THREE ESSAYS IN TURKISH BANKING: DEVELOPMENT BANKS, ISLAMIC BANKS AND COMMERCIAL BANKS

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Abstract

This thesis is composed of three empirical chapters each of which examines separate segments of Turkish banking system from different perspectives. First empirical chapter investigates regional loan distribution of development banks. The findings in this chapter suggest that political connection has played a significant role in development lending. There is also geographical bias which leads to higher volumes of loans in the regions close to the capital city. Second empirical chapter examines Islamic banks and compares them with conventional banks in terms of profitability and competition grounds. The results reveal that Islamic banks earn more returns with respect to conventional banks. The results also suggest that the regulatory changes of the last decade improve market power of these banks. The last empirical chapter investigates micro structure of Repo and Reverse Repo Market of Turkey in which only commercial banks can transact. This chapter initially presents the network topologies of this market that helps one to understand the characteristics of complex network in this market. This chapter then computes a connectivity measure and investigates the drivers of connectivity out of domestic and external factors. Although results provide very rich insights, external factors dominate the behaviour of network in this market.

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Abbreviations

2SLS Two–staged Least Squares

ADF Augmented Dickey–Fuller

AIC Akaike Information Criterion

ARCH Autoregressive Conditional Heteroscedasticity

BAT Banks Association of Turkey

BIST–100 Borsa Istanbul 100 Index

BNDES The National Bank for Economic and Social Development

CBRT Central Bank of the Republic of Turkey

CCR Canonical Cointegration Regression

CDS Credit Default Swap

DOLS Dynamic Ordinary Least Squares

EU European Union

EURIBOR Euro Interbank Offer Rate

FE Fixed Effects

FGLS Feasible Generalised Least Squares

FMOLS Fully Modified Ordinary Least Squares

FPE Final Prediction Error

FSB Financial Stability Board

G–20 Group of Twenty

GARCH Generalised Autoregressive Conditional Heteroscedasticity

GIN Giant In–components

GLS Generalised Least Squares

GMM Generalised Method of Moments

GOUT Giant Out–components

GSCC Giant Strongly Connected Components

GWCC Giant Weakly Connected Components

HQ Hannan–Quinn Information Criterion

IID Independent and Identically Distributed

ISI Import Substitution Industrialisation

IV Instrumental Variable

LM Lagrange Multiplier

LTCM Long Term Capital Management

ML Maximum Likelihood

NEIO New Empirical Industrial Organisation

NPL Non–performing Loans

OECD Organisation of Economic Cooperation and Development

OLS Ordinary Least Squares

PLS Profit–and–Loss–Sharing

P–R Panzar–Rosse

PSM Propensity Scroe Matching

RE Random Effects

ROA Return on Asset

ROE Return on Equity

RRRM Repo and Reverse Repo Market

SCM Synthetic Control Method

SCP Structural Conduct Performance

SDIF Savings Deposits Insurance Fund of Turkey

SFH Special Finance House

SFHA Special Finance House Association

SIFI Systemically Important Financial Institution

SWARCH Regime Switching Autoregressive Conditional Heteroscedasticity

TRLIBOR Turkish Lira Interbank Offer Rate

TSKB Turkish Industrial Development Bank

UK United Kingdom

USA United States of America

VAR Vector Autoregressive Model

VIX Chicago Board Options Exchange Volatility Index

1 Background of the Thesis

1.1 Motivation of the Thesis

Banking systems in emerging market economies reveal common stylised facts in the past couple of decades. The necessity of rapid industrialisation pushed less developed countries to seek sustainable pathways to development. State emerged as a device to ensure sustainable industrialisation during the post–war period when world economy experienced an economic boom. Although development discourse ahead of the 1980s rationalised state intervention in the financial sector (Boskey, 1961; Gerschenkron, 1962; Diamond, 1957; Basu, 1966; Cameron, 1953), the role of state in financial sector had gradually diminished by paving the way for free market dynamics and extensive liberalisation (Goldsmith, 1969; McKinnon, 1973; Shaw, 1973). State has relinquished from many aspects of the economy once liberalisation put into implementation in emerging market countries, to facilitate the integration of local markets with global markets. Certain achievements in efficiency, productivity and competitiveness in the banking systems of emerging market countries could be accepted as the success of liberalisation, yet structural weaknesses of emerging market countries led to chronic economic crises, e.g. Russia, Asia, Latin America, and Turkey (Reinhart and Kaminsky, 1999; Demirgüç-Kunt and Detragiache, 1998; Duttagupta and Cashin, 2011).

The experience of Turkish banking system is not an exception. The economy benefited from the global economic boom under the presence of state in the economy, before the 1980s. The banking system that was under the heavy control of the state has been the promoter of the growth. The role of state in the national economy was reduced considerably after the liberalisation policies of the 1980s (Akyuz and Boratav, 2002; Onis and Guven, 2011). Whilst the removal of several entry barriers and various statutory changes brought certain level of efficiency and productivity gains, structural problems in banking sector hindered devising a coherent strategy for development financing. The severe economic crisis in February 2001 (hereafter

the 2001 crisis) which was triggered by the structural problems in the banking system hit the country significantly. A large body of regulatory and statutory changes was set to overhaul a dysfunctional system, though there is still much to do for the improvement in both economy and the banking system (Saltoglu, 2013).

The operations in Turkish banking system, till the 1980s, were shaped by state–led development strategies. The system which was mainly formed by commercial banks and development banks, became instrumental in planned industrialisation policies particularly after the early 1960s. This period marked by controlled interest rates, directed credit programs, high reserve requirements, and other restrictions on financial intermediation activities (Akyuz and Boratav, 2002). While these financial and regulatory policies were partially successful, they put high burden on the banking system by reducing competitiveness and efficiency. Many restrictions, e.g. interest rate controls, led to non–price competition in the system which proved to be inefficient (Denizer, 1997).

As part of an overarching stabilisation and structural adjustment program in the early 1980s; liberal measures have been implemented to overhaul the banking system, e.g. removal of barriers on market entry, strict control over interest rates and exchange rates. Relaxation of regulatory barriers has attracted a significant number of foreign and domestic banks into the system. Due to the early impacts of liberal measures, the number of commercial banks in the system increased from 43 in 1980 to 79 in 2000 (BAT, 2008). During this period, the number of foreign banks increased from 4 to 18. The market structure of Turkish banking sector experienced significant changes after new entries. The sector became more integrated into the global markets by improved technology and human capital base (Denizer, 1997). The reforms aiming at enhancing efficiency were arguably successful during liberalisation period. Isik and Hassan (2002) and Zaim (1995) report efficiency gains in Turkish banks after the 1980 liberalisation program. The removal of restrictions on cross border fund flows also enabled banking system to borrow in foreign exchange terms that relieved capital shortage in the country.

Despite its significant contribution to the overall restructuring of banking system, liberalisation policies have not been totally constructive for the Turkish economy. Sudden capital inflows led to the dollarisation of banking system which could not be diverted into productive investments. Financial intermediation of the sector declined significantly due to increasing needs of public sector (Gunalp and Celik, 2006) [1]. Banks invested foreign liabilities mainly to government securities which have been very lucrative due to high public financing needs. Gunalp and Celik (2006) report that the profitability of the Turkish banking system increased tremendously since high dollarisation of the banking system and high public borrowing requirement [2]. Governments' bid for more funds from banking system at higher interest rates have stimulated banks to borrow abroad. Due to administered foreign exchange policy of the Central Bank (low foreign exchange rates), huge risks loomed over the banking system due to unmanaged foreign exchange risk.

The restructuring of Turkish banking system after the 1980s proved to be unstable, the end result has been the 2001 crisis that was again dealt with a vast reform program [3]. New policy reforms in banking system after 2001 consisted of a long list of measures that aimed at restructuring of the banking system. Thanks to these reforms, the role of state in banking business has been restrained substantially. An autonomous regulatory and supervisory body namely Banking Regulation and Supervision Agency was established to reduce the politicised bank regulation before the 2000s. 20 banks were taken over by the Savings Deposit Insurance Fund between 1997 and 2003. Along with these radical changes, the banking system was

[1] BAT (2008) report that total credit to total deposit ratio has declined steadily till the 2000s from roughly 84% to 50%.

[2] Zaim (1995) argues that the real profits of the private commercial banks increased almost five–fold over the 1981–1990 period highly over the average profit level of manufacturing sector. The profitability of Turkish banking sector has also been well above the Organisation of Economic Cooperation and Development (OECD) average. Atiyas and Ersel (1996) claim that bank profitability in Turkish banking increased significantly during post–reform period in spite of the parallel increase in operating costs, and reached levels that were five times as high as the OECD average.

[3] Kazgan (1994) argues that Turkish economy became more dependent on foreign funds as a result of the early implementation of liberal policies. She further claims that these policies could have been more successful once they were put into implementation after the resolution of structural problems (Kazgan, 1994, p. 205).

put under severe scrutiny which had potential implications on the well–functioning of Turkish banking system. The structure of Turkish banking system, that faced potential changes after the implementation of liberal reforms in the 1980s, has been once again subject to change after the 2000s.

The problems of banking system after the 2001 crisis were partly resolved through successive policy measures. The banking system transformed itself by adopting international regulatory standards. Several public and private banks have been either liquidated or eliminated through merger and acquisition. Eventually, this restructuring has brought relative stability in the economy that enabled continuous growth of the country in the last decade. The reforms in the banking system during 1980–2000s and after the 2000s episodes have dramatically changed the sectoral outlook. Along a long path of reformation, the final restructuring after 2001 has categorised Turkish banking sector into three main categories: development banks, Islamic banks, and commercial banks [4].

1.2 Context of the Thesis

This thesis examines Turkish banking system beginning from 1960s and onwards. According to the definition of BAT (2008), this epoch is composed of three distinct periods. The first period includes 1960–1980 which is framed by state planning policies. During this period, the state aimed to control the whole economy in line with five year plans, which were also similarly adopted in other countries. This governmental strategy involved the redirection of banking resources in function of economic development. The second period, 1981–2001, was marked by liberalisation policies in the system. Throughout this period, financial markets of the country had been gradually opened to foreign capital inflows whereas foreign banks had started to enter into the national banking system. The third period marks the still ongoing process that has started after the 2001 domestic banking crisis. Over more than

[4] In Turkey, the category of development banks is originally named as development and investment banks. Investment banks are those institutions who provide long–term financing to projects. Islamic banks are known to be "participation banks" in the country. Throughout the thesis, development banks and Islamic banks will refer to these original categories.

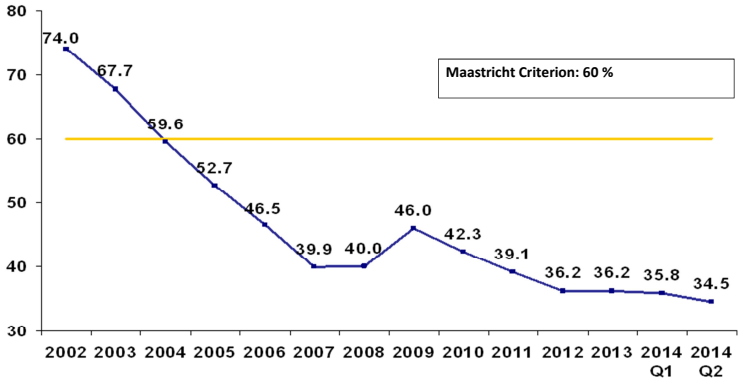
a decade, the country has progressed significantly to overhaul the banking system which had been repeatedly dysfunctional, disoriented and inefficient.

The early 1920s had been the hard times of the newly established Republic of Turkey (1923) who crumpled under the severe conditions of the World War I. The economy of the country relied on primitive agrarian economy where industrial entrepreneurship was relatively weak. The policymakers of the young country initially put a framework to support industry. Izmir Economy Congress (*Izmir Iktisat Kongresi* in Turkish) which took place in 1923 was the result of this endeavour and was successful in setting several concrete targets (BAT, 2008). The Congress underlined the urgency of an industry (development) bank to establish a strong industrial base in the country. Turkish Industry and Mining Bank (*Turkiye Sinai ve Maadin Bankasi* in Turkish) was established to accomplish this aim and several other banks which were directly involved in industrial production, e.g. *Sumerbank* and *Etibank* , were established afterwards to meet the urgent needs of the country. 1950s have been the time when the incentives for private sector and market economy were in practice. Private banks were encouraged to stimulate private ownership in industry and banking. Turkish Industrial and Development Bank (*Turkiye Sinai ve Kalkinma Bankasi* in Turkish) was established under the auspices of the World Bank to include private ownership in industrialisation and development.

So–called liberal policies of the 1950s eventually became unsuccessful and state controlled planning have gained particular importance. In the early 1960s, directed credits to targeted investments and sectors were partially effective in achieving high economic growth rates and low inflation. During this period, development banking had gained particular importance since the banking scheme was considered to be of vital importance to improve sectoral and regional development. The report prepared by BAT (2008) convey that five development banks and two commercial banks were established during this period. This report also argues that these banks were promoting development while planned economic policies were aiming to limit the number of banks to defend banking resources from fierce competition.

The struggle of the state to maintain development at desired levels during 1970s had failed due partly to the oil crises. The banking system proved to be inadequate to finance the needs of a growing economy due to low level of capital accumulation in the country. As a result, the state planning strategies were abandoned by the gradual endorsement of liberalisation policies. During this period, the state had adopted export oriented growth models in replace for import substitute industrialisation polices. This period encompasses the period of 1980s and 1990s and ends with the domestic crisis of 2001 which severely shook the banking system. The liberalisation of capital accounts had led to significant foreign capital inflows. By the 1990s, significant number of foreign banks also entered into the banking system and transformed the outlook of banking system which used to be state oriented beforehand. The inflow of foreign funds, however, could not be channelled to productive investments but were used to the finance government budget deficits. The structural weaknesses in the general economy and government budget resulted in two significant crises of 1994 and 2001.

Turkey experienced an economic crisis which was triggered by a severe banking crash that occurred in February 2001. The International Monetary Fund stepped in to rescue the Turkish economy after the crisis, and provided financial assistance worth of net 20.4 billion US Dollars (Yeldan, 2006). Following the crisis, the country has implemented an orthodox strategy of reducing fiscal deficits, raising interest rates and maintaining an overvalued exchange rate. In order to achieve these harsh fiscal and monetary goals, a massive privatisation program has been implemented so that the influence of state in the economy was further minimised. Problems related to government financing were the main reasons for the fragilities in Turkish banking system. As an outcome of this restructuring, Turkey succeeded to reduce its government debt stock significantly (see Figure 1.1). The reduction of high government financing needs have directly eliminated lucrative but unstable investment strategy of the banks in the system.



Note: Data is from the Central Bank of Turkey. Vertical axis shows the percentage figures and horizontal axis shows the years.

Figure 1.1: EU Defined General Government Gross Debt Stock to GDP 2002–2014 (%)

The early outcome of the policy measures in the banking system was the consolidation of the banking system. In fact during the process of on–going restructuring process, the size of banking system has expanded continuously. Table 1.1 shows the financial sector to GDP ratios for the world, emerging market countries and Turkey in 2001, 2008, 2010 and 2011. There exists a continuous and upward trend in the growth of banking system in Turkey. This continuous and upward trend is unique to Turkey. The banking systems of other emerging market countries, for instance, shrank in 2008. The importance of banking system is growing in Turkish financial markets since capital markets of the country experience fluctuation during the mentioned years.

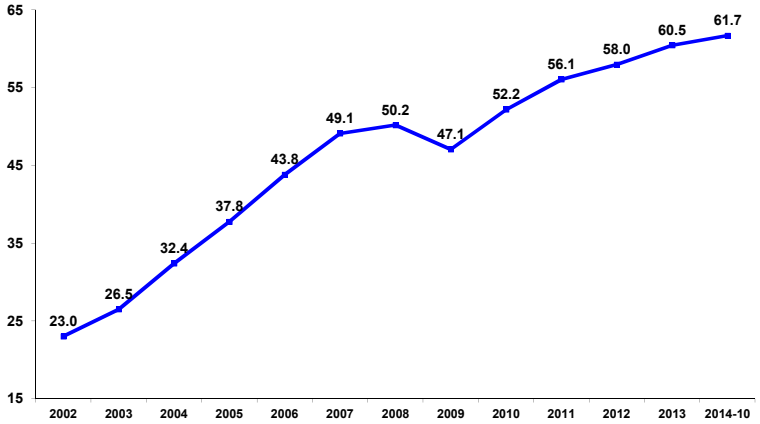
Table 1.1: Financial Sector Assets to GDP Ratios

	2001			2008			2010			2011		
	World	EM	Turkey	World	EM	Turkey	World	EM	Turkey	World	EM	Turkey
Bank Assets	256	140	69	160	87	75	171	106	91	158	100	94
Capital Markets	228	60	80	192	79	47	236	99	75	208	74	59
Total	484	199	149	352	167	121	407	204	166	366	174	153

Note: The data is collected from the International Monetary Fund. EM denotes for emerging market countries.

The importance of Turkish banking system as the intermediary institutions has also significantly increased (see Figure 1.2). The primary role of banking system which was to finance government budget financing before 2001 gradually converged to its ideal role. The ratio of loans to total assets was 23.0% in 2002 and gradually

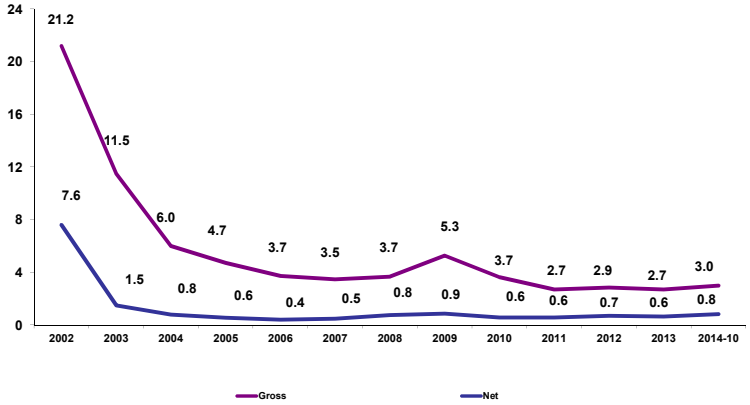
rose to 61.7% as of October 2014. Although there occurred a stagnation around 2008, probably due to the effect of the 2008 financial crisis, this disappeared shortly.



Note: Data is from the Banking Regulation and Supervision Agency of Turkey. Vertical axis shows the percentage figures and horizontal axis shows the years.

Figure 1.2: Loans to Assets in Turkish Banking System After 2001 (%)

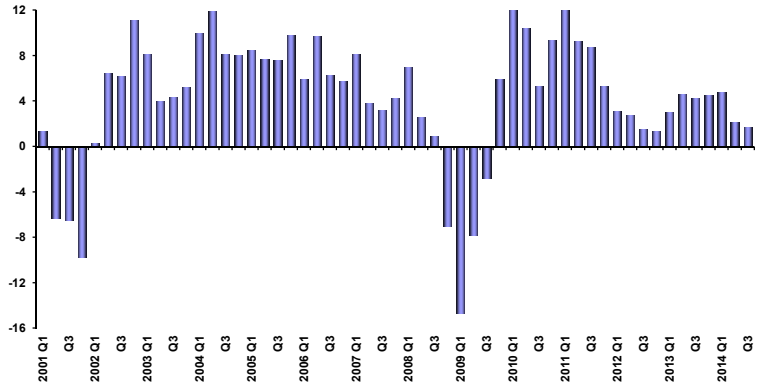
It is another fact that the quality of bank assets increased significantly indicating diminished credit risk in the banking system (see Figure 1.3). Although many emerging market countries and the EU countries have suffered from deteriorating asset portfolio in their banking system after 2008, the earlier restructuring and regulatory reforms in Turkey seem to constantly discipline the banking system. The share of gross and net non–performing loans in the banking system assets were 21.2% and 7.6% in 2002. It seems that the policymakers in the country prioritised cleansing non–performing loans in banking portfolio. The following three years after 2002 experienced a sharp reduction in the share of these ratios. Although 2008 financial crisis led to slight increase in non–performing loans, this was short–lived and the levels returned its pre–crisis levels.



Note: Data is from the Banking Regulation and Supervision Agency of Turkey. Vertical axis shows the percentage figures and horizontal axis shows the years. Gross non–performing loans is the sum of net non–performing loans plus the whole provisions.

Figure 1.3: Non–performing Loans to Assets in Turkish Banking System After 2001 (%)

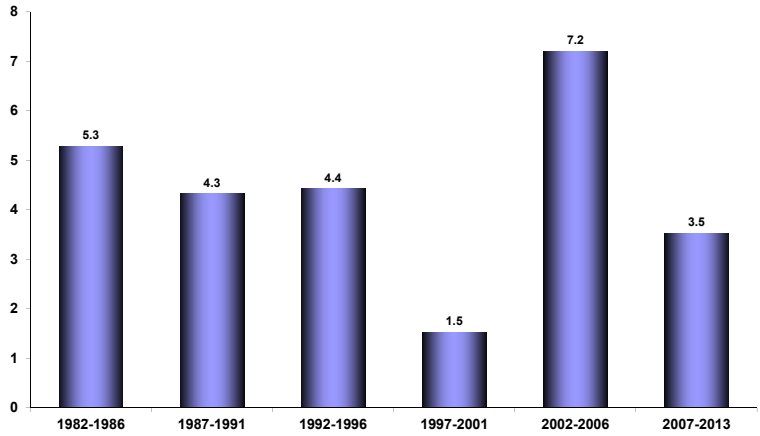
The 2008 financial crisis did not have significant adverse effect on the quality of assets in the banking system. This is probably due to the fact that the country experienced a severe but relatively short–lived recession during the 2008 financial crisis. Figure 1.4 shows quarterly gross domestic product series of the country since 2001. Beginning from the second quarter of 2001, Turkey has experienced consecutive negative growth for three quarters. Probably due to the funds borrowed from the International Monetary Fund, positive growth path was reached shortly. Positive and strong growth continued till the outbreak of the 2008 financial crisis. After negative growth for four quarter around 2009, however, the growth rates returned to positive territory.



Note: Data is from the Turkish Statistics Institute. Vertical axis shows the percentage figures and horizontal axis shows the quarters.

Figure 1.4: Quarterly GDP Growth Figures 2001Q1–2014Q3 (%)

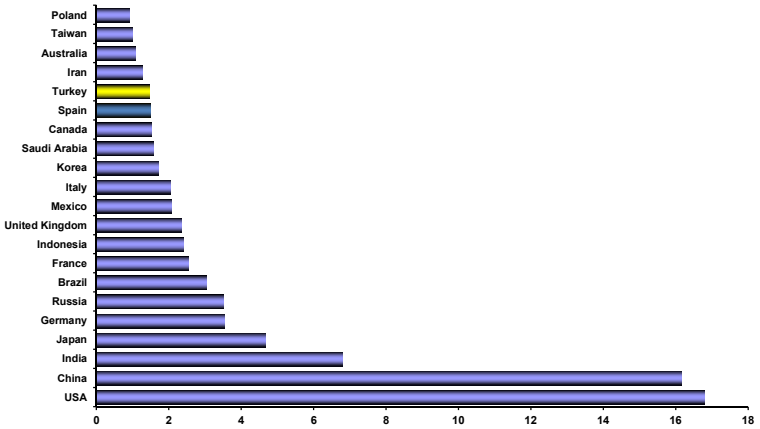
Turkey's growth experience after 2001 is remarkable in its history. Although many reform programs were initiated by the International Monetary Fund, this level of growth could not be achieved in its past four decades. Vigilant and rigorous implementation of regulatory reforms in the banking system has contributed to this achievement. Figure 1.5 demonstrates five year averages of growth figures beginning from 1982. 5.3% average growth rate is the highest average figure up until 2001. This can be the result of liberalisation policies pursued in the early 1980s. The figures turn out to be weaker while reaching the 2001. Average 7.2% growth rate is remarkable during 2002–2006, although it lowers in the consecutive five year.



