

International exchange (Erasmus) for six months | Major in Business Administration – 3,28 (08.2013-02.2014)

Skills

R, SQL, Data Analysis and Data Mining

Languages

Turkish (Native), English (Fluent), German (B2), Spanish(B1)

Certificates

The Institute of Internal Auditors - Certified Internal Auditor (CIA), Credential ID: 157761, IIA

GARP FRM Program - Financial Risk Manager (FRM®), Credential ID: 644842