Note: Data is from the Turkish Statistics Institute and Turkish Treasury. Vertical axis shows the percentage figures and horizontal axis shows the years.

Figure 1.5: Historical GDP Growth Figures of 1984–2013 (%)

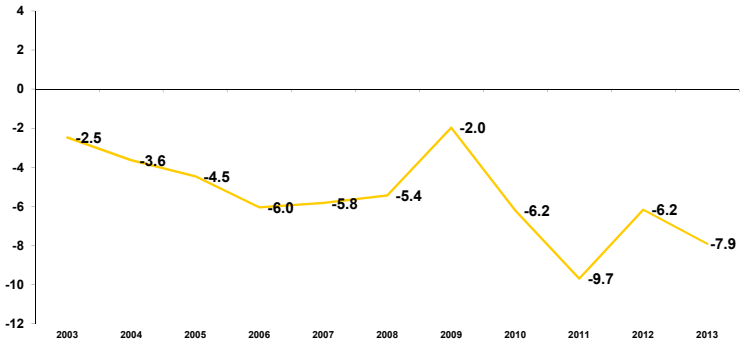
The contribution of regulatory reforms in the past decade to Turkey's growth potential is significant. The structural change in its economy and more healthy financial system brought the country to the higher rankings in terms of its GDP. Figure 1.6 shows that as of 2014 the country is ranked the largest 17^{th} country in the world. One of the lingering questions surrounding Turkey's economic outlook is the long–term potential growth.



Note: Data is from the International Monetary Fund World Economic Outlook, October 2014. Horizontal axis shows trillion Dollars based on purchasing power parity of 2013.

Figure 1.6: Purchasing Power Parity GDP Ranking of Turkey by 2014

It could be argued that regulatory efforts have helped Turkey to stay resilient during the 2008 financial crisis. It is now clear that the banking issues before 2001 have been resolved to some extent through an uninterrupted effort by policymakers. The Turkish experience after 2001 constitutes an interesting example of a structural change. This change was a natural outcome of the reduced role of the state in economy that is implicitly pushed by the reform program and massive regulatory changes in the banking system. A widespread privatisation of state economic enterprises and several state–owned banks and the implementation of vigorous supervision and regulation helped to sustain fiscal discipline on one side. On the other side, however, the economy still suffers from persistence in macroeconomic weakness, e.g. its current account deficit (see Figure 1.7).



Note: Data is from the Turkish Treasury and the Central Bank of Turkey. Vertical axis shows the percentage figures and horizontal axis shows the years.

Figure 1.7: The Ratio of Current Account Balance to GDP 2003–2013 (%)

Against this backdrop, the regulatory reforms and restructuring of banking system in Turkey in the last decade sets a good example for countries challenging similar problems. The regulations and vast reform agenda led to the liquidation of many private banks and privatisation of some state–owned banks. As of 2014, Turkish banking system is three–faceted: development and investment banks, participation (Islamic) banks and commercial banks. The outlook of banking system after long reformation can be seen in Table 1.2.

This success story, however, does not purely correspond to the absolute resolution of problems in the banking system. Saltoglu (2013) argues that despite positive changes in the system, Turkish banking system needs further structural macro reforms. From a wider perspective, the policies pursued in the past decade modified the public financing regularities and banking business. However, the structural issues in general economy, e.g. import–led growth, high current account deficits, and lack of strategic development policies, remain potential threats to the economy.

Table 1.2: Banks in Turkish Banking in 2014

Public Investment Banks		Foreign Commercial Banks Established in Turkey	
		26	ALTERNATIFBANK
1	ILLER BANKASI	27	ARAP TURK BANKASI
2	TURKIYE IHRACAT KREDI BANKASI	28	BANK OF TOKYO MITSUBISHI UFJ TURKEY
3	TURKIYE KALKINMA BANKASI	29	BURGAN BANK
Private Investment Banks		30	CITIBANK
4	AKTIF YATIRIM BANKASI	31	DENIZBANK
5	DILER YATIRIM BANKASI	32	DEUTSCHE BANK
6	GSD YATIRIM BANKASI	33	FINANSBANK
7	NUROL YATIRIM BANKASI	34	HSBC BANK
8	TAIB YATIRIMBANK	35	ING BANK
9	TURKIYE SINAI KALKINMA BANKASI	36	ODEA BANK
Foreign Investment Banks Established in Turkey		37	RABOBANK
10	BANKPOZITIF KREDI VE KALKINMA BANKASI	38	TURKLAND BANK
11	MERRILL LYNCH YATIRIM BANK	Branches of Foreign Banks Established Outside of Turkey	
12	STANDARD CHARTERED YATIRIM BANKASI TURK	39	BANK MELLAT
Public Commercial Banks		40	HABIB BANK LIMITED
13	T.C. ZIRAAT BANKASI	41	INTESA SANPAOLO S.P.A.
14	TURKIYE HALK BANKASI	42	JP MORGAN CHASE BANK NATIONAL ASSOCIATION
15	TURKIYE VAKIFLAR BANKASI	43	SOCIETE GENERALE S.A.
Private Commercial Banks		44	THE ROYAL BANK OF SCOTLAND PLC.
16	AKBANK	Participation Banks	
17	ANADOLUBANK	45	ALBARAKA TURK KATILIM BANKASI
18	FIBABANKA	46	ASYA KATILIM BANKASI
19	EKERBANK	47	KUVEYT TURK KATILIM BANKASI
20	TEKSTIL BANKASI	48	TURKIYE FINANS KATILIM BANKASI
21	TURKISH BANK		
22	TURK EKONOMI BANKASI		
23	TURKIYE GARANTI BANKASI		
24	TURKIYE I BANKASI		
25	YAPI VE KREDI BANKASI		

Note: This table reports the banks in Turkish banking system. This table is designed according to the classification of the Banks Association of Turkey. Public Investments, Private Investment Banks, and Private Established Banks in Turkey are under Development and Investment Banks. Participation Banks are the Islamic Banks and the remaining banks are the commercial banks.

In this thesis, the first and partially the second period in Turkish banking system is examined over development lending in the first empirical chapter. Having said that development banking was the dominant banking scheme in the system in these periods, the evidence about development banking would shed light on these periods of Turkish banking. Development banking is squeezed by two competing views: banking and development views (World Bank, 2012). On the one hand, development banks are mainly development financing institutions and are framed by the development tasks. On the other hand, these banks are under pressure to remain profitable in a banking system. During the first and second period, Turkish development banking was focused on alleviating regional imbalances and poverty and promote industrialisation (Öztürk et al., 2010; BAT, 2008). The poorest regions in Turkey are on the eastern and south–eastern part and the most industrialised regions are on the western and north–western part. The development view suggests that development loans are extended to the distant regions of Turkey, once it is considered that the capital city which locates in the middle of the country was the financial centre of the time. The banking view, however, suggests that due to increasing moral hazard problems and adverse selection concerns with rising proximity, the distant regions will be the disadvantageous parts of the country. This relationship is called spatial dimension of lending and indicates regional bias. Since development banks are mostly state–owned banks, development lending is expected to be under influence of politics. The politics can be influential on two dimensions. The first dimension is the political connection of local political managers with ruling party. It can be argued that close political connection spur development lending to a city. It can be further argued that the election periods change the lending behaviour. Against this backdrop, the following hypotheses are tested in the first empirical chapter.

1. *Hypothesis 1*: Spatial dimension of lending is not operative in regional development lending of Turkey, since the distant regions are the target regions (poorest and most industrialised).

2. *Hypothesis 2*: Political connection of local political managers (mayors) with

the ruling party increases development lending to a city.

3. *Hypothesis 3*: Development lending increases before the elections and starts to decrease when the elections are over.

The third period of Turkish banking system is studied over Islamic banks and commercial banks in the second and third empirical chapters. Islamic banking is getting wider interest because of their potential contribution to financial stability. Turkey has implemented several regulatory reforms targeting Islamic banks in line with rising interest. Islamic banking in Turkey is growing and the government has implemented several regulations in the last decades targeting Islamic banks in Turkey. In the second empirical chapter, the existence of *Shariah* arbitrage is examined. *Shariah* arbitrage simply asserts that Islamic banking exploit "Islamic" status since Islamic banks operate in a demand–driven industry in which the customers are ready to pay a premium for *Shariah* compliant financial products and services. Religious commitments motivate Islamic bank customers to purchase expensive *Shariah* compliant product and services simply because these are religiously permissible. *Shariah* arbitrage is widely argued in scholar circles but never empirically examined. The presence of *Shariah* arbitrage have important policy implications. First, Islamic banks operating in a demand–driven market have incentives to generate high profits which can be detrimental to customer welfare. Second, it can distort competition in a dual–banking system where conventional and Islamic banks operate together. In the second chapter, we test the following hypothesis from a wide perspective.

1. *Hypothesis 1*: *Shariah* arbitrage exists in Turkish Islamic banking since Islamic bank customers are ready to purchase expensive *Shariah* compliant product and services.

The third empirical chapter examines the network structure of Repo and Reverse Repo Market in Turkey. This chapter would reflect to what extent policymakers in Turkey have been successful in the regulation and supervision of banking system

since the third period of Turkish banking system is marked by a wide set of regulatory reforms in Turkey. It is argued that the triggering effect of the 2001 domestic crisis in Turkey was the collapse of a systemically important financial institution in Turkish banking system (Kuzubas et al., 2014). Kuzubas et al. (2014) argue that the failure of a small and unnoticeable institution blocked the fund flows in the repo market of Turkey and the Central Bank was unable to open this blockage. The importance of the network structure of financial markets gained significant importance when the failure of Lehman Brother's increased the risk of cascaded defaults. ECB (2010) asserts that systemically important financial institutions and the network characters of financial markets can be identified by the tools provided by network theory. Moreover, Celik (2013) argues that financial networks of Turkey are mainly dominated by a few banks implying that the failure of these banks can have severe impact on the stability in Turkish financial markets. Departing from this point, the following hypotheses are tested in the third empirical chapter.

1. *Hypothesis 1*: Network theory reveals the dominant structure of Repo and Reverse Repo Market in Turkey which is heavily used by a few institutions.

2. *Hypothesis 2*: External and domestic factors drive connectivity in Repo and Reverse Repo Market in Turkey.

3. *Hypothesis 3*: Turkish policymakers are experienced to curb the adverse effects of external and domestic factors on the connectivity in financial networks.

1.3 Objectives and Contribution of the Thesis

The scholarly interest toward Turkish banking sector is increasing. After 2001, a variety of topics including profitability, concentration, efficiency, performance, competition etc. have been studied in Turkish case. These studies mainly investigate commercial banks in the system (George Assaf et al., 2013; Isik and Hassan, 2002, 2003a,b; Aysan and Ceyhan, 2008), a proper research that covers all the segments of the banking system is yet to come. In this thesis, I investigate three segments of

Turkish banking system: development banks, Islamic banks, and commercial banks via three empirical chapters.

The aim of this study is to fill the gap in the literature by focusing on different topics on Turkish banking system that are scarcely studied. The need for full–fledged studies in emerging market countries is more pronounced because volatilities in these economies and fragilities of their banking systems open up new research venues. It should be clear that further evidence on almost every strand of banking system will provide an insightful dimension to policymakers in the country. Turkish case makes a study interesting, since the country has diverse and dynamic economy, which is now the world's 17^{th} largest, and is increasing its per capita income and economic growth potential. Nonetheless, the country also suffers from the high volatility as a result of structural weaknesses, for instance low saving rates and persistent high inflation. Studying Turkish banking system makes a research even more interesting, because numerous legal, structural and institutional reforms occurred just in last two decades and there is room for further improvement (Saltoglu, 2013). Indeed, many studies highlighted Turkish banking system, yet there is still very much room for investigation and further evidence. This thesis investigates Turkish banking system by covering all its three segments and has the following three broad objectives:

1. To analyse the regional development banking activities in Turkey during 1963–1994 with respect to the effect of political connection, spatial dimension and electoral cycle.

2. To investigate whether or not Islamic banks in Turkey exploit their brand name and earn excess profit during 2003–2011.

3. To investigate the network topologies and the drivers of connectivity in Repo and Reverse Repo Market of Turkey during between during 2007–2012.

The contribution of this study to the literature is many–fold. *First*, to the best of the author's knowledge, this is the first study to examine regional development banking activities in Turkey. Development banking has been an influential policy

tool in Turkish economy but the evidence about development banking in the country is rather scant. The literature, therefore, does not provide any insight about the merits or the drawbacks of development lending in Turkey. This thesis fills this gap by investigating the role of political connection, spatial dimension and electoral cycle in regional shares of development loans in Turkey.

Second, this is the first study testing for the existence of *Shariah* arbitrage among Islamic banks of Turkey. The argument of *Shariah* arbitrage is widely debated in scholar circles, but the presence of it is never examined. This thesis examines *Shariah* arbitrage over profitability of Islamic banks and conventional banks in Turkey. *Third*, this study examines the impact of legislative changes on Islamic banks that could have potential impact on profitability. For this purpose, Synthetic Control Method is employed which is not applied in banking literature. *Fourth*, this study examines the market structure in Turkish banking system by including Islamic banks. The hitherto studies excluded Islamic banks and only covered conventional banks. In including Islamic banks, this study aims to observe whether Islamic banks have relatively high market power which can be the outcome of *Shariah* arbitrage. As a separate analysis, this study also examines the impact of legislative changes on the competitive conditions of Islamic banks.

Fifth, this study investigates the network topologies of Repo and Reverse Repo Market in Turkey. The central bank heavily intervenes in this market and uses the repo rates as the base rate for monetary policy purposes. The literature does not have any evidence on the network structure of this market, and to the best of author's knowledge, the network structure is not monitored by the policymakers in the country. Within this context, this study first aims to uncover the topological properties of Repo and Reverse Repo Market, and then identify the systemically important financial institutions in the market over centrality measures. As a *final* contribution, this study extends the use of network theory by investigating the drivers of connectivity in a financial network. In doing so, this study aims to uncover the relationship between connectivity and several domestic and external dynamics

in an emerging market economy. The studies in the literature mainly conduct simulation exercises but do not explore the dynamics behind the topological properties of financial networks. The findings would be indicative for policymakers in emerging market countries since central banks started to pursue macroprudential policies that span all segments of financial markets.

1.4 Structure of the Thesis

The thesis consists of three empirical chapters that have separate data sets and different topics. I organise each chapter as a standalone essay. The chapter titled as "Regional Loan Distribution in Turkey: The Role of Distance, Political Connection, and Electoral Cycle" will be the first empirical chapter and investigates development banks. "Profitability, Asset Quality and Market Structure: Conventional Banks versus Islamic Banks in Turkey" is the second empirical chapter and examines Islamic banking extensively. I investigate interconnections in Repo and Reverse Repo Market in the third empirical chapter entitled as "Interconnections in Turkish Repo and Reverse Repo Market". I will summarize the overall findings and discuss policy recommendations separately in the final chapter.

The first empirical chapter examines development banks in Turkey. Development banks are special forms of banking that differentiate themselves from conventional banks by extending long term loans to socially beneficial projects or profitable projects that need high volume of debt capital. The focus of the lending activity of development banks is not merely intermediary services but rather development activities. These institutions assist to promote, support and monitor a range of development activities, though their primary role has been the spurt of industrial development. The role of development banks in development process is well recognised but inadequately studied. The literature regarding development banks relies on a handful of novel books written by development economists who laid down the historical background and motivations of development banking (Boskey, 1961; Diamond, 1957; Basu, 1966; Cameron, 1953). Empirical evidences are rather scarce,

and lack country experiences. Among a few papers, Armendariz de Aghion (1999) explains the performance of development banking using a theoretical model and concludes that government support in promoting development is viable but the efficiency of development loans that can be achieved by co–financing arrangements and or co–ownership with private financial institutions also matter. Odedokun (1996) examines the effects of directed credit programmes of development lending on efficiency of resource allocation in selected developing countries. He finds evidence that development lending failed to improve efficiency and enhance resource allocation in the examined countries.

Development banks in Turkey, were among the important institutions especially during state–led industrialisation period (import substitution industrialisation) of the 1960s to the 1970s (Onis and Guven, 2011). The share of development loans to total loans in the system was higher than 30% during the 1960s, although the liberalisation waves led to a steady fall in the amount of development loans. Development banking scheme was extensively utilised during the early stages of industrialisation in Turkey. In need of an urgent and rapid industrialisation, policymakers in Turkey utilised development banking scheme in compliance with development plans that were prepared by five year intervals.

In the first empirical chapter, I investigate development banks by using annual regional data during 1963 and 1994. In particular, I try to find out the drivers of development lending across its regions. Development banks played an important role in Turkish development experience, interestingly though, the empirical evidence is extremely scarce in this strand of banking system. The scarcity was probably due to lack of reliable data source which was partly remedied by new publications of Banks Association of Turkey. I investigate development banking from spatial dimension and political connection. To observe the differing aspects of development lending from commercial lending, I study regional commercial loans in Turkish banking system from identical perspectives.

Spatial dimension of lending simply implies that the closer the regions to financial

center more cheaper funds they get from banking activities (Porteous, 1995; Martin and Minns, 1995; Klagge and Martin, 2005). The spatial dimension of lending might be an important factor in development lending, since the regional data employed in this study reveals that the majority stake of development loans in Turkey were extended to the periphery of the capital city. Since lending decisions are taken in the capital city, I assume that regions close to the capital city were more likely to receive higher volumes of loans.

Empirical and theoretical evidence also show that politics is particularly influential in emerging market countries where a large part of banking sector is dominated by state–owned banks. Once that is considered that, development banks in the country are mainly state–owned, presumably, rent–seeking (Krueger, 1974; Posner, 1975; Bhagwati, 1982; Fisher, 1985) and corruption (Brown and Dinc, 2005; Dinc, 2005) can be influential in development lending. This chapter assumes that mayors who are elected from the ruling party are likely to use their power to attract higher volumes of loan to their regions. This chapter further assumes that ruling party may opt to pump up development loans around election years to guarantee their next term seats.

Second empirical chapter investigates Islamic banks in Turkey from profitability and market structure perspective. The failure of conventional banks during the 2008 financial crisis has paved the way for other means of financial intermediation (Beck et al., 2013; Čihàk and Hesse, 2010). Islamic banks seem to stay relatively resilient in the 2008 financial crisis and became an attraction for the global financial system.

Islamic banks in Turkey have been operating for over thirty years. These banks stayed resilient after the two episodes of financial crises in 2001 and 2008, and demonstrated a significant success by increasing its market share in the total system to 4.5% from nearly 1% in 2001. The growing financial capacity of religiously conservative public has been one of the main factors that led Islamic banks to grow at such high rate (Hardy, 2012). It can be argued that, these types of banks became the sole option for those people who are resistant to conventional banking. In

addition, a recent change in the legislation regulating the banking system has also created a favourable environment to Islamic banks [5].

In the second empirical chapter, I investigate whether Islamic banks are more profitable than their conventional counterparts in Turkish banking system, as a first step. Islamic banking shows key differences from conventional banking mainly because interest (*riba*) is prohibited in Islam (Kuran, 1983; Ebrahim and Safadi, 1995). I argue that Islamic bank customers who have religious commitments are expected to pay premium for these services, since Islamic banking is a means to reach *halal*, i.e. permissible, financial services. If these arguments hold, then Islamic banks earn more profit. In the second step, I examine the impact of mentioned legislative changes on profitability (Martinez Peria, 2001). The changes in legislations might provide certain attraction for potential depositors given that these changes alleviated several limitations. I try to highlight in which direction these modifications changed the profitability trajectory. Lastly, I study the changing competition structure in the banking system taking the legislative changes as an epoch (see e.g. Zhao et al., 2010, how legislative changes are examined in competition context).

Third empirical chapter examines complex networks in Repo and Reverse Repo Market of Turkey in which only commercial banks can transact, but not the other banks. It has been increasingly recognized that bilateral transactions among banks can be regarded as a complex network, i.e. the fund flows among financial agents congest significant risk on some banks called systemically important financial institutions. The 2008 financial crisis has revealed that systemically important financial institutions can create contagious effect in the system and do have cross–border impacts (Gropp et al., 2009). Therefore, it is vitally important to detect these institutions and take necessary measures to curb possible systemic failures in the system.

The issue of complex networks is generally associated with developed countries,

[5] In 2006, the banking law No. 5411 has passed in the parliament and assumed equal treatment for participation banks with conventional banks in the system. The new law also introduced the same deposit insurance scheme to participation banks as previously covered solely conventional banks.

although complex networks related problems also occurred in emerging market countries. The debates around the subject have evolved to include emerging market countries [6]. Local interbank markets are of global concern, since complex networks in local interbank markets can trigger local banking crisis, then can spill–over to global markets.

In terms of financial stability, complex networks in interbank markets have been one of the hot topics in banking literature after the 2008 financial crisis [7]. In Turkey, for example, after the 2001 crisis many regulatory initiatives ignored the severity of complex networks, although it is claimed that one of the main culprits of the crisis was the complex networks in the local interbank market (Kuzubas et al., 2014).

The third empirical chapter examines complex networks in Repo and Reverse Repo Market from several angles. The analysis first uncovers the topology of the market in the last decade. Subsequently I investigate connectivity, the number of transactions out of maximum possible transactions, in the market and its relationship with other financial factors. I particularly disentangle domestic and external drivers of connectivity.

The way this chapter studies Repo and Reverse Repo Market is an example of a temporal network, a time ordered sequence of transactions in the system represented as a graph. These systems are represented as nodes and edges over a time interval. In light of topological properties of network theory, institutions critically important to the network are identified. Ahead of deriving centrality measures to identify critical institutions, I briefly define basic terms for network topology in this chapter. The methodology to calculate the network measures is based on a recently adapted

[6]The 2008 financial crisis demonstrated that proper and well–established resolution regime for systemically important financial institutions was an urgent need. To set the standards of a proper and well–established resolution regime for systemically important financial institutions, Financial Stability Board was mandated to unofficially guide and advice policymakers worldwide. In terms of complex networks related issues, Financial Stability Board aims to find out possible ways to resolve failing institutions quickly without destabilising global financial system and causing minimum harm to taxpayers. Recently under the auspices of Financial Stability Board, policymakers and authorities encouraged policy actions that contain locally important financial institutions as an important step in dealing with systemically important financial institutions (FSB, 2012).

[7]After the novel studies by Freixas et al. (2000) and Allen and Gale (2000) increasing number of studies focus on the network topology in interbank markets.

field known as complex network that is based on graph theory (Georg, 2013; Lenzu and Tedeschi, 2012; Albert and Barabási, 2002). After calculating the measures for each bank, I examine the drivers of connectivity in Repo and Reverse Repo Market.

2 Regional Loan Distribution in Turkey: The Role of Distance, Political Connection, and Electoral Cycle

2.1 Introduction

2.1.1 Motivation of the Chapter

Development banking is a special form of banking that differentiates itself from commercial banking by the provision of long term loans to socially beneficial projects or profitable projects that need substantial volume of debt capital (Diamond, 1957; Armendariz de Aghion, 1999; Boskey, 1961; Cameron, 1972). Most of the development banks are state–owned banks, and the focus of the lending activity is not commercial activities or individual borrowings but rather development activities. Development banks continue to give impetus to the process of industrialisation, although the tasks of these banks evolved considerably. Besides providing long–term loans to the projects, many of these banks are re–equipped with new tasks like alleviating poverty, funding small and medium enterprises, raising technical capacities in high–technology industries.

The discipline of development banking has its origins in growth theories of the 1950s (Diamond, 1957). The dominant view in the theories was that the growth of income was related directly and positively to savings. In the shortage of savings, long–term financing was considered to be vitally important for investment and high growth rates. Under the post–war circumstances in the world, there appeared the necessity of a vehicle that could provide long–term financing to revitalize capital investment. Development financing institutions emerged as a viable solution for long–term financing needs. Developing countries [8] were encouraged to establish

[8]There are different usages to define the term "underdevelopment" in development economics and practice. The countries where development process is still in progress are generally named as "developing countries". Yet, the use of "least developed countries" and "emerging market countries" correspond to differences in their development progress. In this chapter, all the countries

their national development banks to bridge the saving and investment gap in their home countries. The intention was to provide long–term financing for profitable and socially beneficial projects in almost every area of the economy. Development banks were also encouraged to provide technical expertise to the project holders who lack expertise.

Development banks provided long–term financing in line with development goals of governments. The project evaluation process of these banks used to be particularly detailed to assess the economic and social impacts of the project on the economy. The emphasis of development in development banking has faded considerably after the 1980s (World Bank, 2012). Bruck (2002) argues the "banking" aspect of these institutions started to dominate "development" aspect after the 1980s. Development banks differentiated their financial services especially after the 1980s with the new demands of the market [9]. Development banks' intention to change over time to accommodate the recent necessities of development should not be surprising. To stay competitive, these banks are faced with a conundrum between development activities and banking business.

Even after the 1980s, state intervention in banking business is justified by market failures. It is still widely accepted that governments can correct the disruptions in financial sector which can severely affect the overall economy (World Bank, 2012). In many countries where private financial institutions fail to maintain development activities, development banks are still perceived to be a viable means for such activities. In recent years with the impact of the 2008 financial crisis, the world economy has witnessed a revival of interest in development banks. World Bank (2012) documents several new development banks that have been established in developing countries (for example, Bosnia and Herzegovina, India, Malawi, Mexico, Mongolia, Mozambique, Serbia, and Thailand) as well as in some advanced countries (for example, Green Investment Bank of the United Kingdom (UK)). The interest to-

except for advanced ones, not otherwise defined, will be called as "developing countries".

[9]Developments banks currently contribute to development financing through new facilities like working capital financing, venture capital financing, leasing, insurance and consultancy.

wards development banks has been fuelled by their potential countercyclical role during the course of crisis. To address the adverse impacts of the crisis, these banks were employed with unique mandates to mitigate contractions in credit supply. Although the resurgence in development banking is apparent, there is still suspicion about the benefits of development banking. World Bank (2012) argues that most of the development banks are far from adopting best practices in governance and risk management. This survey also indicates that these banks are still susceptible to unproductive political interference.

There are relatively few papers about development banking in the literature. Armendariz de Aghion (1999) develops a model in which banking system is highly decentralised. This model shows that decentralised banks fail to provide long–term funding if state does not intervene. The basic finding of this study suggests that state intervention in the form of development banking can be a panacea to lack of long–term financing once certain type of cooperation with private banks is established. Co–financing arrangements with private banks and co–ownership structures in development banks (state and private ownership) can improve the efficiency of development banking. Cross country evidence, however, suggests that the directed credit programs of development banking activities distort the allocation of resources in developing countries (Odedokun, 1996). Over a panel of 38 countries, this study shows that development loans in relation to the GDP have negative impacts on the efficiency of investment utilisation. There are also a few papers investigating single country cases. Bandyopadhyay (1978) examines development banking in India in the 1970s. This paper discusses several issues in operational, organisational, and planning structures of these banks and proposes operational research can be effective to solve problems in these areas. Padin (2003) analyses the long–term effects of liberalisation on development banking in Puerto Rico and its impact on the development trajectory of the country. This paper uncovers the conflict between domestic business class and interventionist state and discusses the background of the failure of developmental state projects.

This chapter aims to fill the gap in development banking literature by examining the case in Turkey. Development banking in Turkey is not unique in terms of its history. The early examples of these banks were founded just after the establishment of the Republic of Turkey. The need for urgent industrialisation of the country was partially fulfilled by state–owned banks which were typically in charge of the tasks attached to development banking. The import substitution industrialisation (ISI) strategies implemented during the 1960s also invigorated development banking in the country. These banks continued to be influential until the liberalisation of the 1980s [10]. Due to the structural problems both in the banking system and the general economy during that time, the ISI project did not continue successfully. The failure of ISI strategies in addition to the discourse of the liberalisation policies disrupted development banking. Foreign bank entries, widespread privatisation, creation and enhancement of equity markets etc. have all scaled back the breadth of development banking in the country. Nonetheless, development banking in the banking system still survives.

Although development banks are actively present in Turkish banking system, there is a general scarcity of evidence on development banking in the country [11]. From this departure, this chapter will shed more light on development banking in Turkey by studying regional level data during 1963–1994.

2.1.2 Objectives and Contribution of the Chapter

In this chapter, I explore the relationship between politics and development banking in Turkey from two dimensions. I take into account the political connection of local governors with the ruling party(ies). Development banks, during the sample period, were mainly state–owned and were prone to political influence. I also explore the impact of electoral cycles on lending activities to observe whether the politicians

[10] At initial stages, these banks mainly supported specific sectors, especially mining, agriculture, tourism etc. In line with the global trend in the 1950s, the number of development banks increased and these banks started to cover almost all sectors in the economy.

[11] Öztürk et al. (2010) investigated development banking in the country and argued that development banking activities failed to support growth and industrialisation. This study, however, did not discuss the potential drivers of development lending in the country.

exploit these banks to attain their political will.

This chapter also considers the spatial dimension of lending. The spatial dimension of lending assumes that the proximity to the financial centres is an influential factor in attracting higher amount of bank loans. Testing the significance of spatial dimension on development lending has interesting implications for Turkey. If the assumptions hold, the results would indicate that the regions distant to the capital city are left deprived of development loans [12]. The distant cities of the country are either the poorest or the most industrialised cities. Then this finding would imply that development loans could not be utilised in line with the tasks of development banking.

Against this backdrop, this chapter aims to answer the following questions:

i. did political connection influence development banking activities?

ii. was development lending proportional to distance?

iii. was regional distribution of development loans manipulated during election years?

iv. to what extent development banking activities differed from commercial banking activities?

To answer these questions the following hypotheses are tested in the first empirical chapter:

1. *Hypothesis 1*: Since the distant regions are the target regions (poorest and most industrialised) of development banks in Turkey, spatial dimension of lending should not be operative.

2. *Hypothesis 2*: If local political managers (mayors) are elected from the ruling party, the political connection arising from same party affiliation increases development lending to a city.

[12] With regards to development banking, capital cities can be considered as the financial centres, since the majority of lending decisions are taken at the capital city.

3. *Hypothesis 3*: Electoral cycle is effective in regional development lending. That is, development lending increases before the elections and starts to decrease when the elections are over.

I employ two unique datasets separately for commercial loans and development loans. The Banks Association of Turkey recently published a historical dataset for Turkish banking system. This dataset categorizes the loans provided in Turkish banking system based on their functions and sectoral focus, e.g. as development, commercial, marine, occupational etc. The datasets used in this chapter comprise annual aggregate loan–level data for each region in the country. By employing two separate datasets, the findings of this chapter will enable one to compare and contrast commercial and development loans in Turkey. To measure the magnitude of political connection, I collect the results of local elections for each city during the sample period. I simply assume that there appears political connection if the mayors are elected from the ruling party.

This chapter contributes to the literature in a number of directions. First, it fills the gap by employing regional data in Turkish development banking. Despite its presence in Turkey, to date, there has been no published work about development banks in Turkey with regional evidence. Second, it expands the definition of political connection by incorporating the relationship between local and central politicians. The political influence on development lending is frequently argued, but the impact of it is never examined. Third, it presents empirical evidence on spatial dimension of development lending. The empirical evidence on the spatial dimension of lending is scarce and does not cover development banking. This chapter provides further evidence on spatial dimension of development lending front. Finally, it provides a detailed review on the origin and evolution of development banking.

2.1.3 Structure of the Chapter

This chapter is organised as follows: The next section provides an overview of development banking. It briefly explains the history of development banking, the

motivation behind the establishment of development banks from the perspective of development economics. Moreover, the need for state intervention will be concisely revisited with up–to–date discussions. Third section will discuss Turkey's development banking experience. It will explain a Turkey specific issue that is similar in developing countries. The theoretical background of spatial dimension, political connection, and elections are provided in the fourth section. Fifth section presents methodology and the data with specific emphasis on Turkish demographics. Sixth section presents the estimation process and results, respectively. The last section presents policy recommendations and concludes.

2.2 Development Banking

Development banks provide long–term loans and support development in many areas of social and economic life. Their contribution to entrepreneurship, technical expertise, poverty elimination is of great significance especially in underdeveloped parts of the world. The counter–cyclicality of development banking activities make these banks attractive for other developing countries. Many developing countries suffer short–term capital flows that are vulnerable to fragilities and volatilities in these countries (Dallas, 2012; Rappaport, 2005). Development banks as a means of state intervention in banking business help to fight against the adverse impact of crisis.

In the finance–led growth literature, various theoretical papers provide evidence that financial institutions can absorb elevated risk through various ways. Levine (1991) and Bencivenga and Smith (1991) construct theoretical models by which they show that contracts of financial institutions overcome the idiosyncratic liquidity shocks of individuals and facilitate the mobility of savings towards less–liquid but high–return projects. As the risk of premature termination of high–return project emerges as a result of liquidity shocks, their models show that, financial intermediaries can help to smooth out the liquidity constraints.

In addition to dealing with the idiosyncratic liquidity shocks of savers, financial

institutions ease the risk related to investing in a single project. Efficient risk diversification by financial institutions encourages risk averse savers to increase their loanable funds in the financial system. Levine (1991) and Saint-Paul (1992) emphasize that the productivity shocks that discourage risk–averse savers from investing in a single firm could be diversified by investing in a portfolio. Portfolio composition thus prevents the direct match of individual saver (investor) with high risk–high return projects. The studies by Greenwood and Jovanovic (1990) and King and Levine (1993) show how holding a diversified portfolio of innovative projects leads to pooling risk of these investments and accelerates technological change and development. Innovative projects would remain under–financed unless financial intermediaries invest in these projects through a diversified portfolio.

Commercial banks' contribution to development via risk diversification and easement of liquidity constraint is significant, yet their contribution to development is not sustainable. The avoidance of credit supply can hardly be mitigated by commercial banks during crisis periods (Beck et al., 2000; Levine and Zervos, 1998; Williamson, 1987). The pro–cyclicality in commercial banks during crisis makes development banks indispensable for economic recovery. Besides carrying very distinctive features in banking system, development banks aim at addressing this shortage.

2.2.1 Historical Debates and Development Banking

The history of development banking is intertwined with the role of state intervention in economics. An important development which raised the importance of state in economy is the "Great Recession". Active state intervention was adopted in many countries followed by the failure of free market economies in the optimal resource allocation. The inter–war economic turbulences resulted in a gradual swing of economic theory and practice towards interventionism. Interventionist policies have seen great approval by the policymakers which firmly endorsed that state can be a key player in a well–functioning economy, with an urgent need for post–war reconstruction. For several reasons, which are not directly related to the scope of this

chapter, state interventionism could not be sustainable. By the 1980s, the collapse of the state interventionism produced a significant attack on the presence of state in economy. The advanced countries renounced welfare statism, whereas developing countries opted for liberalisation programmes which dismantled socialist central planning in several other developing countries.

The political outcome of the World War II was the formation of new political structures in developed countries with a stronger representation of organised labour. With the new formation, the objectives of the working class have been on the top agenda of the economic policymaking. Moreover, the success of Keynesian policy tools to smooth the business cycles in the inter–war period encouraged policymakers to inject more money into the system by creating budget deficits. Hence, the golden rule of the free market economy which takes balanced budget granted at all costs was broken. The fiscal policy that uses budgetary sources for investments to reduce high unemployment rate was deemed to be successful. In this vein, the state was expected to help stabilise the economy by automatically increasing/reducing spending in the recessionary/boom phase of the business cycle.

In many advanced countries, the role of state went beyond the maintenance of economic activity through aggregate demand management. The level of coordination in economic activities has increased considerably. Japan and France, for instance, combined sectoral industrial policy with centralised investment through five year indicative planning. Scandinavian countries engaged in centralised wage bargaining process with active labour market policy otherwise wage setting would have been only possible through a pure market mechanism. Even in the UK and the USA, the countries which were accepted to be the least open to the idea of centralised industrial development, the state substantially involved in industrial development. The evolution of the European Coal and Steel Community and European Economic Community during this period established a ground for collaboration for joint industrial policies (Sanderson, 1958).

The response of developing countries during the time has been more than ad-

vanced countries. The desire of newly independent countries to acquire economic independence instigated these countries to meet the demands for more rapid policy implementation. During this period, it was widely accepted that state–led industrialisation was the fastest and surest way to achieve this aim (Cameron, 1972, 1953). The traditional development strategy of developing countries, which was believed to be the reliance on commodity exports to finance manufactured imports, was no longer sustainable. Three reasons can explain this thought more explicitly:

i. First, the volatile economic conditions and falling terms of trade for primary commodity exports,

ii. Second, the fragility of the international economy as a result of the damage caused by the "Great Recession", and

iii. Third, the low income elasticities of primary commodities which limited the scope for increase in export.

Developing countries abandoned primary commodity production to attain self–reinforcing growth mechanism, and targeted manufacturing industries as a plausible way for development. In order for an uninterrupted industrialisation, state took the role of main coordinator and financier, since a capitalist class was non–existent in developing countries (Rosenstein-Rodan, 1943; Nurkse, 1966). Acknowledging the necessity of coordination led by state, Gerschenkron (1962) discussed the importance of institutions, which will be the baseline for the *raison d'étre* of development banking.

The 1950s has been the period when the idea of state interventionism for rapid industrialisation has flourished. Rosenstein-Rodan (1943) argues that more equal distribution of income could be achieved via faster growth in depressed areas where underdevelopment was widespread. Arguing that demographics of depressed areas quite differ in terms of skilled labour, fair income distribution could be achieved via two ways of mobilisation, either labour through capital (immigration) or capital

through labour (industrialisation). According to Rosenstein-Rodan (1943), the immigration would be a costly option for industrialisation. He, instead, supports the idea that critical amount of resources should be allocated for development activities in a coordinative action. If coordination could not be maintained, an economy that has all the pre–conditions for industrialisation would fail to industrialise because of a failure to coordinate complementary investments. Possible coordination failures are interpreted as the call for a "big push" industrialisation which would be centrally controlled by the state.

Nurkse (1966) proposes the idea that developing economies should grow in all sectors of the economy so that demand across the industries could be well–balanced. Nurkse (1966) perceives balanced growth as a necessity for mutually supportive investment environment. Besides the very argument of balanced growth, he emphasizes the importance of capital formation, which was deemed to be a result of enough capacity to save. Therefore, he argued that poor nations remained poor because of a vicious circle of being poor.

Rostow (1956) defines economic development categorically. He argues that the process of economic growth is a combination of two or three decades which he calls it as "take–off" process. In order for take–off to take place, three pre–conditions should be well set: a long period (a century or slight more) when preparation are met, take–off (two or three decades), and long–time of growth when growth itself becomes normal and automatic. In this formulation, the take–off is underpinned as the interval during which the rate of investment proliferates in such a way that real output per capita rises and this initial increase brings about radical changes in production techniques. Meanwhile, there would be a need for a group of people (entrepreneurial and managerial class) who have the will and authority to apply and disseminate the techniques. During the initial stage of growth, the rise in income should be diverted to productive investment. Hence, the take–off requires a group of society who has the command over the income generation warranted to create productive investment. Rostow (1956) argues that the take–off requires social and

institutional changes that accompany the increase in investment. The central idea of Rostow (1956) is the emergence of entrepreneurial and managerial class that makes productive investment available. As opposed to the studies of Nurkse (1966) and Rosenstein-Rodan (1943), Rostow (1956) does not mention the role of state in this process. Nonetheless, the deficiency of entrepreneurial capacity is still evident in some developing countries. The industrialisation in the absence of this class is not mentioned within the context of "take off" formulation.

The mechanism how state should support development is not explicitly defined in Nurkse (1966) and Rosenstein-Rodan (1943). Gerschenkron (1962) and Cameron (1972)[13] fill this gap and focus on the institutional aspect of state–interventionism. Gerschenkron (1962) argues that a number of important historical instances of industrialisation which took place in a backward country exhibits considerable differences not only with regard to the speed of development but also with regard to productive and organisational structures. These differences, according to Gerschenkron (1962), is a result of the application of different institutional instruments. On the exploration of the remedies of backwardness, Gerschenkron (1962) underlines the importance of specialised financial institutions to foster industrialisation. He points out that gradual character of industrialisation requires a special form of an institutional device that would provide long–term capital to industry.

2.2.2 Development Banking in Retrospective: Advanced versus Developing Countries

2.2.2.1 Advanced Countries

In continental Europe, development banking began to support industrialisation explicitly in the 19^{th} century through providing large amounts of financing to growing industries. To mark the dynamics of development banking in continental Europe, Diamond (1957) emphasizes the main ingredients of investment in England in the

[13]Cameron (1972) makes many references to Gerschenkron (1962) in country experiences. Hence, I briefly outline the basic features of Cameron (1972) and Gerschenkron (1962) by giving sole references to Gerschenkron (1962).

19^{th} century. He points out that there was a significant amount of capital accumulation during the early industrialisation in the country. The capital could easily be reinvested in industrial projects and lent to government and/or private individuals. The gains of productivity were so distributed that the gains from investing the capital was disproportionately higher than any other business; that is, the inequality of returns favoured the capital holders who had high propensity to save.

Diamond (1957) also argues that there was also a substantial amount of entrepreneurs who were chasing new opportunities for the expansion of existing businesses or creating new ones. Moreover, technical innovations that are essential for new investment appeared gradually so that necessary skills, both technical and administrative, were absorbed without delay. Hence, the gradual process of capital accumulation and technical progress did not require specialised institutions for long–term financing needs and entrepreneurial capacity building. The businesses that were run by individual entrepreneurs were replaced by corporations to great extent, they in turn changed the financing requirement in Britain in late 19^{th} century. By then, traditional banks in the country went on providing short–term financing, yet at the same time, new types of financial houses, e.g. issue houses, underwriters, company promoters, investment trust, have emerged to take longer term commitments (Diamond, 1957). The conversion of the enterprises from a personal or partnership form to corporations made it possible to attract savings form individuals and non–banking entities through the proliferation of stock exchanges.

England has been the source of inspiration for the movement of industrialisation in the continental Europe. The economic situation of the European countries was so backward that (Cameron, 1953) compares continental Europe to the underdevelopment of India or South Africa in the 1950s. Urgent need of industrialisation in many European countries required high capital outlay to take over the old technology that was necessary in increasing the scale of production and investment across the countries.

The examples of contemporary development banks were first established in France.

The country has established two banks namely *Crédit Foncier* and *Crédit Mobilier* to finance development and industry respectively (Diamond, 1957; Boskey, 1961). It is worth noting that, *Crédit Mobilier* was privately owned, but was immensely influenced by government policies. The bank was a major promoter and financier of the public projects which were directly sponsored by the government, e.g. railway building, urban improvement and beautification. These examples of French banks had a quick and pervasive influence on Europe's economy. The foundation of *Crédit Mobilier* gave impetus to the establishment of the others in continental Europe.

The *Crédit Mobilier* had a short life in France's banking system, however it became a model for similar investment banks established in Germany, Austria, Belgium, Netherlands, Italy, Switzerland and Spain. Inspired by *Crédit Mobilier*, the banking system throughout Europe, west of Russia, played a role in industrialisation that was unfamiliar in England. German banking system became closely associated with industry as promoter and financier. The main sources of capital for the new banks were the older banks, which also contributed to the management of these banks. The participation of several banks in the newer ones both in capital and management has created opportunities for tapping on a larger pool of savings and long–term investment in riskier projects. The collaboration was not simply through long–term lending, these new banks also shared the equities of many enterprises, either directly or through participating companies, and provided assistance in the form of underwriting and floating security issues. The important innovation they created was the transformation of older enterprises into corporations which are suitable for large–scale operations. Apart from the banks in England case, they played an important role in the provision of technical advice and managerial talent. They, for instance, took the responsibility of each enterprise they were in charge of. They relied on considerable amount of share capital and not exclusively on deposits, they combined the image of both investment houses and banks. Diamond (1957) provides the example of German case by arguing that the development banks in the country never gave up investing in fixed capital investment even when deposit base mounted.

Hence, the followers of *Crédit Mobilier* model in continental Europe continued to act as planners, entrepreneurs, financiers and managers.

The early examples of development banks in Europe held the view that gradual accumulation of capital would be inadequate for rapid industrialisation (Boskey, 1961). European enterprises were predominantly smaller, and were faced with larger capital requirements. The requirements of large–scale industry made it even more difficult for individual enterprises to expand or to find original capital stock. Larger capital requirements could have been raised only with difficulty in Europe, unlike Britain, due to lack of a large prosperous middle class and developed stock markets. *Crédit Mobilier* and its successors have found grounds to serve the Europe's capital need by (Diamond, 1957):

i. Mobilising large amounts of capital from other banks and individuals,

ii. Using that capital for equity investment as well as for long–term lending,

iii. Promoting new enterprises in basic facilities, mining and secondary industries,

iv. Lending to public authorities,

v. Facilitating the use of the joint–stock company, and

vi. Helping the creation of active capital markets.

2.2.2.2 Developing Countries

Development banking in developing countries became widespread after the world wars. *Crédit Mobilier* model formed the prototype of modern "development banking" for developing countries (Cameron, 1953; Diamond, 1957). Developing countries adopted development banking so swiftly that, by the early 1980s many developing countries, e.g. Brazil, Korea, Taiwan, India, Mexico, Turkey, had already established their own development banks. These banks' contribution to national economies have been considerable. Stalling and Studart (2006) convey that these banks have been crucial instruments in Mexico's post–war industrialisation. Especially the national

development bank namely *Nacional Financiera*, played a key role in channelling external financial resources to domestic firms. The National Bank for Economic and Social Development (*BNDES*) of Brazil, founded in 1952, is no exception to this tradition (Hermann, 2010). Until the 1980s, *BNDES* played a fundamental role in financing the Brazilian industrialisation process.

Although the banks in developing countries had the common feature of providing long–term financing, they had particular differences. Diamond (1957) argues that if a government sponsors the foundation of a development bank, then it was highly likely that this bank has to be concerned with all areas of business. These include agriculture, small industry, large–scale industry, mining and urban housing, as well as transport and power, which are more likely to be in the public domain. It was also evident that several banks that were set up to cover all these fields could specialise in one or more. Moreover, the size of enterprise that has been financed on a profitability basis varied from country to country. It was almost a common practice that development banks did not finance below certain amount, unless the bank aimed at financing small–size enterprises. Geographical considerations also impacted the business model of development banks. The activities of development banks might concentrate in certain cities or regions, yet, it was the main intention of development banks that the development financing reach all the areas of the country. If geographical limitations apply, then they were the regional development banks who have specialised in certain regions or provinces.

2.3 Turkish Experience

Looking back to the Turkish development banking experience, development banking was utilised in order to support the development of entrepreneurship and industrialisation in Turkey like many other developing countries. Although the early examples of many banks after the foundation of Republic of Turkey did not carry the name "development bank", they have played similar roles as if they were development banks. After the foundation of new "Republic", government policies in the

country targeted private sector as the engine for industrialisation in policy design. Yet, shortly after the outbreak of "Great Recession" in the early 1930s, due partly to the under–performance of the private sector in economy, the government itself took active role in the establishment of production lines and funded them directly (Altug et al., 2008).

As a result of the early practices of state–led industrialisation, significant improvements achieved in industrial development. Numerous state economic enterprises were set–up in key industries most of which have been the milestones of Turkish industrialisation. Industrial plants in private sectors also owed their existence to official support and protection (Krueger and Tuncer, 1982). Hence, from the 1930s onwards, the state became the driving force of industrialisation. During this period, state–owned banks were established in specialised sectors such as *Sumerbank*, *Belediyeler Bank*, *Etibank*, *Denizbank* and *Halk Bank* in order to fund infrastructural and industrial investments stipulated by five–year development plans. The main reason behind the establishment of these banks was not setting up a development bank in nature, but these banks can be perceived as development banks in essence, because they functioned as development banks [14]. *Sumerbank* and *Etibank*, for instance, provided massive support to state projects that helped the industrialisation of the country.

The World War II interrupted the progress of state-led industrialisation process, the banks like *Sumerbank* and *Etibank* continued to be the major symbols of the economic policy of "etatism" in the Turkish economy. Eventually, Turkey entered into the 1950s with a significant progress in development, but the 1950s has also shown that the country has reached its limits by state–led industrialisation strategy. Soon after, the government diverted its policy focus to private sector.

This policy shift resulted in substantial amount of credit and foreign exchange allocations in private sector. The 1950s also witnessed considerable expansion in the private–owned banking both in number and size. The rise of private–owned

[14]These banks were established between 1933 and 1938 to remove the damage of long wartime period.

banks did not slow down the activity of development banking. On the contrary, the very development bank penetrated into the Turkish banking system by the early 1950s with the establishment of Turkish Industrial Development Bank (*TSKB* in Turkish). During the foundation of this bank, the World Bank placed significant support (Basu, 1966). As Diamond (1957) reports, this bank is the first development bank among developing countries and both commercial banks and the government put share equity to the bank. The government also introduced a profit guarantee scheme to the bank's shareholders to back the presence of private ownership in the country. The establishment of the bank also reflects the intention to vitalize private entrepreneurship and liberal markets. Among its objectives to assist private enterprises, encourage private and foreign capital in corporations and help to the establishment of national capital markets in Turkey have been at the top priorities (Diamond, 1957; Boskey, 1961; Öztürk et al., 2010).

The support for state–led industrialisation continued till 1950s successfully, both in private and public. The great holding company–banks of the state have achieved remarkable growth during the 1950s. For instance, industrial activities of the *Sumerbank* has shown significant performance, particularly in textile sector. *Etibank* continued to invest heavily in power generation and supported mine improvement. Till the end of 1950s, however, the heavy investment program of the government was accompanied by inflationary growth, the ultimate result of which was a strict stabilisation program that was introduced in 1958. The liberal policies of the 1950s came to a halt in 1960 with a military intervention, the aim of which was declared as the completion of the stabilisation program and sustain stability. The former expansionary economic policy was reversed with national development plans and establishment of a state institution for that purpose. Thereafter, and with the establishment of State Planning Organisation (*Devlet Planlama Teskilati*), the notion of planning through ISI became a central element of economic policy-making in Turkey.

The importance attached to development banking rose considerably during the

ISI period between the late 1950s and 1979. During this period, many other development banks were established. The rising number and effectiveness of development banking was closely related to the notion of planning that became a central component of economic policy-making in Turkey. The important issue that deserves particular interest is that, in line with the ISI strategy, great importance was attached to the allocation and mobilisation of resources through directed credits and incentive programs including subsidised lending to priority sectors/regions.

The 1980s gave a new direction to development banking in the country, as the ISI strategy could not last mainly due to the foreign exchange scarcity. Therefore, the 1980s brought about structural changes in the roles of the state that had been the main vehicle for productive investments in the economy. Since then, extensive state regulation and intervention has left its place to deregulated markets. In the meantime, the development banks tended to depart from medium and long–term credit facilities which were the core of development banking activities and inclined to provide shorter term loans like other commercial banks in the system. The place of development banking within the banking system has deteriorated during the liberalisation period. This policy change has shown itself in the declining share of development banking activities in the total banking system. As can be seen from Figure 2.1, the share of development loans in total loans declined from 25–30% in the 1960s to 10–15% in the 1980s. After a moderate and stable period, the structural change of state-dominant policymaking towards liberal policies had directly reflected on development banking during this period. Moreover, the share of development loans in total loans has kept on declining gradually and decreased to 4% in the 2000s.

The previous historical review of the evolution of development banks shows that development banks filled a significant gap in banking system. They were originally created to promote development in developing countries where the shortage of domestic savings has hindered a rapid expansion of aggregate investments. These banks still contribute to industrialisation and development in these countries. Neverthe-

Figure 2.1: The Share of Development Loans in Total Loans between 1963–1994

less, development banks have been the focus of a great deal of criticism, especially on two grounds. First of all, unproductive and non–transparent management of bank resources is of significant concern. Opponents of development banking claim that development banks operate by drawing primarily on fiscal resources that carry a high opportunity cost. Poor risk management, which in the long run leads to high rates of non–performing loans, imposes high financial costs on government budgets. Second, there exists a time mismatch between the life of loans and the life of ruling parties. In developing countries, governments are influential in the decision–making process of what and where to invest, but their life of power is not enough to manage the risk of long–term loans. The mismatch motivates policymakers to disregard the credit risk and in turn results in low loan recovery rates.

The creation and *the raison d'étre* of development banking is justified by the poor conditions that necessitate a special vehicle in development financing in developing countries. Nonetheless, the theoretical assumptions of liberalisation do not leave any room for the presence of development banks. This chapter aims at understanding the motivations behind lending behaviour of development banks in Turkey by examining

whether regional development loan distribution is influenced by political connection. Additionally, the spatial dimension in development lending is investigated. If these loans were primarily extended to the close periphery of the capital city where the lending decisions are taken, it could be argued that development banking hardly fulfilled its roles in the country. The distant cities are either the poorest or the mostly industrialised parts of Turkey.

The literature on development banks is very slim. It is mainly confined in published books that discuss theoretical and institutional background of development banks (Diamond, 1957; Boskey, 1961; Cameron, 1972). The empirical literature is rather scant, as to the author's knowledge, there are merely two empirical studies on development bank lending. Odedokun (1996) provides panel data evidence and finds that development banking loans could not maintain efficient resource allocation in developing countries. Similarly, Öztürk et al. (2010) examine development lending in Turkey and reveal that development lending in the country failed to promote growth in the country in contrast to commercial lending.

This study differentiates itself from these two studies on several grounds and has several contributions to the literature. First, it investigates the regional aspects of development lending which should be regarded as a novelty in development lending literature. Second, the spatial dimension of development lending which could have many implications for policy design in developing countries is firstly studied in this study . Third, this chapter investigates the impact of political affiliation of mayors on development lending. The empirical studies that investigate political connection observed the phenomena from several approximations, e.g. CEO's political background, yet the relationship between local and central rulers is yet to be investigated. Against this background, next two subsections will discuss the spatial dimension of lending and the political connection.

2.4 Theoretical Background and Stylised Facts

The aim of this study is to investigate the impact of spatial dimension and political connection on lending behaviour of development banks during 1993–1994. Recent empirical evidence revealed that the firms that are located near to financial centres benefit from their close geographical proximity. In addition, politically connected managers can ease credit constraint once they find grounds on state level. In our case, development banks are examined from the lens of spatial dimension and political connection. In Turkey, the capital city has been the centre of lending decisions of development banks, and in turn can be considered as the financial centre of the period where state involvement in banking activity was high. The lending activities of development banks are prone to political influence, since ruling party might favour the mayors who are elected from their party(ies) [15]. Therefore, the lending decisions might be influenced from political connection and proximity to political/financial center by ignoring economic or social concerns. Moreover, around election times, governing party(ies) may utilise the sources of development banks to guarantee next term seat that in turn has an impact on banks' behaviour around election years.

2.4.1 Spatial Concentration

Studies that examine the regional distribution of any sort of financing are relatively scarce due to the basic assumption that financial capital is highly mobile across regions. The basic argument of Modigliani and Miller (1958) was that in corporate finance, financial capital is perfectly liquid that corporate managers are indifferent in using the equity or external financing. The studies after the 1980s have shown theoretically and empirically that financial activities have spatial dimension that hinders the free flow of financial capital (Harrigan and McGregor, 1987; Hutchinson and McKillop, 1990; Roberts and Fishkind, 1979).

[15] The coalition governments are widespread in Turkish political history. So, there may be more than one party that makes political connection.

The main reason behind capital immobility across the regions is the informational asymmetry. Accordingly, the informational asymmetry grows as the distance increases. Hence, the intention to avoid adverse selection leads to higher cost that in turn proliferates regional disparity. Centralised large banks are likely to have limited information about the investment opportunities in the periphery. Limited information either ignores profitable projects or selects unprofitable projects that create adverse selection. Moral hazard then emerges and financial institutions face huge costs as a result of higher default risk. Higher cost of funding may exacerbate adverse selection and moral hazard problem by causing institutions to select unprofitable projects. This vicious circle impedes financial activities from centre to periphery.

Hutchinson and McKillop (1990) and Roberts and Fishkind (1979) argue that even if individuals within a regional economy have free information on the basic economic activities within the region, regional financial market is segmented in two senses. First, there is an increasing opportunity cost, which is a positive function of the distance of the region from the centre, in gathering information. Second, there is a subset of heterogeneous assets across different regions providing cheaper products to closer regions. These factors, together with varying risk appetite of the population, exhibit regional differences in interest rates sensitivity by leading to,

i. regional interest rate differentials,

ii. a variation in regional interest rates increasing with the remoteness of the region, and

iii. decreasing demand and supply elasticity of asset with the increasing degree of regional remoteness.

Moore and Hill (1982) and Harrigan and McGregor (1987) model the market segmentation across the regions based on information costs which play a crucial role in inhibiting inter–regional capital mobility. These models are monetarist in their character and take the transactions demand of money. However, in Keynesian view,

the demand for money can be speculative. Dow (1987) develops the model proposed by Moore and Hill (1982) by embedding liquidity preference as a result of speculative demand. According to the basic findings of Dow (1987), this modification also leads to preference to invest in long–term national assets rather than regional assets by regional investors.

Related with all these findings, another strand of literature examines the effect of institutional concentration on regional financial activity. The main findings of Martin and Minns (1995) and Klagge and Martin (2005) suggest that institutional segmentation brings about low cost of funding due to the fact that the competition in financial centres makes the cost of funding lower. Moreover, financial agents in the financial centres hugely benefit from economies of scale and highly skilled labour.

The spatial dimension of loan distribution is also related with the information type by which the credit decision is made. Particularly, the loan opportunities may not be evenly distributed across the regions if the lending decisions are given by the centre based on hard information (Berger et al., 2005; Stein, 2002). In usual practice, the credit decisions given at the centre are usually based on hard rather than soft information. Hard information is quantitative and easy to store, reproduce and transmit with limited personal influence, and its content is independent of its collection process. Credit decisions made on hard information is considered to be selective toward realistically high return projects, however, a significant amount of loans can be extended to less profitable projects which are located within close distance to center and available for hard information. Those projects that are in far distance and more profitable would not be available for funding due to the weak record of hard information. If regional disparity is severe and the larger firms are located close to center, then these firms will be much more advantageous of having hard information.

Turkey provides a unique setting to analyse the dual role of distance and centralised institutional structure in the loan distribution of development banks. Unlike many other developing countries where there may be a number of small and locally

based banks, Turkey had no regional banks. Decision centres or headquarters of all banks are located in either Istanbul (the financial centre) or Ankara (the capital). According to Ozyildirim and Onder (2008), the centralised institutional structure of the Turkish banking sector impacts the provision of local banking services.

In order to emphasise the importance of spatial dimension in Turkish development banking, the lending mechanisms of development banking in the country should be detailed to some extent. In Turkey, the credit decisions of development loans were used to be taken in the capital. Long file preparation process of large denomination of the loans benefits the project owners near to the capital where the necessary information to prepare files is relatively cheap. Poor conditions of highways and limited transportation facilities of the time make it highly expensive to reach those project owners in the distant regions. Adverse selection is less likely in nearer regions since loan officers are better in assessing the risk profiles of the projects nearby the capital (Berger et al., 2005). All in all, the loanable funds to the periphery are expected to be less due to information asymmetry, adverse selection, and cost of information (Porteous, 1995).

In this chapter, it is argued that physical distance from capital city is important for lending decisions of development banks. As argued by Porteous (1995), development banks might ration credit supply as the distance from the center increases. The assumption of this chapter is that if development banks operate in line with their aims and scope, they should overcome information asymmetry and introduce credit facilities to the regions regardless of their distance to the centre.

2.4.2 Political Connection and Electoral Cycle

The rent–seeking behaviour of mayors is theoretically and empirically investigated in a number of studies (Rowley et al., 1988; Bartolini and Fiorillo, 2011). In this study, it is argued that with increasing degree of political connection, mayors can attract more development loans to their cities. From a populist view, political elites might stimulate public expenditures in those provinces whose mayors are

elected from their party. Potentially, development loans can play as a means to gain political objectives. On the other hand, populist politicians may support private investments in the politically connected provinces as a reward, the reverse is also valid. From a rent–seeking mayor perspective, mayors from the ruling party may consider the development loans as instruments for their next term seat. On the other hand, in a corrupt political environment, mayors may maximise their interests by supporting those project holders who would implicitly pay off the mayor.

Development banks in Turkey have been mainly state–owned banks, and presumably, rent–seeking (Krueger, 1974; Posner, 1975; Bhagwati, 1982; Fisher, 1985) and corruption (Brown and Dinc, 2005; Dinc, 2005) are influential in banking activity. This argument is based on the assumption that mayors who are elected from the ruling party are likely to use their power to attract higher volumes of development loans to their region. Furthermore, ruling party may be tempted to pump up development loans before/during/after election years. This chapter splits the effect of politics into two components: *political connection* and *electoral cycle*.

The impact of politics in banking business is discussed in a handful of studies but the findings are mixed. It is almost a common finding of the opposing arguments that the presence of state–ownership leads to low asset quality, inefficiency and lower productivity (La Porta et al., 2003; Khwaja and Mian, 2005; Onder and Ozyildirim, 2011; Micco et al., 2007a; Laeven, 2001). The proponents of state–ownership, on the other hand, base their arguments on bright examples of state intervention in many Asian countries, e.g. Japan, South Korea, Taiwan (Amsden, 1989; Wade, 1990).

Those who criticize state–owned banks argue that these banks are the under–performers because they are mainly under the lead of politicians who exploit these banks to reach their political objectives (La Porta et al., 2003, 2002). Politicians either favour their supporters with cheap credits in order to meet their political interest or fail to finance profitable projects. For instance, Shleifer and Vishny (2002) argue that governments do not have enough incentives to ensure socially desirable investments. They acquire control of banks in order to provide rents in

the form of employment, subsidies, and other benefits to their supporters in return for their votes, political contributions, and bribes.

The proponents of state–ownership do not accept so–called under–performance as harmful to social utility. The proponents mainly explain inefficiency by the nature of projects state–owned banks tend to finance. They argue that these banks focus on socially profitable but financially unprofitable projects. These type of projects could be under–financed when state–owned banks do not exist (Stiglitz, 1993; Gerschenkron, 1962). Governments as a social planner may have adequate information about socially desirable projects, and state–owned banks support these projects in favour of common interest of society. Bruck (2002) and Armendariz de Aghion (1999) elaborate that state ownership overcomes institutional failures that disrupt private capital market operations and generates aggregate demand and other positive externalities.

Growing number of cross–country studies exhibit that state–ownership in banking is negatively associated with financial development (Barth et al., 2004; La Porta et al., 2002, 2003), financial stability (Caprio and Martinez-Peria, 2002; La Porta et al., 2002), and profitability (Berger et al., 2009; Iannotta et al., 2007; Sapienza, 2004). Depending on the findings of single country findings, political connection can be worse if the state becomes heavily active in banking business. For instance, Cole (2009b) analyses the impact of bank nationalisation in India and finds that, although state–owned banks showed a large credit expansion especially in rural areas after nationalisation, this expansion did not lead to desired outcomes. Moreover, the results of the study suggest that nationalisation was associated with poor quality of financial intermediation. As a common practice before the 1980s, governments were present in banking business with large numbers of state–owned banks. Even if their presence has become weaker after many privatisation practices since the 1980s, their influence is still active. Yeyati et al. (2004) report that majority of banking assets in emerging market countries are still controlled by the governments. Hence, the empirical findings and the current outlook of bank ownership across the countries

both suggest that politics does matter for banking business.

The politics and banking nexus can also be assessed from rent–seeking perspective (Krueger, 1974; Posner, 1975; Bhagwati, 1982; Fisher, 1985). While Krueger (1974) studies import licenses as a special case for rent–seeking, her findings constitute generalizable evidences on various forms of government intervention. Each of government interventions lead people to compete for the rents, in each case there is a dead–weight loss associated with that competition. The same arguments are also valid for monopoly rents which cause huge dead–weight losses (Posner, 1975).

Bhagwati (1982) separates rent–seeking as unproductive and productive. He focuses upon the case where rent–seeking may be welfare–improving when the resources employed in rent–seeking have a negative shadow value. Likewise, Cowen et al. (1994) study the cases where rents may be productive. They focus on the case of local politician who lobbies to transfer federal loans to her district. The basic finding of this study is that the political effort to attract federal loans augments social welfare.

In the banking literature, rent–seeking is often studied at firm–level (Khwaja and Mian, 2005; Francis et al., 2009; Claessens et al., 2008; Disli et al., 2013). The issue of rent–seeking, however, is rarely visited from public perspective (Onder and Ozyildirim, 2011). Local governments (municipalities) can potentially be rent–seekers by exploiting their interactions with central government. Judging rent–seeking as helpful or harmful to the welfare of society is hard to judge in development banking case. Onder and Ozyildirim (2011) argue political connection is welfare promotive, if politically connected lending adds positively to the economic development of provinces. They disregard the opportunity cost of lending the banking sources through state–owned banks. Private–banks might have been more effective than state–owned banks in promoting development and growth.

The influence of politics in banking may be exercised around election years. Nordhaus (1975) theoretically examines the impact of elections cycles on economy. The politicians are concerned about their future success and can design economic

policy to maintain their political will. The author shows that the macroeconomic aggregates during the election years are influenced by government policies. In general, politicians pursue expansionary policies before elections and resort to contractionary policies after the election. The influence of elections on economic policies can also divert lending behaviour. Unlike private–owned banks, state–owned banks can be more sensitive to election cycle. In order to achieve political objectives, the ruling party(ies) may exploit the financial resources of state–owned banks as a means to attract voters. Dinc (2005) and Micco et al. (2007a) show the evidence of loan proliferation in state–owned banks during election years in developing countries. The findings of Micco et al. (2007a) show that the increased lending by state–owned banks during election years is associated with a decrease in their interest rate margins and profitability which implies that these banks extend loans at favourable rates.

Country specific cases present mixed evidence on the influence of election cycle on state–owned bank lending. Cole (2009a) and Carvalho (2010) present evidence of political manipulation of bank lending during election years in India and Brazil respectively. However, Baum et al. (2010) claim that electoral cycle in Turkey did not have significant impact on state–owned bank loans.

2.5 Methodology and Data

2.5.1 Methodology

This chapter examines the regional development banking activities in Turkey during 1963–1994. The political connection of mayors with the central government and also the distance of the regions to the capital city are at focus. The use of regional loan distribution allows one to benefit from panel data framework in the analyses when time dimension of the data is relatively short. The following model is estimated:

$$RegionalLoan_{i,t} = \alpha + \beta_1 RegionalLoan_{i,t-1} + \beta_2 Distance_i + \beta_3 PoliticalConnection_{i,t} + \beta_4 Election_t + \beta_5 CONTROL_{it} + \mu_i + \varepsilon_{it} \quad (2.1)$$

where $RegionalLoan_{it}$ is loan volume in region i at time t. $Distance_i$ is the distance from region i to the capital city. $PoliticalConnection_{it}$ is the variable that measures the political connection of local governors to the central government. $Election_t$ is a dummy for election years in the country and takes 1 for the election year and one year ahead and after, and 0 otherwise. Parliamentary and local elections are examined as separate. $CONTROL_{it}$ is the vector of control variables for the banking sector specific and macroeconomic factors that might affect the volume of regional development loan allocation. μ_i is the vector that represents the regional unobserved effects.

The above model is first estimated using random effects [16] . Observing that this model suffers from heteroscedasticity and autocorrelation, the model is re–estimated by feasible generalised least squares (FGLS). Development loans allocated to one region are likely to be affected from loan allocations made to other regions. Regions, in this respect, could be said to be in competition, which translates as cross sectional correlation in the model. As for the time dimension, it is expected that the amount of credits in one region to be affected by the amount of credits that the region receives in the previous time period (year). The FGLS estimations, therefore, include a lagged value of the dependent variable and also allow for heteroscedasticity and cross sectional correlation. The dynamic structure of the model, however, causes the Within Groups Estimator to produce inconsistent estimates because of the correlation between the lagged values of the dependent variable and the unobserved cross sectional effects. Similarly, statistical properties of the Generalised Least Squares

[16] It is not possible to obtain direct estimates for the fixed effects model because of the time-invariant regressors such as *Distance*.

(GLS) or Maximum Likelihood (ML) estimates for dynamic panel models strongly depend on the assumptions made for the initial value of the dependent variable as well as how the number of time periods and cross-sectional units approach to infinity. The models, therefore, are also estimated by one–step system Generalised Method of Moments (GMM), where the lagged levels of the endogenous variables are used as instruments for their first differences (Arellano and Bond, 1991) [17]. During the estimations, the validity of the instruments is checked by using Sargan test of over–identifying restrictions. The Arellano–Bond test for autocorrelation, which is calculated for the differenced residuals, is also applied. In order to check the FGLS and GMM results, the model is also estimated by Hausman–Taylor estimator proposed by Hausman and Taylor (1981) [18].

2.5.2 Data

In this paper, a balanced panel dataset is constructed by employing annual data on regional development loans and regional commercial loans along with other indicators belonging to each region during 1963–1994. This period was marked by the state–planning development strategies of the Turkish state. Starting from 1980s the influence of development banking was reduced but the importance of development banks as the development financing institutions continued early 1990s. To answer the research questions of spatial dimension, political connection and electoral cycle, the sample period is selected an ideal time interval. In 2008, The Banks Association of Turkey (BAT) has opened a new dataset available for public use that covers the banking data starting from 1963. For the post–1994 period, the BAT continues to publish aggregate loan data but without providing regional distribution.

[17] In this chapter the panel has relatively large T and smaller N. When T is greater than N the series in the panel may suffer from nonstationarity. Given that GMM dynamic panel model results are largely comparable with those of FGLS models that will be elaborated in next sections, and the persistence in changes in loan data is small, this chapter uses the GMM estimators to control for dynamic structure in bank lending (see e.g. Aizenman et al., 2013, who provide a similar discussion for using GMM estimator in a panel where T is greater than N).

[18] Please see Appendix A for the details of the estimation procedure.

Table 2.1: Regions and Cities in Turkey

	Regions	Cities
1	Middle North	Ankara, Bilecik, Bolu, Cankiri, Corum, Eskisehir, Kirsehir, Kutahya, Usak, Yozgat
2	Aegean	Aydin, Balikesir, Burdur, Canakkale, Denizli, Isparta, Izmir, Manisa, Mugla
3	Mediterranean	Adana, Antalya, Gaziantep, Hatay, Icel, Kahramanmaras
4	North East	Agri, Artvin, Erzincan, Erzurum, Kars
5	South East	Mus, Hakkari, Mardin, Bingol, Bitlis, Diyarbakir, Siirt, Sanliurfa, Van
6	Middle East	Adiyaman, Amasya, Elazig, Malatya, Sivas, Tokat, Tunceli
7	Middle South	Afyon, Kayseri, Konya, Nevsehir, Nigde
8	Marmara	Bursa, Edirne, Kocaeli, Kirklareli, Istanbul, Sakarya, Tekirdag
9	Black Sea	Giresun, Gumushane, Kastamonu, Ordu, Rize, Samsun, Sinop, Trabzon

Source: Banks Association of Turkey

Table 2.2: Data Sources

Variable	Source
Election	Presidency of Supreme Election Council
Distance	General Directorate of Highways
Development Loans	The Banks Association of Turkey
Commercial Loans	The Banks Association of Turkey
Urbanisation	Turkish Statistics Institute
Population	Turkish Statistics Institute
Fixed Capital Investment	State Planning Organisation

In the classification of the BAT, there are nine regions in Turkey. Table 2.1 presents the regions and the cities in each region. Table 2.2 reports the data and their sources. All banking related data are obtained from the BAT. Population and fixed capital investment figures are from the Turkish Statistics Institute and State Planning Organisation respectively. We obtain urbanisation figures from urban and rural population figures of Turkish Statistics Institute. The results of general and local election figures are collected from Presidency of Supreme Election Council [19] .

[19]Baum et al. (2010) study Turkish banking over the same period and argue that macroeconomic aggregates are not available in the earlier years of their sample period. The unavailability of macroeconomic data motivates them using election dummies, in line with the strategy in this study, to capture the effects of time–varying macroeconomic factors. Please refer to Baum et al. (2010) for a detailed discussion.

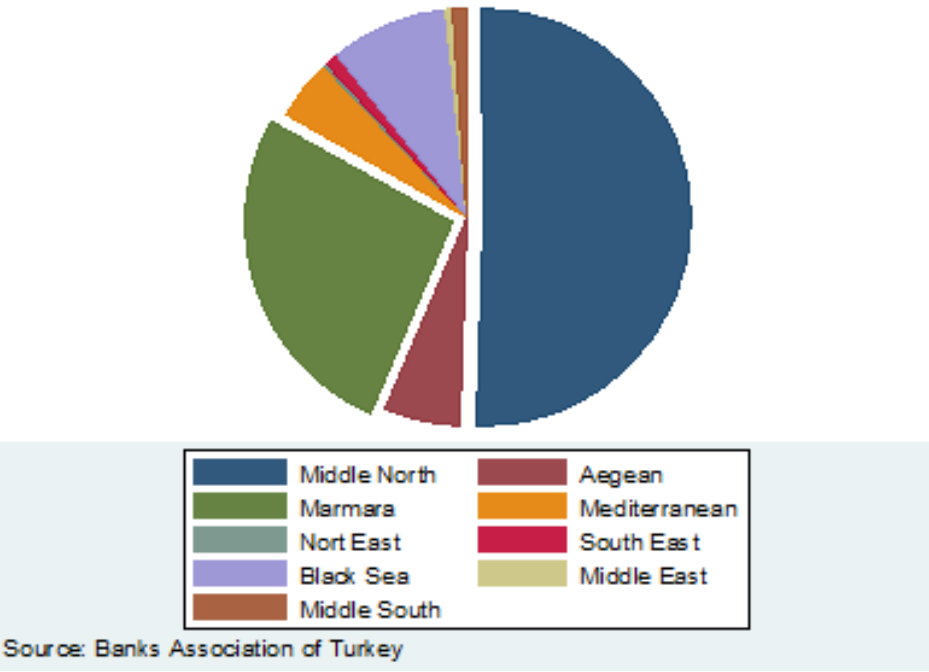


Figure 2.2: Regional Distribution of Development Loans between 1963–1994

Figure 2.2 plots the regional shares of development loans during 1963–1994. Since regional differences in terms of industrialisation and poverty is significant in Turkey (see e.g. Gezici and Hewings, 2007; Celebioglu and Dallerba, 2010), one would expect that development loans were used as a policy vehicle to promote development in those poor regions. Figure 2.2 shows that the allocation of development loans among regions was not balanced. At first glance, it is obvious that *Middle North* where the capital city is located was allocated a quite high amount of development loans. When development loans are concerned, the rationale would suggest that the level of industrialisation or poverty can be the targets of development lending. Taking into consideration the demographic and industrial prospects of this region, these two reasons do not explain why the region attracted that much development loans. The development loan share of *Middle North* has been the highest on average (see Table 2.3). *Marmara* region which has the largest population during the sample period (see Table 2.3) fell behind *Middle North* in terms of its loan share. If the *Black Sea*, *Middle North* and *Marmara* regions are left aside, the total share of remaining regions is trivial.

Figure 2.3 plots the regional distribution of commercial loans during the same

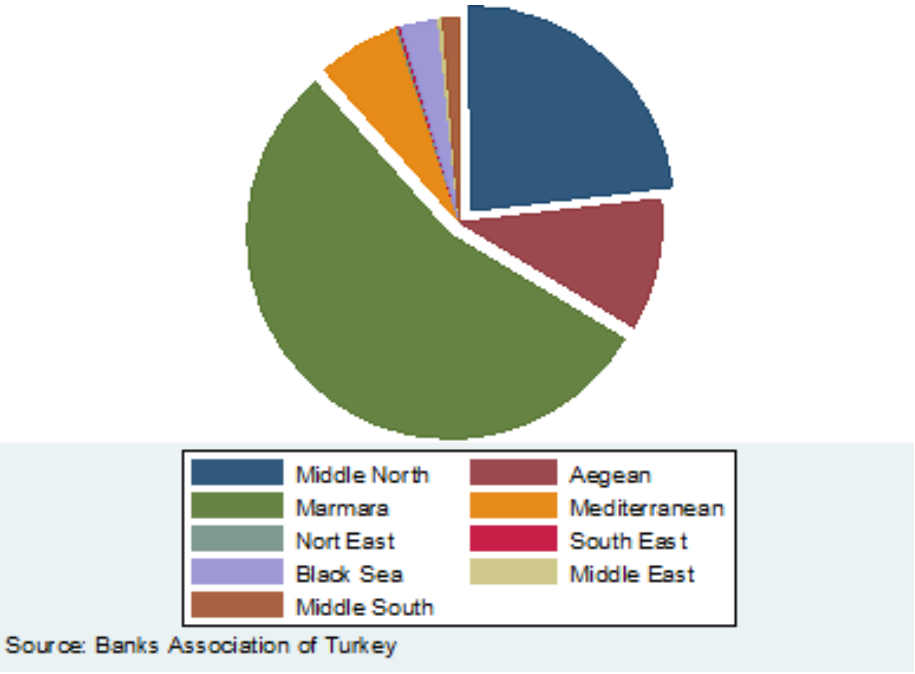


Figure 2.3: Regional Distribution of Commercial Loans between 1963–1994

period. As observed from Figure 2.3, commercial banks were heavily extended to the *Marmara* region. Just contrary to the development loans, the distribution among regions raises the importance of urbanisation. A substantial part of the commercial loans were channelled to the *Marmara* region. More urbanised (industrialised) regions collect more from commercial loans, however, the distance to the capital city seems to be effective. *Middle North* where the capital city is located was allocated the second highest amount of commercial loans. Once *Middle North* and *Marmara* regions are left aside, the total share of commercial loans, just like total share of development loans, in the remainder of regions is trivial.

Table 2.3: Descriptive statistics of regional variables

Shares of development loans during 1963-1964 (%)									
	Middle North	Aegean	Marmara	Mediterranean	North East	South East	Black Sea	Middle East	Middle South
Mean	50.44	5.87	26.81	4.80	0.36	0.96	9.11	0.57	1.07
Median	55.19	3.74	25.12	2.45	0.27	0.58	9.10	0.31	0.59
Min	4.54	0.00	13.88	0.00	0.00	0.00	0.00	0.00	0.00
Max	73.19	22.97	74.73	17.18	2.43	3.92	22.60	3.34	4.61
Std. Dev.	17.02	5.93	11.27	4.98	0.56	1.16	6.15	0.79	1.21
Political connection									
	Middle North	Aegean	Marmara	Mediterranean	North East	South East	Black Sea	Middle East	Middle South
Mean	0.08	0.08	0.10	0.06	0.03	0.04	0.06	0.04	0.04
Median	0.08	0.07	0.12	0.05	0.03	0.03	0.07	0.04	0.04
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Max	0.14	0.15	0.21	0.13	0.06	0.09	0.11	0.06	0.09
Std. Dev.	0.05	0.06	0.08	0.04	0.02	0.03	0.03	0.01	0.03
Urbanisation									
	Middle North	Aegean	Marmara	Mediterranean	North East	South East	Black Sea	Middle East	Middle South
Mean	0.54	0.45	0.66	0.49	0.31	0.40	0.29	0.37	0.38
Median	0.54	0.42	0.59	0.48	0.29	0.40	0.27	0.35	0.38
Min	0.37	0.34	0.56	0.38	0.20	0.27	0.18	0.25	0.28
Max	0.69	0.59	0.80	0.61	0.45	0.53	0.44	0.49	0.47
Std. Dev. 0.09	0.09	0.07	0.07	0.07	0.08	0.06	0.15	0.08	
Distance to Ankara, (km)									
	Middle North	Aegean	Marmara	Mediterranean	North East	South East	Black Sea	Middle East	Middle South
	2189	4864	3414	3460	4656	9409	4837	4135	1455
Distance to Istanbul, (km)									
	Middle North	Aegean	Marmara	Mediterranean	North East	South East	Black Sea	Middle East	Middle South
	4544	5081	1075	5885	6392	13297	7374	7045	3408

2.5.2.1 Distance Measure

There is no data available for distance and political connection variables, they need to be calculated. The approach to measure distance vary according to the theme that is studied. For instance, Onder and Ozyildirim (2011) examine the impact of distance on banking activities and local output growth nexus. Since their study is related to loans distributed by local branches, they employ a functional distance measure which is calculated via adjusting the distance between two financial centres by number of branches in each centre. This approach can also be seen in Alessandrini et al. (2005). In our study, we are studying how transportation costs and informational asymmetries as a function of physical distance impact regional development lending. As indicated clearly by Brevoort and Wolken (2008), transportation costs are of vital importance in the amount of lending. Automated teller machines and internet banking have significantly reduced transportation costs, yet, the the use of automated teller machines and internet was highly limited in Turkey during 1963–1994.

I follow Degryse and Ongena (2005) who calculate the distance as physical distance [20]. In this study, the distance measure is calculated by taking the physical distance from each city in region i to the capital city (Ankara). Since this chapter examines regional data, the distance variable should be modified to measure regional distance. At first hand, I calculate the sum of the distances of each province in region i, $Distance = \sum_{k=1}^{n_i} distance_k$. Then, I calculate the mean value to consider the average effect of the distance of region i, $MeanDistance = \sum_{k=1}^{n_i} \frac{distance_k}{n}$. My prior expectation is that the development loans are negatively distributed in proportion to their distance. The equations, therefore, are estimated by including inverses of the distance measure that has been measured previously $InverseDistance = \sum_{k=1}^{n_i} \frac{1}{distance_k}$. To take into account the non–linear effect of the distance, I also calculate the sum of squared distances to account for non–linear effects, $SquaredDistance =$

[20] In a similar way, based on physical distance, Petersen and Rajan (2002) takes the distance of a firm to its lender as the log of one plus the physical distance between that firm and its lending institution.

$\sum_{k=1}^{n_i} distance_k^2$.

2.5.2.2 Political Connection Measure

To examine the relationship between the regional distribution of development loans and politically connected provinces, I raise several assumptions.

Assumption-1: In Turkey, municipalities are the local administrations whose administrators (mayors) are elected autonomously but strongly under control of central government [21]. For instance the municipalities are highly dependent on the central government for their income. A higher portion of their revenues are transferred from central government budget through transfer payments. In addition, municipalities can receive loans from the central government or from private financial institutions with a reimbursement guarantee that is obtained from Turkish Treasury. Up until late 1990s a guarantee scheme was also introduced to municipalities that enabled cheap loans from private and state banks. Loose credit risk management of the loans under this guarantee scheme resulted in recurrent defaults that required government bail-out many times. Although the local governments are heavily dependent on central government, the hierarchy in the local governments is rigidly monitored by the political parties from which the mayor is elected. This political autonomy and fiscal dependency jointly makes local governments highly fragile in terms of their utilisation of government sources. It can be argued that if the mayor of the province is elected from the ruling party, it may be easier to get development loans for public projects. On the other hand, potential interest groups may utilise the political connection of corrupted mayors with the ruling party to get development loans for their

[21] After the World War II, Turkey experienced a rapid urbanisation and a fair degree of industrialisation. The rapid urbanisation has resulted in the growth of the private sector that in turn led to the necessity of building new facilities for marketing and distribution of goods as well as communication, transportation, and other infrastructure for new business and industrial activities. The local governments could not keep pace with these developments. The Municipal Law, 1930, had given to the local governments the responsibility of carrying out numerous functions without paying much attention to the issue of financial means at the disposal of the municipalities. The system of local revenues was inadequate and dysfunctional in their nature (Heper, 1989). The inadequacy of local revenues made the expenditures of municipalities totally dependent on the funds transferred from central government which was at the complete discretion of the central government. The lack of any official rule that designs the nature of this funding has been the main reason why public funds were considered to be transferred on partisan considerations.

projects. The first assumption is that politically connected mayors attract higher shares from development loans by exercising their political connection.

Assumption-2: In Turkey, the population exhibits substantial heterogeneity that assumes population as a significant factor on the effectiveness of political connection. The impact of political connection in receiving development loans should consider demographics. The second assumption is that, politically connected mayors in highly populated cities attract more development loans to their cities.

To observe the effect of political connection, I generate an index. As *Assumption-1* and *Assumption-2* suggest, I detect politically connected mayors for each year during the sample year. In order to measure the political connection, I document the mayors' political affiliation during the sample period. Then, I decide whether there exists a political connection by matching the mayors' political party and the ruling political party(ies). If the mayors' political party is the ruling party(ies), I argue that there is a political connection.

In the sample period, there have been local elections in 1963, 1968, 1973, 1977, 1984, 1989, and 1994. The general elections took place in 1961, 1965, 1969, 1973, 1977, 1983, 1987, and 1991. In the sample period, there were already two coups in 1971 and 1980. After each coup, the military has taken over the governments and established *ad hoc* governments. I consider the latest outlook as the representative of the year. For instance, if there were more than one election in either local or general government or both, I take the latest mayor and latest ruling party to represent the political connection. I adjust the political connection with the population of the provinces that gives me a final index on regional scale. The adjusted political connection measure, (*Political Connection*), for region i in year t is then calculated as follows:

$$PoliticalConnection_{it} = \frac{\sum_{k=1}^{n}(Population_{itk} * Mayor_k)}{\sum_{k=1}^{n} Population_{itk}} \tag{2.2}$$

where k denotes the cities in region i and n denotes the number of cities in region i on year t. $Mayor$ is a dummy that takes value 1 if the mayor of the province k is from the ruling party and takes 0 otherwise. $Population$ is the population figure for the city k in region i on year t.

During the sample period there have been six censuses in Turkey: 1965, 1970, 1975, 1980, 1985, 1990, and 2000. The population of the years between the censuses should be estimated. The population between the two censuses is estimated according to the Turkstat assumption, the population of Turkey grows exponentially between any two censuses, $Population_t = Population_0 * e^{rt}$. Here, 0 represents the base year, i.e. between two censuses the base year is the earlier census.

2.6 Estimation and Results

In this chapter, I aim to investigate the importance of spatial proximity to the political centre as well as the political connection and elections in determining the amount of development loans that the regions have access to. Several proxies for the spatial proximity have been experimented. One of the explanatory variables included in the model is the one lagged value of development loans, which is expected to have an impact on the current loan distribution. Considering that the patterns in the loan provision might be different during the election times, three dummies are included: dummies for one year before and after the election and for the election year. The regression models reported in this study include dummies created for both parliamentary (general) election times and local elections.

I analyse the impact of distance, political connection, and elections on the regional shares of development loans and commercial loans. All models are estimated using a balanced panel data of 279 observations. The specification tests confirm that the estimates are reliable. It is confirmed that the GMM estimations are overall statistically significant. The Arellano-Bond $AR(2)$ tests show that there is no second order serial correlation in the models. The Sargan tests confirm the validity of overidentifying restrictions. The results reported are robust to heteroscedasticity,

and heteroscedastic robust standard errors are reported. Since the time dimension of the panel data exceeds the number of cross sections, the estimation procedure follows Roodman (2009a) to deal with the problems of over–identification and the symptom of instrument proliferation. The number of instruments in GMM estimations is reduced by including upto second lags of dependent variables and collapsing the instrument matrix (Roodman, 2009a).

In this study, a fixed effects or a generalised least squares estimation would also perform as well as a dynamic GMM model. Leaving out the fixed effects estimation due to the existence of time invariant variable, distance; the model is estimated by FGLS. The Likelihood Ratio test for heteroscedasticity and the Wooldridge test for autocorrelation (Wooldridge, 2010; Drukker, 2003) indicated that this model suffers from both heteroscedasticity and autocorrelation. Furthermore, the results of a Wald test on residual variances indicated existence of group-wise heteroscedasticity in the model (p-values are reported in Table 2.4). Development loans allocated to one region are likely to be affected from loan allocations made to other regions. The Breush–Pagan Lagrange Multiplier (LM) test of independence resulted in rejection of cross–sectional independence. Regions, in this respect, could be said to be in competition, which translates as cross sectional correlation in our model. Hence, the model is re–estimated by FGLS allowing for a heteroscedastic error structure and a cross sectional correlation (Baum, 2001).

The choice of estimator within random effects estimators is a hard one (see Appendix A). Although the FGLS model is estimated by allowing for a heteroscedastic error structure and a cross sectional correlation, I employ Hausman–Taylor estimator, originally proposed by Hausman and Taylor (1981), for a robustness check. I utilise a slightly different version of Hausman–Taylor estimator proposed by Amemiya and MaCurdy (1986) which is akin to Hausman–Taylor estimator but uses extra instruments to gain efficiency at the cost of additional assumptions on data–generating process for balanced panels.

2.6.1 Development Loans

Table 2.4, Table 2.5 and Table 2.6 present the estimation results for FGLS, Hausman–Taylor, and one–step system GMM estimators respectively. The results support the evidence that the distance from the financial centre matters (Ozyildirim and Onder, 2008; Harrigan and McGregor, 1987; Hutchinson and McKillop, 1990; Roberts and Fishkind, 1979). The findings suggest that distance from the capital city negatively and significantly impact development lending in Turkey. Different distance measures are employed in order to observe possible changing effects according to different definitions. The majority of the distance estimates, $MeanDistance$ and $InverseDistance$ are statistically significant and have expected sign. The estimates of $SquaredDistance$, that is used to examine the non–linear effects of distance, in FGLS estimations are significant but not significant in the remaining estimations, though the signs are negative as expected. The estimations indicate that the further the region is from the capital city, the less is the development lending. The results, thus show that $Marmara$ region suffered from being distant to the capital city in getting development loans. It is obvious that $Marmara$, as the leading industrial and commercial region has scarcely used development loans with respect to its industrial and commercial capacity, which implies that development loans were not used to promote industrialisation of the country. The spatial effects also play negative for distant regions, e.g. *Black Sea*, *South East*, who have low level of economic development. It is also clear that the loans were not used to lessen economic inequality across the regions.

Table 2.4: Estimation Results of Development Banking–FGLS Estimator

Dependent variable : Real regional development loans						
	General Election			Local Election		
Variables	Model I	Model II	Model III	Model I	Model II	Model III
Log(loan)$_{t-1}$	0.323***	0.262***	0.312***	0.330***	0.276***	0.323***
	(0.0269)	(0.0226)	(0.0258)	(0.0293)	(0.0251)	(0.0285)
Inverse distance	7.044e+06***			6.919e+06***		
	(910,786)			(905,934)		
Mean distance		-0.00250***			-0.00244***	
		(0.000336)			(0.000334)	
Distance squared			-1.37e-07***			-1.32e-07***
			(3.21e-08)			(3.19e-08)
Political connection	3.834***	3.042***	3.175***	4.323***	3.432***	3.713***
	(1.106)	(0.970)	(1.055)	(1.170)	(0.973)	(1.096)
Pre-election dummy	0.117	0.155	0.106	0.111	0.117	0.151
	(0.150)	(0.122)	(0.132)	(0.176)	(0.133)	(0.150)
Election dummy	-0.211	-0.0953	-0.186	0.324*	0.346**	0.370**
	(0.165)	(0.136)	(0.145)	(0.187)	(0.143)	(0.160)
Post-election dummy	-0.139	-0.0930	-0.132	0.180	0.140	0.165
	(0.153)	(0.124)	(0.133)	(0.166)	(0.125)	(0.141)
Post coup dummy	-0.247	-0.209	-0.267	0.0187	0.0228	0.00426
	(0.222)	(0.188)	(0.199)	(0.257)	(0.201)	(0.223)
1988 dummy	-13.20***	-13.27***	-13.28***	-13.37***	-13.40***	-13.46***
	(0.383)	(0.310)	(0.360)	(0.430)	(0.349)	(0.407)
Log(fixed capital investment)	0.389***	0.298**	0.326**	0.359**	0.329***	0.323**
	(0.138)	(0.121)	(0.129)	(0.152)	(0.127)	(0.139)
Urbanisation	4.068***	5.017***	5.184***	3.787***	4.744***	4.887***
	(0.614)	(0.547)	(0.628)	(0.654)	(0.582)	(0.667)
Recession	-0.204	-0.170	-0.182	-0.227	-0.197	-0.192
	(0.213)	(0.176)	(0.188)	(0.230)	(0.177)	(0.198)
Constant	0.712	4.132***	2.160	0.917	3.497**	1.956
	(1.733)	(1.555)	(1.615)	(1.918)	(1.607)	(1.732)
Observations	279	279	279	279	279	279
Number of regions	9	9	9	9	9	9
Wald test (p) †	0.00	0.00	0.00	0.00	0.00	0.00
Wald test (p) ‡	0.00	0.00	0.00	0.00	0.00	0.00
LM test (p) ‡	0.00	0.00	0.00	0.00	0.00	0.00

Notes: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors are given in parentheses. † indicates Wald test for overall significance. ‡ indicates Wald test for group-wise heteroscedasticity and Breusch-Pagan LM test for cross–sectional correlation are performed on estimations allowing for a heteroscedastic but uncorrelated error structure. Inverse distance, mean distance, and squared distance measures of region i are, $MeanDistance = \sum_{k=1}^{n_i} \frac{distance_k}{n}$, $InverseDistance = \sum_{k=1}^{n_i} \frac{1}{distance_k}$ and $SquaredDistance = \sum_{k=1}^{n_i} distance_k^2$, respectively. Political connection is measured by $PoliticalConnection_{it} = \frac{\sum_{k=1}^{n} (Population_{itk} * Mayor_k)}{\sum_{k=1}^{n} Population_{itk}}$ where k denotes the cities in region i and n denotes the number of cities in region i on year t. $Mayor$ is a dummy that takes value 1 if the mayor of the province k is from the ruling party and takes 0 otherwise. $Population$ is the population figure for the city k in region i on year t. I estimate the population between censuses based on Turkstat assumption, the population of Turkey grows exponentially between any two censuses, $Population_t = Population_0 * e^{rt}$. Here, 0 represents the base year, i.e. between two censuses the base year is the earlier census. Pre-election, election, and post-election dummies take the value of 1, one year before election, election and one year after election respectively, and 0 otherwise. 1988 dummy takes the value of 1 on the year 1988 and 0 otherwise. Log(fixed capital investment) is the logarithmic transformation of annual fixed capital investment figure. The urbanisation figure is the ratio of urban population in total population. The analysis follow Baum et al. (2010) in the creation of post coup and recession dummies. Post coup dummy takes the value of for the three consecutive years after 1980 when the coup took place, and 0 otherwise. The recession dummy takes the value of 1 when the years were 1979, 1980 and 1994 when there occurred economic downturn in the country, and 0 otherwise.

Table 2.5: Estimation Results of Development Banking–Hausman-Taylor Estimator

Dependent variable : *Real regional development loans*

	General Election			Local Election		
Variables	Model I	Model II	Model III	Model I	Model II	Model III
Log(loan)_{t-1}	0.326***	0.326***	0.326***	0.338***	0.337***	0.338***
	(0.0357)	(0.0357)	(0.0357)	(0.0357)	(0.0357)	(0.0357)
Inverse distance	1.465e+07*			1.484e+07*		
	(8.883e+06)			(8.957e+06)		
Mean distance		-0.00357**			-0.00357**	
		(0.00175)			(0.00178)	
Distance squared			-2.34e-07			-2.34e-07
			(1.84e-07)			(1.87e-07)
Political connection	3.700*	3.609*	3.608*	4.334**	4.245**	4.247**
	(2.008)	(2.007)	(2.009)	(1.983)	(1.983)	(1.984)
Pre-election dummy	0.0370	0.0355	0.0351	-0.111	-0.110	-0.111
	(0.247)	(0.247)	(0.247)	(0.244)	(0.244)	(0.244)
Election dummy	-0.142	-0.142	-0.143	0.488**	0.486**	0.486**
	(0.253)	(0.253)	(0.253)	(0.241)	(0.240)	(0.241)
Post-election dummy	-0.284	-0.286	-0.286	0.235	0.233	0.234
	(0.260)	(0.259)	(0.260)	(0.231)	(0.231)	(0.231)
Post coup dummy	0.112	0.109	0.110	0.353	0.349	0.350
	(0.294)	(0.294)	(0.294)	(0.299)	(0.299)	(0.299)
1988 dummy	-12.35***	-12.34***	-12.34***	-12.34***	-12.34***	-12.34***
	(0.560)	(0.559)	(0.560)	(0.559)	(0.559)	(0.559)
Log(fixed capital investment)	0.926***	0.890***	0.902***	0.990***	0.954***	0.968***
	(0.321)	(0.312)	(0.320)	(0.320)	(0.312)	(0.320)
Urbanisation	-0.562	-0.258	-0.360	-1.137	-0.839	-0.954
	(2.393)	(2.316)	(2.390)	(2.392)	(2.321)	(2.391)
Recession	-0.360	-0.361	-0.361	-0.375	-0.374	-0.375
	(0.324)	(0.323)	(0.323)	(0.291)	(0.291)	(0.291)
Constant	-4.952	-1.450	-2.916	-5.948*	-2.439	-3.920
	(3.547)	(3.249)	(3.324)	(3.518)	(3.229)	(3.298)
Observations	279	279	279	279	279	279
Number of regions	9	9	9	9	9	9
Wald test (p) †	0.00	0.00	0.00	0.00	0.00	0.00

Notes: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors are given in parentheses. † indicates Wald test for overall significance. Inverse distance, mean distance, and squared distance measures of region i are, $MeanDistance = \sum_{k=1}^{n_i} \frac{distance_k}{n}$, $InverseDistance = \sum_{k=1}^{n_i} \frac{1}{distance_k}$ and $SquaredDistance = \sum_{k=1}^{n_i} distance_k^2$, respectively. Political connection is measured by $PoliticalConnection_{it} = \frac{\sum_{k=1}^{n} (Population_{itk} * Mayor_k)}{\sum_{k=1}^{n} Population_{itk}}$ where k denotes the cities in region i and n denotes the number of cities in region i on year t. $Mayor$ is a dummy that takes value 1 if the mayor of the province k is from the ruling party and takes 0 otherwise. $Population$ is the population figure for the city k in region i on year t. I estimate the population between censuses based on Turkstat assumption, the population of Turkey grows exponentially between any two censuses, $Population_t = Population_0 * e^{rt}$. Here, 0 represents the base year, i.e. between two censuses the base year is the earlier census. Pre-election, election, and post-election dummies take the value of 1, one year before election, election and one year after election respectively, and 0 otherwise. 1988 dummy takes the value of 1 on the year 1988 and 0 otherwise. Log(fixed capital investment) is the logarithmic transformation of annual fixed capital investment figure. The urbanisation figure is the ratio of urban population in total population. The analysis follow Baum et al. (2010) in the creation of post coup and recession dummies. Post coup dummy takes the value of for the three consecutive years after 1980 when the coup took place, and 0 otherwise. The recession dummy takes the value of 1 when the years were 1979, 1980 and 1994 when there occurred economic downturn in the country, and 0 otherwise.

Table 2.6: Estimation Results of Development Banking–GMM Estimator

Dependent variable : *Real regional development loans*

	General Election			Local Election		
Variables	Model I	Model II	Model III	Model I	Model II	Model III
Log(loan)_{t-1}	0.100**	0.0972**	0.101**	0.0835*	0.0807*	0.0844*
	(0.0463)	(0.0467)	(0.0461)	(0.0485)	(0.0486)	(0.0483)
Inverse distance	5.519e+07**			6.333e+07*		
	(2.617e+07)			(3.327e+07)		
Mean distance		-0.0180			-0.0206	
		(0.0123)			(0.0143)	
Distance squared			-1.58e-06			-1.82e-06
			(1.17e-06)			(1.29e-06)
Political connection	8.926*	8.822**	8.956**	5.843*	5.731**	5.880**
	(4.575)	(4.485)	(4.496)	(2.986)	(2.898)	(2.943)
Pre-election dummy	0.427***	0.429***	0.426***	0.0824	0.0776	0.0840
	(0.153)	(0.152)	(0.153)	(0.190)	(0.191)	(0.190)
Election dummy	0.313**	0.316**	0.312**	-0.0465	-0.0535	-0.0442
	(0.136)	(0.136)	(0.136)	(0.0972)	(0.0944)	(0.0956)
Post-election dummy	0.492**	0.491**	0.493**	0.0182	0.0196	0.0177
	(0.195)	(0.193)	(0.193)	(0.131)	(0.134)	(0.132)
Post coup dummy	0.0881	0.0911	0.0873	0.0290	0.0301	0.0286
	(0.195)	(0.196)	(0.197)	(0.200)	(0.199)	(0.200)
1988 dummy	-14.44***	-14.40***	-14.45***	-13.84***	-13.81***	-13.86***
	(0.610)	(0.621)	(0.616)	(0.532)	(0.553)	(0.543)
Log(fixed capital investment)	1.842***	1.831***	1.845***	1.316***	1.308***	1.319***
	(0.469)	(0.453)	(0.457)	(0.338)	(0.329)	(0.333)
Urbanisation	-8.239*	-8.184*	-8.254*	-4.905	-4.860	-4.920
	(4.497)	(4.401)	(4.431)	(3.928)	(3.898)	(3.903)
Recession	0.130	0.132	0.129	-0.140	-0.139	-0.141
	(0.224)	(0.224)	(0.224)	(0.153)	(0.153)	(0.154)
Constant	-14.68**	-0.0110	-5.809	-9.173**	7.562	1.021
	(6.298)	(8.095)	(5.536)	(4.398)	(7.963)	(3.483)
Observations	279	279	279	279	279	279
Number of regions	9	9	9	9	9	9
Number of instruments	35	35	35	34	34	34
Sargan p-value †	0.115	0.127	0.111	0.207	0.221	0.202
AR(2) p-value †	0.669	0.666	0.671	0.323	0.326	0.321
F test p-value ‡	0.00	0.00	0.00	0.00	0.00	0.00

Notes: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors are given in parentheses. † indicates the invalidity of the instruments is rejected by using Sargan test of over–identifying restrictions for the models with no heteroscedasticity or autocorrelation. The second order serial correlation is also removed. ‡ indicates the Wald test for overall significance. Inverse distance, mean distance, and squared distance measures of region i are, $MeanDistance = \sum_{k=1}^{n_i} \frac{distance_k}{n}$, $InverseDistance = \sum_{k=1}^{n_i} \frac{1}{distance_k}$ and $SquaredDistance = \sum_{k=1}^{n_i} distance_k^2$, respectively. Political connection is measured by $PoliticalConnection_{it} = \frac{\sum_{k=1}^{n} (Population_{itk} * Mayor_k)}{\sum_{k=1}^{n} Population_{itk}}$ where k denotes the cities in region i and n denotes the number of cities in region i on year t. *Mayor* is a dummy that takes value 1 if the mayor of the province k is from the ruling party and takes 0 otherwise. *Population* is the population figure for the city k in region i on year t. I estimate the population between censuses based on Turkstat assumption, the population of Turkey grows exponentially between any two censuses, $Population_t = Population_0 * e^{rt}$. Here, 0 represents the base year, i.e. between two censuses the base year is the earlier census. Pre-election, election, and post-election dummies take the value of 1, one year before election, election and one year after election respectively, and 0 otherwise. 1988 dummy takes the value of 1 on the year 1988 and 0 otherwise. Log(fixed capital investment) is the logarithmic transformation of annual fixed capital investment figure. The urbanisation figure is the ratio of urban population in total population. The analysis follow Baum et al. (2010) in the creation of post coup and recession dummies. Post coup dummy takes the value of for the three consecutive years after 1980 when the coup took place, and 0 otherwise. The recession dummy takes the value of 1 when the years were 1979, 1980 and 1994 when there occurred economic downturn in the country, and 0 otherwise.

The results suggest that increasing political connection between local and central governments spurs development lending. The results are robust to using alternative estimators, FGLS, Hausman–Taylor, and one–step GMM estimators. The results reveal that the regions, whose mayors and general government have the same political party origin, are more likely to get higher volume of loans. The results are in line with prior findings in the literature (Micco et al., 2007a; Micco and Panizza, 2006; Micco et al., 2007b; Onder and Ozyildirim, 2011). Onder and Ozyildirim (2011), for instance, find that local politicians affect lending decisions of the state–owned banks in their cities. Since there is limited incentive for state–owned banks to improve governance and to reduce the moral hazard problem (see e.g. Dinc, 2005), mayors might have played a significant role in lowering asymmetric information between development banks and project owners. Onder and Ozyildirim (2011) find that state–owned bank lending did not promote growth in the politically connected cities. The significant relationship between political connection and development lending in this study, however, does not necessarily show that politically driven loans reduce welfare.

In terms of the impact of elections, I estimate different models for general and local elections. The results indicate that development loans do not react to general and local elections. Baum et al. (2010) examine the impact of local and general elections on Turkish banking system, and find that banks reduce their loan–to–asset ratios during and around the election year. They relate this finding to the banks' perception of increased risk stemming from political uncertainty. An interesting finding in their study suggests that state–owned banks do not differentiate from private–banks in terms of lending behaviour before, during and after the elections. They conclude that politicians do not distort the lending pattern in state–owned banks around election years. The findings of this study should be perceived as plausible outcomes and in agreement with the findings of Baum et al. (2010). Development banks' main scope is long–term project financing. The elections can have transitory effects relative to the life of development loans, which implies that elections may not

affect the lending behaviour of development banks.

The impacts of the control variables on development lending are very much in line with expectations. The *Post coup* dummy represents consecutive three years after the coup happened in 1980 [22]. According to results, coup and recessions are not significantly associated with development lending, providing the evidence that macroeconomic and political disorder do not affect development banking activities. The results are surprising given that development lending is expected to dwindle by extreme economic and political conditions of the country. I have included the 1971 coup into consideration and assigned 1 to *Post coup* dummy for the consecutive three years after 1971. The insignificant results remained unchanged. I assumed two and four consecutive years after the coup years and redesigned *Post coup* dummy accordingly. The results did not change either [23].

The $Urbanisation$ variable is calculated as the measure of urban population in the total population of a city. On the estimation of the populations between any two censuses, I assume the same considerations regarding the $Population$ variable in political connection variable, $PoliticalConnection$. An interesting but expected result is that, urbanisation is negatively associated with development loan provision. This finding can be explained by development banks' scope of supporting rural development (see e.g. Park and Sehrt, 2001, how state–owned banks support rural economy). The increasing level of urbanisation negatively affects development loan distribution. The estimates of urbanisation by RE estimator are positive, though GMM and Hausman–Taylor estimators yield negative results. After plugging an interaction term into the equation to control for the joint effect of urbanisation and political connection, the FGLS results also indicate a negative relationship between urbanisation and development loans.

[22]Baum et al. (2010) argue that, thanks to remittances from Turkish citizens in Germany and other European countries, an economic downturn did not take place in Turkish economy in the 1960s or early 1970s. Hence, they did not control for the impact of the coup in 1971 for that reason. Baum et al. (2010) define a dummy that takes 1 for consecutive three years after 1980, the coup year, 0 otherwise.

[23]I have not reported the estimation results for those alternative *Post coup* definitions to save space.

Although urbanisation *per se* affects development loan allocation, it is assumed that political connection with differing degree of urbanisation is influential on development lending. The political connection with increasing urbanisation might fuel development loan allocation. To examine the effect of being "politically connected and urbanised" on the development loan shares of the regions, I plug an interaction variable into the equation (2.1) and estimate equation (2.3) :

$$\begin{aligned} RDIL_{i,t} = \alpha &+ \beta_1 RDIL_{i,t-1} + \beta_2 Distance_i + \beta_3 PoliticalConnection_{i,t} \\ &+ \beta_4 Election_t + \beta_5 PoliticalConnection_{i,t} * Urbanisation \\ &+ \beta_6 CONTROL_{i,t} + \mu_i + \varepsilon_{i,t} \end{aligned} \tag{2.3}$$

On the estimation of Equation (2.3), the interaction term, $Political\ Connection_{i,t} * Urbanisation$, is found to be significant. Once interaction term is introduced, the positive impact of $Urbanisation$ reduces with negative parameter estimate of $Political\ Connection_{i,t} * Urbanisation$ in the models (see Table 2.7). This also provides useful insights about the relationship between urbanisation and political connection. That is, political connection fuels development banking in rural areas.

Table 2.7: Estimation Results with Interaction Terms–FGLS Estimator

Variables	General Election	Local Election
Log(loan)$_{t-1}$	0.256***	0.274***
	(0.0239)	(0.0256)
Mean distance	-0.00245***	-0.00237***
	(0.000381)	(0.000381)
Political connection	12.00***	12.18***
	(2.681)	(2.912)
Political connection*Urbanisation	-16.76***	-16.50***
	(4.034)	(4.322)
Pre-election dummy	0.190	0.190
	(0.116)	(0.120)
Election dummy	0.0678	0.384***
	(0.128)	(0.130)
Post-election dummy	-0.0511	0.0879
	(0.114)	(0.115)
Post coup dummy	-0.0524	0.133
	(0.180)	(0.187)
1988 dummy	-13.29***	-13.41***
	(0.325)	(0.356)
Log(fixed capital investment)	0.141	0.128
	(0.111)	(0.114)
Urbanisation	6.585***	6.334***
	(0.498)	(0.525)
Recession	-0.0724	-0.152
	(0.167)	(0.164)
Constant	5.392***	5.317***
	(1.467)	(1.480)
Observations	279	279
Number of regions	9	9
Wald test (p) †	0.00	0.00
Wald test (p) ‡	0.00	0.00
LM test (p) ‡	0.00	0.00

Notes: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors are given in parentheses. † indicates Wald test for overall significance. ‡ indicates Wald test for group-wise heteroscedasticity and Breusch-Pagan LM test for cross–sectional correlation are performed on estimations allowing for a heteroscedastic but uncorrelated error structure. Inverse distance, mean distance, and squared distance measures of region i are, $MeanDistance = \sum_{k=1}^{n_i} \frac{distance_k}{n}$. Political connection is measured by $PoliticalConnection_{it} = \frac{\sum_{k=1}^{n} (Population_{itk} * Mayor_k)}{\sum_{k=1}^{n} Population_{itk}}$ where k denotes the cities in region i and n denotes the number of cities in region i on year t. $Mayor$ is a dummy that takes value 1 if the mayor of the province k is from the ruling party and takes 0 otherwise. $Population$ is the population figure for the city k in region i on year t. I estimate the population between censuses based on Turkstat assumption, the population of Turkey grows exponentially between any two censuses, $Population_t = Population_0 * e^{rt}$. Here, 0 represents the base year, i.e. between two censuses the base year is the earlier census. Pre-election, election, and post-election dummies take the value of 1, one year before election, election and one year after election respectively, and 0 otherwise. 1988 dummy takes the value of 1 on the year 1988 and 0 otherwise. Log(fixed capital investment) is the logarithmic transformation of annual fixed capital investment figure. The urbanisation figure is the ratio of urban population in total population. The analysis follow Baum et al. (2010) in the creation of post coup and recession dummies. Post coup dummy takes the value of for the three consecutive years after 1980 when the coup took place, and 0 otherwise. The recession dummy takes the value of 1 when the years were 1979, 1980 and 1994 when there occurred economic downturn in the country, and 0 otherwise. $Politicalconnection * Urbanisation$ is an interaction term to capture the impact of political connection in closer regions.

Fixed capital investments positively and significantly impact the development loan distribution. Developing countries who have relatively low level of capital stock tend to attain high growth rates once adequate capital stock is injected (Rostow, 1956; Rosenstein-Rodan, 1943; Gerschenkron, 1962). Empirical evidences also

suggest that the rate of capital formation has a positive influence on a country's economic growth (Barro, 1991; Kormendi and Meguire, 1985). The findings of this chapter reveals that development lending contributed to country's capital formation significantly. The positive link between fixed capital investment and growth suggests that development lending can be regarded as growth promotive.

I incorporate 1988 dummy into the model to control for the sudden drop of development loans in many regions. In 1988, total development loans have been directed solely to *Marmara* and *Middle North* regions. 1988 indicates a year when the name of State Industry and Workers Investment Bank (*Devlet Sanayi ve Isci Yatirim Bankasi* in Turkish) has changed to Development Bank of Turkey (*Turkiye Kalkinma Bankasi* in Turkish). This bank was one of the effective banks in development banking in Turkey during its time and the main motivation of the bank was spurring industrialisation. The changed name presumably motivated the bank to lend to industrial projects that were mostly present in *Marmara* region. Due to bank's location, which is the capital city (*Middle North*), the spatial dimension of development loan distribution is very visible [24].

2.6.2 Commercial Loans

I analyse commercial loans in the similar way I do for development loans [25]. The findings of commercial loans would be a robustness check for the findings of development banks, especially from spatial dimension and political connection perspectives. I expect that spatial dimension of lending should be effective for commercial loans. Commercial banks reduce informational asymmetry and moral hazard by allocating loans to close periphery that would also minimises the cost of funding. The political connection, as defined in this study, may not be effective in commercial banking. Mayors may not attract commercial loans by exploiting their political affiliation.

[24] The clear reason behind this decision still needs confirmation, yet, this institutional change in Development Bank of Turkey suggests a reasonable explanation. To have more information about the scope of the Bank's activities please visit: http://www.kalkinma.com.tr/

[25] According to the definition of BAT (2008), the loans are classified as commercial (*ticari*) loans, development (*kalkinma*) loans and expertise (*ihtisas*) loans. Expertise loans are the sectoral loans that focus on specific sectors of economy, e.g. mining, agriculture, maritime etc.

This is especially valid when commercial banks are private–owned.

I explore the impact of distance, political connection, and elections on commercial loan provision. I run several regressions with different estimators as I run for development loans. Table 2.8 presents the estimation results with Hausman–Taylor and one–step system GMM estimator. Once commercial loans are examined, the results underpin the findings of development loans in terms of spatial dimension. Distance from the political centre negatively and significantly impacts commercial loan provision [26]. Political connection does not have a statistically significant association with commercial loans, as opposed to the findings of development loans. Khwaja and Mian (2005) find that politically connected borrowers do not have much incentive to borrow from private banks where the loan has to be repaid. Commercial banks are better at assessing the credit risk of their customers and can perform successful governance practices. The results of commercial loans in this study provide evidence that political connection of mayors with the ruling party was not a motive for commercial lending.

In terms of the impact of elections, I follow the same strategy pursued for development loans and estimate separate models for general and local elections. Similar to the findings of development loans, the results do not provide exact and clear relationship. The results of commercial loans confirm the findings of Akalın and Erkişi (2007) and Baum et al. (2010) who examine election cycles and their impacts on Turkish economy. Baum et al. (2010) find no particular effect of election cycles on deposit–to–asset and bond–to–asset ratios of Turkish banks during 1963–2007. They conclude that election cycles do not render any change on the behaviour of depositors and governments. Akalın and Erkişi (2007) also find no evidence of election cycle in Turkey during 1950–2006. They particularly could not find evidence

[26] Although the period I study corresponds to heavy state dominance in banking activity, I have computed the same distance measures simply taking the financial center as Istanbul (see e.g. Onder and Ozyildirim, 2011), the most populous city having larger industry and commercial base. In doing so, I explore as to whether Istanbul dominates in commercial lending activity. I do not present the results to save space but the results do not show significant relationship. This is just in line with the arguments of spatial dimension of lending, since during the sample period, the headquarters of the great portion of commercial banks were also in Ankara (BAT, 2008).

of governmental policy shift around election years.

Regarding the control variables, the estimate of the *Post coup* dummy is negative but statistically insignificant. *Recession* dummy enters into the regressions with negative and statistically significant signs which is quite expected. It is reasonable that during recession times economic activity slows down, supply and demand shocks lead bank lending to dwindle. The effect of urbanisation on commercial loans is statistically insignificant. Black and Henderson (1999) find a high correlation between urbanisation and economic growth in developing countries, because urbanisation contributes to efficient functioning of goods, labour and financial markets and information spillovers amongst producers. During the sample period, with the majority of the population still rural, the relationship between urbanisation on bank lending might not be clear. I find that fixed capital investments have positive but insignificant impact on commercial loans. Motivated from the discussion on the findings of development loans, capital formation in the regions was not triggered by commercial lending. This can be explained by the fact that the composition of commercial loans mainly exclude those expertise loans, e.g. agricultural loans, vocational loans, trade loans, that are open to capital accumulation (see e.g. BAT, 2008).

Overall, the results of commercial loans suggest that spatial dimension of lending is also crucial in the provision of commercial loans. Growing costs and agency problems with increasing remoteness also matter for commercial lending. Intuitive and interesting finding is that political connection does not matter. Mayors' political influence is not effective in commercial lending. The association between commercial loan distribution and the elections is still fuzzy as is found in development loans.

Table 2.8: Estimation Results of Commercial Banking

Dependent variable : *Real regional per capita commercial loans*				
	Hausman-Taylor		One-Step System GMM	
Variables	General Election	Local Election	General Election	Local Election
Log(loan)_{t-1}	0.728***	0.699***	0.618***	0.494**
	(0.0446)	(0.0457)	(0.188)	(0.201)
Mean distance	-0.00154*	-0.00174*	-0.00771*	-0.0103**
	(0.000823)	(0.000905)	(0.00415)	(0.00429)
Political connection	0.247	0.226	-1.673	-2.047
	(0.278)	(0.284)	(1.682)	(1.488)
Pre-election dummy	0.154***	-0.0863*	-0.134	-0.0411
	(0.0491)	(0.0492)	(0.150)	(0.129)
Election dummy	0.0171	-0.150***	-0.151	-0.100
	(0.0497)	(0.0484)	(0.154)	(0.125)
Post-election dummy	-0.0937*	-0.0149	-0.218	-0.219*
	(0.0496)	(0.0486)	(0.142)	(0.133)
Post coup dummy	0.0824	0.0711	0.0201	-0.0879
	(0.0595)	(0.0631)	(0.179)	(0.201)
Log(fixed capital investment)	0.00104	0.0331	0.0935	0.117
	(0.0695)	(0.0725)	(0.234)	(0.244)
Urbanisation	-0.151	-0.383	-0.267	-0.358
	(0.538)	(0.558)	(1.534)	(1.602)
Recession	-0.195***	-0.208***	-0.450**	-0.325*
	(0.0644)	(0.0610)	(0.175)	(0.169)
Constant	0.224	0.0165	2.737	3.634*
	(0.822)	(0.876)	(1.950)	(2.129)
Observations	279	279	279	279
Number of regions	9	9	9	9
Number of instruments			35	35
Sargan p-value †			0.959	0.985
AR(2) †			0.922	0.470
F test p-value ‡	0.00	0.00	0.00	0.00

Notes: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors are given in parentheses. ‡ indicates Wald test for overall significance. † indicates the invalidity of the instruments is rejected by using Sargan test of over–identifying restrictions for the models with no heteroscedasticity or autocorrelation. The second order serial correlation is also removed. Inverse distance, mean distance, and squared distance measures of region i are, $MeanDistance = \sum_{k=1}^{n_i} \frac{distance_k}{n}$, $InverseDistance = \sum_{k=1}^{n_i} \frac{1}{distance_k}$ and $SquaredDistance = \sum_{k=1}^{n_i} distance_k^2$, respectively. Political connection is measured by $PoliticalConnection_{it} = \frac{\sum_{k=1}^{n} (Population_{itk} * Mayor_k)}{\sum_{k=1}^{n} Population_{itk}}$ where k denotes the cities in region i and n denotes the number of cities in region i on year t. $Mayor$ is a dummy that takes value 1 if the mayor of the province k is from the ruling party and takes 0 otherwise. *Population* is the population figure for the city k in region i on year t. I estimate the population between censuses based on Turkstat assumption, the population of Turkey grows exponentially between any two censuses, $Population_t = Population_0 * e^{rt}$. Here, 0 represents the base year, i.e. between two censuses the base year is the earlier census. Pre-election, election, and post-election dummies take the value of 1, one year before election, election and one year after election respectively, and 0 otherwise. 1988 dummy takes the value of 1 on the year 1988 and 0 otherwise. Log(fixed capital investment) is the logarithmic transformation of annual fixed capital investment figure. The urbanisation figure is the ratio of urban population in total population. The analysis follow Baum et al. (2010) in the creation of post coup and recession dummies. Post coup dummy takes the value of for the three consecutive years after 1980 when the coup took place, and 0 otherwise. The recession dummy takes the value of 1 when the years were 1979, 1980 and 1994 when there occurred economic downturn in the country, and 0 otherwise.

2.7 Summary and Conclusion

Development banking has been a widely adopted scheme in wide range of countries due to its non–negligible impact on development. Although the slim literature about development banking has focused on technical and governance issues, the driving forces of development lending is also a question of great concern. Especially during the episode of the 2008 financial crisis, the rising interest toward development banking leads to ascertain its potential contribution to crisis management.

Development banks are generally state–owned banks, although there are a few examples of private–owned development banks. The particular variant of development banking literature analyses state ownership in banking, which generally deals with the question of whether or not state ownership brings efficiency, high performance and development. There is now a well–established body of studies in the literature about state–ownership in banking, but the variety of evidences of this literature need to be broadened to development banking.

This study examined regional shares of development loans during 1963–1994, and tested the presence of spatial dimension, political connection and electoral cycle in development lending. The theory of spatial dimension of lending suggests that the proximity of locations to the financial center is crucial in determining lending decisions. Adverse selection and moral hazard problems are partly resolved in closer cities by creating cheap loan opportunities. Political connection is a common phenomena particularly in bank lending. There can be numerous ways of exploiting political connection. This study, in particular, examines regional bank level data and considers that mayors' connection with central governments is a viable way of exploiting development loans. Since government policies are theoretically and empirically found to change around electoral cycles, how regional lending changes around election years is explored.

By using regional data during 1963–1994, this chapter contributes to the literature by the first examination of spatial dimension, political connection, and electoral cycle in development lending in Turkey. The chapter benefited from different estima-

tion techniques and the development loans are compared with commercial loans to elucidate the impact of spatial dimension, political connection and electoral cycles. The results demonstrated that distance played an important role in development banking activity, as spatial dimension of lending suggests. The findings suggest that the regions that are far from the financial center, the capital city, were deprived of a desirable level of development loans. Since these regions are either the most industrialised or the poorest regions of the country, the evidence of spatial dimension of lending implies that development banking could not be effectively utilised to promote industrialisation and to remove regional imbalances in Turkey. Since development banks operate under two opposing views of development and banking views, the findings show that Turkish development banking seemed to be under influence of banking view rather than development view.

Mayors' political affiliation also plays a crucial role in development lending. The results of this chapter suggest that the mayors who are elected from the ruling party tend to attract more loans to their cities. Local governments' economic dependency on central government paves the way for the exploitation of development loans most of which were managed by the state. Interestingly, development lending were not manipulated in accordance with electoral cycles in Turkey. The results do not provide support of electoral cycle theory which suggest that governments pursue expansionary policies before elections and tend to cut expenditures afterwards.

Although the role of development banks in development process of countries is clear, the literature lacks empirical evidence regarding the drivers of development lending. This study is an attempt to fill this gap and provides evidences related to geographical bias, political connection and electoral cycles in Turkey. If the evidences are supported by further evidences from different countries, the use of development banks as a tool–kit to alleviate poverty, foster industrialisation and enhance expertise etc., would be questionable.

This chapter has several policy implications. If development banks are used to foster development, the moral hazard and adverse selection problems arising from

the proximity to the financial centre should be minimised. Since moral hazard and adverse selection problems are related to transportation costs, the use of technology in the project evaluation process should be intensified. Regarding the impact of political connection, this chapter opens new research questions whether or not political connection in lending is welfare promoting. If the competition among mayors to attract more loans to their regions is the optimum solution in development lending, then it could be argued that political connection leads to efficient allocation of development loans. The policies then can be devised to encourage competition between mayors, yet, empirical findings generally indicate the reverse possibility.

Appendices

A Estimation Procedure

Consider panel data model with unobserved individual effects as:

$$y_{it} = X_{it}\beta + \alpha_i + \epsilon_{it} \tag{A.1}$$

where ϵ_{it} is uncorrelated with X_{it} and α_i is correlated with X_{it}. The fixed effects (FE) panel approach estimate the equation (A.1) by differencing. Differencing eliminates α_i permitting consistent estimation of β. A random effects (RE) or pooled panel approach assumes α_i is uncorrelated with X_{it}, since α_i is IID(0, σ_α^2). RE estimation may lead to inconsistent parameter estimates if in fact α_i is correlated with X_{it}.

The choice between FE and RE estimators in cross sectional and panel data analysis is a hard one. FE estimator allows for endogeneity of all the regressors and the individual effects. The use of FE estimator in panel data seems consistent, yet, FE (within) estimators wipes out time–invariant regressors in the estimated model. In this study, the need for estimation of the coefficient of *Distance* variable reinforces not to use FE estimators. At first glance, RE estimators is an option, but Mundlak (1978) argues that the RE model assumes exogeneity of all the regressors and the random individual effects. Hausman and Taylor (1981) propose a model in which some of the correlated regressors are correlated with individual effects. The estimator Hausman and Taylor (1981) use is based on an IV estimator which uses both the between and within variation of the strictly exogenous variables as instruments.

The model Hausman and Taylor (1981) employ is simply defined as:

$$y_{it} = X_{it}\beta + Z_i\gamma + \alpha_i + \epsilon_{it} \tag{A.2}$$

where $i = 1, 2, ..., N$ and $t = 1, 2, ..., T$. The Z_i are time invariant variables. α_i is IID(0, σ_α^2) and ϵ_{it} is IID(0, σ_ϵ^2) both independent of each other and among themselves. Hausman and Taylor (1981) split X into two subsets such that $X = [X_1 X_2]$ and $Z = [Z_1 Z_2]$. X_1 is $n \times k_1$, X_2 is $n \times k_2$, Z_1 is $n \times g_1$, Z_2 is $n \times g_2$, and $n = NT$. X_1 and Z_1 are assumed to be exogenous and not correlated with α_i and ϵ_{it}. Yet, X_2 and Z_2 are correlated with α_i but not with ϵ_{it}. It is obvious that in this model ordinary least squares (OLS) is biased and inconsistent, while the FE estimator which wipes out the α_i is consistent. It is also clear that the FE estimator also can not estimate γ since Z_i are eliminated. The RE estimator which is GLS on equation (A.2) presuming a strict exogeneity of regressors may also yield biased and consistent estimates of the regression coefficients. Hausman and Taylor (1981) suggests an instrumental variable (IV) estimator for this case by pre–multiplying equation (A.2) by $\Omega^{-1/2}$ where Ω is the variance covariance term of the error component $\alpha_i + \epsilon_{it}$, and then performs two–staged least squares (2SLS) using as instruments $[Q, X_1, Z_2]$. Q is the within transformation matrix with $\tilde{y} = Qy$ having a typical element $\tilde{y}_{it} = y_{it} - \bar{y}_i$ and $\bar{y}_i$ is the individual mean. If the model is identified in the sense that there are at least as many time–varying exogenous regressors X_1 as there are individual time-invariant endogenous regressors Z_2, then this estimator is more efficient than FE estimator. If the model is under-identified, then the estimator becomes FE estimator and can not estimate γ.

In a model to estimate, if left–hand–side variable is dynamic, depending on its own past realisations and independent variables that are not strictly exogenous, meaning that they are correlated with past and possibly current realisations of the error, FE and RE estimators may be inconsistent. Dynamic panel data models proposed by Arellano and Bond (1991) (difference GMM) and Arellano and Bover (1995) (system GMM) among many others are the popular ones to overcome these deficiencies. Arellano and Bond (1991) transform all regressors by differencing and uses the generalised method of moments (GMM) proposed by Hansen (1982). Arellano and Bover (1995) augment the estimator proposed by Arellano and Bond (1991)

making an additional assumption that first differences of instrument variables are uncorrelated with the fixed effects. This allows the introduction of more instruments that can improve efficiency.

In difference GMM lagged levels of the endogenous variables are used as instruments in the differenced equation. Thus, under the assumptions that the original error term, ϵ_{it}, is serially uncorrelated and that the explanatory variables, X_{it} and Z_i are weakly exogenous

$$E(y_{i,t-s}\Delta\epsilon_{it}) = 0; for \text{ s} \geq 2; \text{ t} = 3, ..., T \tag{A.3}$$

$$E(X_{i,t-s}\Delta\epsilon_{it}) = 0; for \text{ s} \geq 2; \text{ t} = 3, ..., T \tag{A.4}$$

where X_{it} represents all the explanatory variables other than the lagged dependent variable estimated in the models. Arellano and Bover (1995) suggest the inclusion of the equation in levels to the differenced equation to obtain a system of equations. The variables in levels are, then, instrumented with lagged first differences. Then, additional orthogonality restrictions are imposed:

$$E(\Delta y_{i,t-s}\epsilon_{it}) = 0; for \text{ s} = 1 \tag{A.5}$$

$$E(\Delta X_{i,t-s}\epsilon_{it}) = 0; for \text{ s} = 1 \tag{A.6}$$

In the estimation, by construct, first order serial correlation is expected to exist in the first differenced equation. Yet, the GMM estimator should remove second order serial correlation in the differenced equation (Roodman, 2009b). Moreover,

test of over–identifying restrictions is employed to test the validity of the over–identification restrictions whether or not instruments are not weak. As Roodman (2009a) explained clearly, the GMM estimators easily generate too many instruments that are potential suspects. A large instrument collection ruins the instruments' joint validity. To overcome the instrument proliferation we follow the options proposed by Roodman (2009a).

3 Profitability, Asset Quality and Market Structure: Conventional Banks versus Islamic Banks in Turkey

3.1 Introduction

3.1.1 Motivation of the Chapter

Islamic banking is growing into a mainstream industry with still a significant outreach potential, although it incepted its operations with micro–lending institutions in the the Middle East. According to latest figures from Ernst & Young (2012), Islamic finance activity has been growing between 10 and 20% per year, with Islamic finance assets exceeding $1.3 trillion in cumulative value in 2011. Ernst & Young (2012) also reports that the growth continues steadily suggesting an average annual growth of 19% over past four years (2011: 24%). Islamic banking has transformed itself from a trivial financial experiment to a major element in global banking in the last decade. In August 2004, for example, the Islamic Bank of Britain was formed as the first fully fledged Islamic bank in a country without a Muslim majority. Moreover, to meet the increasing demand for Islamic products, several major international banks, e.g., Citibank, Deutsche Bank, HSBC, and BNP Paribas, established Islamic windows.

The increasing awareness among religiously motivated customers and the recent financial crisis which induced search for alternative havens are often mentioned as the triggering factors for the growth of Islamic finance (Khan, 2010). In parallel to the accelerating importance of the Islamic banking sector, increasing academic attention has resulted in a wide range of research foci, varying from measuring the efficiency of Islamic banks (e.g. Samad, 1999; Abdul-Majid et al., 2010; Srairi, 2010) to the identification of differences with conventional banking practices (e.g. Iqbal, 2001; Beck et al., 2013; Elnahass et al., 2013). Moreover there is now a thriving

literature studying the resilience of Islamic banks during the global financial crisis (Čihàk and Hesse, 2010; Hasan and Dridi, 2011; Abedifar et al., 2013).

Since the main pillar of Islamic banking is the prohibition of *riba* (interest), an Islamic bank deposit account cannot pay a formally fixed rate of return. The origin of Islamic banking model is based on profit–and–loss sharing (PLS) mechanism, which is typically manifested through *Mudarabah* (profit–sharing) and *Musharaka* (joint venture) contracts. Under the PLS paradigm, bank assets and liabilities are balanced in such a way that borrowers and lenders share profits and losses with banks. Islamic banking provides securitised assets where the investor's return is simply connected to the profit or loss of a pool of diversified assets. The structure of securitisation does not allow for excessive leverage. Given this emphasis on equity financing, advocates of Islamic banking argue that Islamic banks ideally contribute to financial stability (Khan and Mirakhor, 1990; Ebrahim and Safadi, 1995), and are more stable than conventional banks (Hasan and Dridi, 2011; Beck et al., 2013).

Islamic banking, at least in principle, shows key differences from conventional banking because interest (*riba*) is prohibited in Islam, i.e. banks are not allowed to offer predetermined interest rates on deposits and are not allowed to charge interest on loans [27]. However, prior research shows that Islamic deposit accounts offer similar rates to those of conventional deposits (Khan, 2010; Ergec and Arslan, 2013; Chong and Liu, 2009), which creates significant concerns whether or not Islamic banks are mere replication of conventional practices. Many studies further provide evidences that Islamic banks in principle and in practice do not show significant difference from conventional banks (Kuran, 1983, 1993, 2004; Khan, 2010).

Whether or not their differences from conventional banks are real, Islamic banks

[27]Kia and Darrat (2007) refer to two major reasons why interest–free Islamic banks contribute to stability more than others. The first reason is related with the demand for money. Interest rates, which appear to be the most effective component in the determination of demand for money, could be speculative and even manipulative. The second reason is related with balance sheet issues. As per the balance sheet perspective, along with changes in the interest rates, the banks revalue their assets before they do for liabilities. The loan interest rates respond to changes in market interest rates much earlier than the savings interest rates. In this case, the revaluation of balance sheet entries, a key component for profit maximisation, makes the impact of interest rate changes more vulnerable. In Islamic banking system, there is no need for revaluation of balance sheet entries because there is no interest rate risk.

contribute to financial inclusion. In a broad sense, financial inclusion refers to the provision of financial services to each and every member of an economy. The inclusion of financially excluded people can be achieved especially via cheap loans. In the context of Islamic banking, financial inclusion is associated with the spread of banking services among interest–sensitive conservative people. In countries where Muslim population is the majority, Islamic banks provide banking services to interest–sensitive customers who would be otherwise excluded from the banking system (Aysan et al., 2013c). This form of financial inclusion, however, is not associated with the cost of banking services, but rather product differentiation through *Shariah* compliant financial services.

This chapter investigates whether or not financial inclusion in the form of Islamic banking causes excess profit and increasing market power for Islamic banks in a dual–banking system. Islamic bank customers refrain from interest–bearing financial products which induces them to pay higher cost in return for financial products cleared from interest rate items. The provision of interest–free financial products can significantly alleviate financial exclusion while increasing profitability and market power of Islamic banks. Increasing market power would also fuel the cost of financial services via "monopoly premium" (Freixas and Rochet, 2008). Having customers who are ready to pay additional cost to reduce their fear of participating in interest–based transaction can keep Islamic financial institutions profitable compared to conventional banks. This operational difference leads to *Shariah* arbitrage which is perceived to be rent–seeking (El-Gamal, 2006, 2007; Garner, 2013).

This chapter studies Turkish banking system which has a dual structure. The majority of the Turkish banking system is composed of conventional banks but a small stake of the system pertains to Islamic banks operating in the country for over thirty years. The interest toward Islamic banking in Turkey increased considerably in the last decade. Ernst & Young (2012) regards Turkey as a potential international market similar to Saudi Arabia, Malaysia, Qatar, and Indonesia. Among many reasons for the interest toward Islamic banking, growing financial capacity

of "religiously conservative" strand of new businessmen has been, maybe, the most influential factor that made Islamic banks more attractive (Hardy, 2012). Hardy (2012) posits that Anatolian businessmen who found constructive environment with the ruling party in the country, do not differentiate Islamic banks with conventional banks. In addition to that, Islamic banks gained equal opportunities with their conventional counterparts in the system with a new law (Banking Law No 5411 of 2005)[28]. The increasing presence of Islamic banks with new branches across the country can be an indication of this positive impact. The favourable environment of the last decade enabled Islamic banks to reach over 4.5% of market share in total assets from nearly 1% in 2001. The dynamism and recent statutory amendments demonstrate that Islamic banking is an emerging phenomenon in Turkish banking system.

3.1.2 Objectives and Contribution of the Chapter

This chapter investigates Islamic banking in Turkey from two angles. This chapter first examines the presence of *Shariah* arbitrage in Turkish Islamic banking by relying on conventional versus Islamic banking duality. We particularly test the following hypothesis:

1. *Hypothesis 1*: *Shariah* arbitrage exists in Turkish Islamic banking since Islamic bank customers are ready to purchase expensive *Shariah* compliant product and services.

Specifically, the dynamics of quarterly returns of Islamic banks vis-à-vis the quarterly returns of conventional banks in Turkey is explored to test *Shariah* arbitrage. The examination of *Shariah* arbitrage would not be complete if the legislative changes in the last decade were not accounted for, since the returns of Islamic banks might have risen after the enactment of new legislations. This chapter separately

[28]This law partially removed unequal treatment on Islamic banks by introducing "bank" status to Islamic banks which used to be "special finance houses" beforehand, and covered all the banks in the system including Islamic banks under the same deposit insurance scheme.

investigates the impact of the new legislations on Islamic banks' profitability to observe if the legislative amendments increased the profitability. This chapter second investigates whether or not Islamic banks differentiate from conventional banks with respect to their market power. Prior research extensively examines the market structure in conventional banking disregarding the presence of Islamic banks in Turkish banking system (see e.g. Gunalp and Celik, 2006). Additionally, this chapter investigates the impact of legislative changes on competition in Turkish banking system. As Zhao et al. (2010) argues, regulations can considerably change the competitive conditions in a banking system. The impact of regulations gain further importance in Turkish Islamic banking since it lifts the unequal treatment. It would be a reasonable outcome if legislative amendments create more monopolistic power to Islamic banks.

The approach to exploring *Shariah* arbitrage is associated with the nature of Islamic banking whether or not Islamic banking is conducive to higher profitability. El-Gamal (2007) argues that Islamic banking poses a captive market in which customers tend to pay an extra premium for *Shariah* compliant products and services. Since *Shariah* arbitrage questions the nature of Islamic banking but not Islamic banks, this chapter employs propensity score matching to reduce "self selection bias". The classification of banking data as conventional and Islamic carries potential selection bias since a bank's decision to be Islamic is highly unlikely to be exogenous. Following Rosenbaum and Rubin (1985), this chapter employs propensity score matching to reduce selection bias in the analysis. Propensity score matching is a non–parametric technique which is particularly popular in medical experiments and gaining wider acceptance in the evaluation of policy interventions (Becker and Ichino, 2002; Fatum and Hutchison, 2010), and in observational studies specifically in the field of finance and banking (see e.g. Saunders and Sascha, 2011; Allen et al., 2012; Duygun et al., 2014). In this chapter, Nearest–Neighbour Matching, Stratification, and Kernel Matching have been employed to implement

matching with computed propensity scores [29].

To examine the the legislative changes on profitability, a comparative case study is conducted. The synthetic control method will be employed for that purpose (Abadie and Gardeazabal, 2003; Abadie et al., 2010). To investigate the market structure in whole Turkish banking system, Islamic banks are included in the sample. Hitherto, studies analysing the market structure of Turkish banking had an exclusive focus on conventional banks and ignored Islamic banks. To examine the market structure in Turkish banking, Panzar–Rosse (P–R) model is employed (Panzar and Rosse, 1987, 1977). The impacts of legislative changes on Islamic banking will be the focus of Panzar–Rosse models to examine how Islamic banks, particularly, react to legislative changes.

This chapter contributes to the literature in several ways. First, the primary focus of this chapter is to test the conjecture that Islamic banks exploit *Shariah* arbitrage to attain higher profitability (El-Gamal, 2006, 2007; Khan, 2010). This is an important contribution since the argument of *Shariah* arbitrage is widely discussed but never tested. Second, this chapter investigates the impact of a recent regulation on profitability and market structure which is yet to examined insofar. The findings of this study will provide implications for policymakers in charge of regulating a dual banking system composed of Islamic banks and conventional banks.

3.1.3 Structure of the Chapter

The remainder of the chapter is organised as follows: the second section will briefly discuss Islamic banking in general and Islamic banking in Turkey in particular. Profitability issue with an Islamic–conventional banking comparison will be the theme of the third section. This section will provide the similarities and differences in these two different kinds of banking and will examine the potential reasons for the differentiation in profitability. Within the same concept of regulatory changes, market structure will be discussed in the fourth section and the fifth section respec-

[29] see Eren (2007) and Imbens (2003) for a detailed review about the matching techniques.

tively. Each section will present the data, methodology, and the results. The last section will summarize the findings and conclude as usual.

3.2 Islamic Banking: Principles and Turkish History

3.2.1 Islamic Banking Principles: Conflicting Views

Islamic banking gets the inspiration from the religion which strictly prohibits interest but allows business on the PLS. The basic distinguishing characteristic of Islamic banking system is the absence of the payment or receipt of any predetermined interest rate *riba*. There is consensus among Muslim scholars that any form of predetermined return on the use of money is unacceptable. Instead of such a predetermined interest rate, the principles of Islamic banking proposes the PLS which effectively transforms Islamic banks into equity–based firms. In the PLS, depositors of an Islamic bank become a shareholder and are offered simply a share of whatever profit or loss the bank earns. The funds obtained on the PLS basis are invested on the basis of PLS again. Whatever the bank gains/loses from such businesses will be again distributed according to a pre–agreed formula [30].

There is a deep divide between the opponents and proponents' views on the idealism of Islamic banking. The proponents of Islamic banking basically defend Islamic banking from its positive impact on financial stability and economic growth. The arguments of the advocates of Islamic banking raise Islamic banks as the viable alternatives of conventional banks to promote economic growth and to absorb macro–financial shocks (Hasan and Dridi, 2011; Ebrahim and Safadi, 1995).

[30]Besides its own capital, there are two kinds of deposit accounts in an Islamic bank which are the main sources of funds for the bank: transaction accounts and, investment accounts. Transaction accounts are equivalent to regular (non–interest bearing) checking accounts in conventional banks. Deposits in such accounts are the funds that are ready for immediate withdrawal. Consequently, the bank cannot use these funds in any short– or long–term investment project since they could be withdrawn by the depositor any time. By depositing funds in current accounts, the depositor gets services in the form of safety, convenience and the use of checks instead of cash. For these services, the bank then can charge the depositor full fees in return for the bank's cost to produce such services. The investment accounts represent the major source of funds for lending portfolio. Investment accounts in Islamic banks do not guarantee fixed and predetermined interest rate. The contractual agreement between the depositor and the bank solely contain the ratio by which the profit (or loss) is to be distributed.

From financial stability point of view, the advocates of Islamic banking argue that the practice of fixed interest rate based banking is a major cause for many banks to fail during a crisis. Khan (1986) claims that fixed interest rate based banking prevents conventional banks from instantaneous adjustments to financial shocks. The author defines Islamic banks simply as the institutions which do not receive predetermined interest, using a neoclassical model and shows that Islamic banks show resilience to financial shocks. Islamic banks in the model demonstrate balanced assets and liabilities, but conventional banks can not escape huge balance sheet imbalances.

The advocates of Islamic banking further argue that the contribution of Islamic banks to general economy is higher than conventional banks. Accordingly, conventional banks are exposed to agency problems more than Islamic banks. Siddiqi (1981) posits that the conventional banks are prone to adverse selection problems, because they lend to borrowers who have sufficient collaterals, and give only secondary attention to the soundness of the projects. On the contrary, Islamic banks have an incentive to finance those more promising investment projects, since the profitability of the project will be shared between the lender and the borrower. The relationship between creditor and debtor is harmonised under Islamic banking since both sides have a mutual interest in the success of the project.

The criticism toward Islamic banking originates mainly from their actual practices which diverge in significant ways from religious doctrines and have significant resemblance with conventional banking practices. The actual practices show that the majority of Islamic banking operations are not based on PLS, but rather on the use of the *murabaha* contract, an instrument which is akin to the standard debt contract in conventional banking [31]. Yousef (2004) names it "*murabaha* syndrome"

[31] A *murabaha* contract works as following: for instance a firm which upgrades its machinery equipment applies an Islamic Bank to buy the machinery on its behalf, with an agreement to purchase the machinery on a marked–up basis from the bank. If the bank's purchase price is, say £100,000, it might resell the machinery to the firm for, £110,000 payable in 12 equal monthly instalments. The bank retains ownership until the last instalment is paid and so the bank's position is fully secured. This is accepted as *Sharia*-compliant because the agreement is based on a real transaction and the rate of mark–up is (theoretically) not a function of the time, i.e. time value of money. This kind of transaction is permissible since the bank owns the machinery and bear

and argues that this kind of financing mimics conventional banking. Several other studies also give support for "*murabaha* syndrome" and claim that Islamic banking replicates conventional banking practices. Khan (2010), for instance, claims that "profit rate" or "mark–up rate" is just a variant of "interest rate" without having a fundamental difference (see El-Gamal, 2006; Kuran, 2004; Sohrab Behdad and Nomani, 2006, for further debates).

The intense use of debt contracts in Islamic banking is at odds with the expectations of an equity–based Islamic model which PLS principle suggests. Kuran (2004) complains that the exercise of PLS mechanism is rather limited in Islamic banking. He points out that Islamic financial services are not very different from those offered by their conventional counterparts. Touching upon the agency problems and adverse selection problems, Kuran (1993) argues that Islamic banks are not distinguishable from conventional banks, since the informational asymmetry does not positively discriminate Islamic banks from conventional banks.

When financial stability is concerned, the opponents claim that Islamic banks cannot act differently from conventional banks. Islamic banks have the same susceptibility to financial shocks, since they are exposed to standard moral hazard problems. As Warde (2010) argues, Islamic banking faces severe moral hazard problems associated with ex–post information asymmetry in PLS instruments. For example, the borrower who borrows over a *Shariah*–compliant financial product has an incentive to under–declare profits and/or undertake high–risk projects since it is the main principle that profit/loss will be incurred on a pre–defined rate.

Despite significant controversies, Islamic banks' contribution to financial inclusion is significant. Financial inclusion, in a broad sense, refers to provision of financial services to each and every member of an economy. There can be several barriers to financial services, e.g. poor, disadvantaged people, geographical segregation, societal groups and individuals, the elders etc. (Simpson and Buckland, 2009;

some risk; whereas an equivalent loan for £100,000 at 10% interest, secured by the machinery, is not (for more contract-related details, see Khan, 2010). Although the mark–up rates are selected in accordance with the on–going market rates, e.g. London Interbank offer rate (LIBOR), London Interbank offer rate (EURIBOR), swap rates.

Chakravarty and Pal, 2013). In the context of Islamic banking, financial inclusion concerns the spread of banking services among interest–sensitive conservative people. In countries where Muslim population is the considerable part of the whole population, Islamic banks provide banking services to interest–sensitive customers who would be otherwise excluded from the banking system (Aysan et al., 2013c).

In many developing and developed countries, policymakers devise several policies to maintain financial inclusion (Chakravarty and Pal, 2013). Cheap credits to target customers, for instance, designed to attract those who find banking services expensive. Whilst financial exclusion can be removed via reducing the cost of financial services to target customers, in the case of Islamic banking, removing financial exclusion can bring extra costs. Since the exclusion does not stem from any inability to access finance but from the sensitivity of the potential customers, Islamic bank customers are ready to bear a higher cost once the products are sterilised from interest items. The provision of interest free financial products can significantly remove financial inclusion while increasing profitability and market power of Islamic banks. Increasing market power might also fuel the cost of financial services via "monopoly premium" by a secondary effect (Freixas and Rochet, 2008). Since the customers of Islamic banks are ready to pay additional cost to reduce their fear of participating in interest–based transaction, Islamic financial institutions may keep generating excessive profits. A serious question that needs to be examined then is whether or not Islamic banks exploit their status by proving *Shariah* licenses. If this concern is proved to be true, then Islamic banks may impose their market power to earn monopoly profits which is detrimental to consumer utility (Freixas and Rochet, 2008). This study mostly discusses Turkish Islamic banking on this ground.

3.2.2 Islamic Banking in Turkey

In the past decade, after a long period of sluggish performance in economy, Turkey exercised substantial reforms to maintain the credibility of the financial

system. The momentum of reforms intensified followed by the 2001 crisis, after which the general economy shrank with roughly 5% of national domestic product (four months moving averages) and eventually over 20 insolvent banks were transferred to the Savings Deposit Insurance Fund of Turkey (SDIF) (see e.g. Aysan et al., 2011; Akyurek, 2006).

Islamic banks in Turkey have been able to survive and grew steadily without any severe breakdown even during distressed times. During the 2001 crisis, when conventional banks suffered from open foreign exchange and interest rate positions, Islamic banks have managed to safeguard themselves from adverse market movements. In fact, Islamic banks in Turkey were circumscribed by both Islamic principles and regulatory arrangements in Turkey. The first dimension of the limitation was due to its very nature since the prohibition of investment in fixed income securities deprives Islamic banks from a lucrative banking business. The second dimension was the disadvantageous regulatory imbalance between Islamic banks and conventional banks. For example, until 2005, Islamic banks were excluded from deposit insurance scheme, which covered conventional banks. Moreover, an interbank–like market for Islamic banks did not exist in Turkey that would leave Islamic banks extremely exposed to illiquidity during distressed times (Syed-Ali, 2006).

Nowadays, Islamic banking in Turkey is experiencing significant transformation. Once a negligible part of the banking industry, Islamic banking sector is now growing steadily and surely. The primary reason for this positive development is the constructive regulatory climate in which these banks can now operate (Hardy, 2012).

Until 1980s, the dual banking system in Turkey was non–existent, the banks operated under conventional banking rules. Particularly after the early 1960s, commercial banks as well as state–owned development banks became the tool–kits of planned industrialization policies. The government's involvement was substantial in the banking sector, and included, *inter alia*, interest rate controls, directed credit programs, high reserve requirements, as well as entry restrictions. State intervention in these forms, however, led to capital shortage. Interest–free banking was first

made legal in 1985, as part of a plan to attract more funds from the Gulf states to the country who was craving for foreign exchange.

To separate Islamic banks from the conventional banks in the banking system, these banks were given the status of special finance houses (SFHs). Despite having similar operations in the banking system, such a name was given with the objective to soften their Islamic image in order not to offend the ideological sensibilities of the political establishment. As the name "Finance House" would suggest, these institutions were not in the same status of conventional banks. Until late 2005, these banks remained subject to different statutory and regulatory arrangements. Different regulatory and statutory arrangements brought different rights which used to cover solely conventional banks but not the others. For instance, Aysan et al. (2013a) convey that Islamic banks were not fully covered by a deposit guarantee scheme, although a comprehensive scheme was used to cover conventional deposits.

Islamic finance began its operations in 1985 with Bahrain–based *Al–Baraka Türk* and Saudi–based *Faisal Finans*. The Kuwaiti–based *Kuveyt Türk* was opened in 1989. Afterwards, new SFHs were opened with domestic capital. These institutions included *Anadolu Finans* (1991), *İhlas Finans* (1995) and *Asya Finans* (1996). This chapter refers to Aysan et al. (2013a), for an overview of the developments in the Islamic banking sector in Turkey.

In the 1990s, Turkish economy suffered from the interruptions in international capital flows. The first nasty experience was due the 1991 Gulf War during which the capital inflow to the country fell down significantly due to the the country's neighbourhood to Iraq. The first and severe outcome for Turkish banking system during these times occurred in 1994. 2001 crisis followed 1994 crisis and as a result of both crises, the number of conventional banks fell sharply from more than 50 to just 33. The financial crisis not only affected conventional banks, but also the SFHs. *İhlas Finans* was bankrupted and the Turkish holding company Ülker purchased *Faisal Finans* in 2000, changing its name to Family Finance. After the merger of *Anadolu Finans* and *Family Finans* into *Türkiye Finans* in December 2005, there

are currently four Islamic banks operating in Turkey.

Ahead of 2000s, SFHs were subject to the Banking Decree No 83/7506 of 1983 and were under the supervision of the Undersecretariat of the Treasury and the Central Bank of the Republic of Turkey (Presley, 2012). The 2001 crisis led to a rehabilitation of Turkey's financial system, and the parliament passed a new law in order to discipline the overall banking system (Banking Act No. 4389 of 1999). Under this law, SFHs were brought under the same umbrella of regulations covering conventional banks. After the collapse of *İhlas Finans*, and because of the economic turmoil, the government instituted an Islamic deposit insurance scheme to instil depositors' confidence. The Islamic deposit insurance scheme provided insurance up to 50,000 TL for each deposit ownership in each bank, while the conventional insurance offered at that time an unlimited coverage. Furthermore, unlike the conventional system, which was managed by the government, the Islamic deposit insurance system was administered by the Special Finance Houses Association (SFHA). Membership to the Association was compulsory for all licensed Islamic banks, and as the scheme was backed by Islamic banks concerns about its *Shariah*–compliance were allayed.

On December 2005, upon enactment of the Banking Act No. 5411, the dual deposit insurance system was revised and the management of the Islamic deposit insurance fund was transferred to the SDIF. Of equal importance, following amendments to the banking law, SFHs were renamed as "Participation Banks", which allowed them to integrate fully into the financial system.

Participation banking in Turkey has not traditionally made up a large portion of Turkey's finance sector due to the tradition of the secular state. However, by becoming more and more like banks in both image and reality, they progressively gained acceptance among depositors and investors. Also, after the 2001 crisis, the ruling Justice and Development Party (*AKP* in Turkish) paved the way to the ascent of Islamic finance. The sector has managed to increase its market share both on the credits and deposits segments of the financial industry.

3.3 *Shariah* Arbitrage and Profitability

3.3.1 Methodology

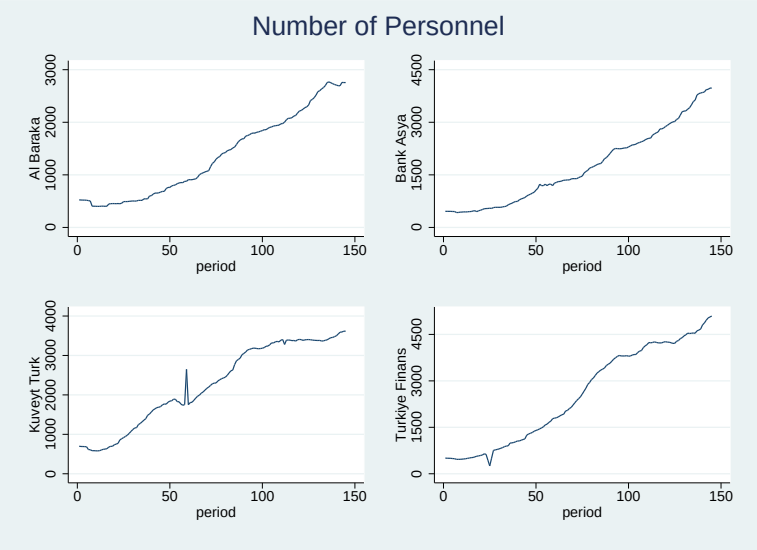
In this section, the approach to assessing the influence of "Islamic bank" status on profitability basically attempts to answer the following question: Have Islamic banks produced more profits than conventional banks with respect to their asset quality? Table 3.1 presents the descriptive statistics for return on asset (ROA) and return on equity (ROE) with a comparison of conventional and Islamic banks. During the period of 2001–2013, the mean value of ROA in Islamic banks was around 0.2% whereas 0.5% in conventional banks. In terms of ROE, the mean values are 2.8% and 1.6% for conventional and Islamic banks respectively.

Table 3.1: Average ROA and ROE for Islamic and Conventional Banks

	Conventional banks					Islamic banks				
Variable	Obs	Mean	Std Dev	Min	Max	Obs	Mean	Std Dev	Min	Max
ROA	1044	0.0051	0.0135	-0.1034	0.1640	144	0.0018	0.0033	-0.0044	0.0112
ROE	1044	0.0280	0.0699	-1.1821	0.4021	144	0.0157	0.0308	-0.0463	0.1107

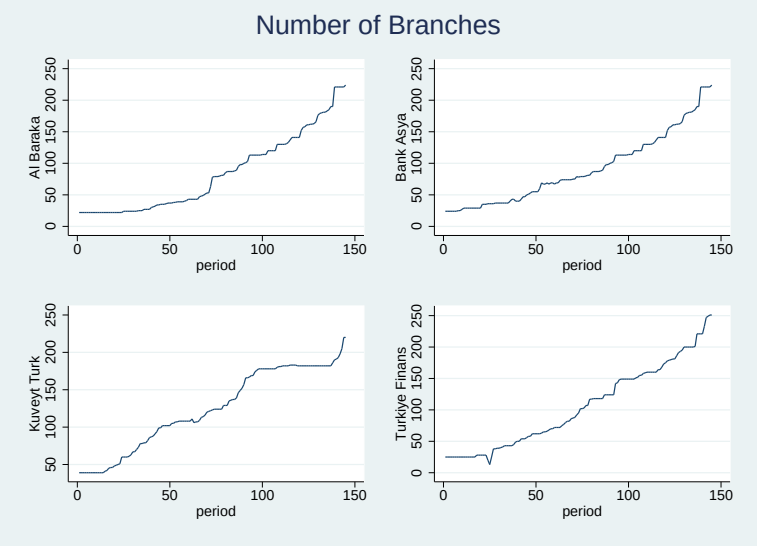
A priori inspection of the data gives an impression that Islamic banks in Turkey are less profitable than their conventional counterparts. The rapid increase in personnel and branch numbers can be one of the prompt explanations for the *a priori* inspection. Over the last decade, Islamic banks have opened new branches in order to extend their services to broader client base (see Figure 3.1). The number of branches was below fifty in the beginning of 2000s yet the figure has almost reached over two hundreds in the end of 2012. As a consequence of new branches the personnel number has risen considerably (see Figure 3.2). The number of personnel was below thousand in all Islamic banks but at the end of 2012 the figure has almost increased between three and five times. A sharp impact of new branches and rising personnel expenses can drastically dampen profitability. The information from descriptive data analysis can be misleading, since classifying bank observations as conventional and Islamic carry "self–selection bias". The accurate comparison between two banking schemes requires the observations share the same identification,

so that differences among the examined bank characteristics can be predicated to "Islamic bank" status.



Note: Vertical axis shows the number of personnel and horizontal axis shows the monthly period during 2001–2013.

Figure 3.1: The Number of Personnel in Islamic Banks between 2001–2013



Note: Vertical axis shows the number of branches and horizontal axis shows the quarterly period during 2001–2013.

Figure 3.2: The Number of Branches in Islamic banks between 2001–2013

Islamic and conventional banks in the country show clear differences. The majority of conventional banks operate longer than Islamic banks, even some of these banks show presence for over hundred years in the country. Conventional banks have extensive branch coverage, so they can easily reach small depositors and col-

lect higher amount of deposits. Islamic banks operate for around thirty years and their branch coverage is still limited. Ahead of comparing these two groups of banks, "sample selection bias" is addressed so that Islamic and conventional bank characteristics (apart from the examined variables–ROA and ROE) are not significantly different. In doing so, the variations in examined variables of two bank groups can be attributable to their brand name. I use matching techniques namely Propensity Score Matching (PSM) proposed by Rosenbaum and Rubin (1985) and identify a sub–set of bank observations among conventional banks whose main characteristics are similar to those of Islamic banks. This procedure involves the estimation of propensity scores, i.e. a bank's propensity to being "Islamic" over a set of bank characteristics in this study. A conventional bank observation is then selected as a match to each Islamic bank observation.

In order to estimate the average treatment effect of being an Islamic bank on profitability, the propensity to being "Islamic" is estimated by employing binary response models in the first stage. In doing so, similarity is defined as the conditional probability of receiving a treatment despite the unavailability of experimental data. Then, each Islamic bank observation is matched to a conventional bank observation with a similar propensity score. By adjusting covariates between treated and control groups, PSM allows to construct counterfactuals using observational data. PSM simply estimates average treatment affect between treatment and control groups [32]. If the assumptions of PSM is satisfied, this technique produces an unbiased causal effect using observational data sets (Li, 2013).

Let IB_{jt} is a dummy variable when j belongs to an Islamic bank at time t. y_{jt}^{1} is defined as the bank characteristics of Islamic bank observation j at time t, whereas y_{jt}^{0} is defined as the bank characteristics of a conventional bank observation that is matched to Islamic bank at time t. The average treatment effect of being an Islamic

[32]Under the assumption that Islamic banks receive the treatment of being an Islamic bank, conventional banks constitute the control group in this experiment. An experimental study by Saunders and Sascha (2011) examines the impact of being private on loan cost by matching. Similarly, Duygun et al. (2014) examine the effect of trademarking on bank efficiency among commercial banks.

bank is simply defined as,

$$\tau_{jt} = y^1_{jt} - y^0_{jt} \tag{3.1}$$

If y^0_{jt} is perfectly observable, the calculation of average treatment effect would be straightforward. The issue of unobservability, also known as "missing counterfactual", is overcome by employing PSM to calculate the average treatment effect. The average treatment effect estimated by PSM would be equal to the difference of mean outcomes $\bar{y}^1 - \bar{y}^0$. The estimation of PSM begins with fitting a binary response model (logit or probit optionally) that is specified by $p(D_{jt} = 1) = f(h(Z))$ where $f(.)$ is a normal/logistic cumulative distribution function (probit/logit) and $h(Z)$ is the specification of the probit model constructed over covariates Z. Once treated and control units are matched with a binary response model, balancing tests are exercised to test whether the estimated propensity score balances the characteristics between the treated and the control group. This implies that observations with the same propensity scores have the same distribution of observable characteristics. In other words, for a given propensity score, exposure to treatment is random and therefore treated and control groups should be on average observationally identical. Standard t–test is used to test whether or not the bank characteristics are the same are not statistically significant.

To select matched pairs, propensity scores are obtained through the estimates of $p(IB_{jt} = 1) = F(h(Z))$ [33]. Although exposure to treatment is random and treated and control groups should be on average identical, it is not possible to find observations with perfectly identical values for all covariates in Z. The reason is that the probability of observing two units with exactly the same value of the propensity score is in principle zero since $p(Z)$ is a continuous variable.

In order to eliminate this problem, several PSM techniques are employed to esti-

[33]The logit model is also employed, but the estimated propensity scores did not change as expected. The logit model results are not reported.

mate missing counterfactuals by using obtained propensity scores. There are several methods used as a matching technique for this estimation process, this chapter uses three of them in our analysis *Stratification Matching* , *Nearest–Neighbour Matching*, and *Kernel Matching* (Becker and Ichino, 2002). The results of these techniques will be used as robustness checks for each computed average treatment effect.

3.3.2 Matching Techniques

To estimate the average treatment effect, this chapter first employs *Stratification Matching* that splits the sample into equally spaced intervals where estimated mean propensity score is not significantly different among treatment and control groups. An apparent peril of this technique is that it does not include those observations in estimated blocks where the observations are absent. The possibility of the exclusion of those observations may lead to inconsistent estimates and the inconsistency gets severe if the sample size is relatively low and the number of spaced intervals is high. *Nearest–Neighbour Matching* remedies this weakness by searching for a pair of treated and non–treated observation with the closest propensity score. In doing so, the information from closest pairs is not ignored in the calculation of average treatment effect. The estimation of average treatment can be poor in *Nearest–Neighbour Matching*, since the technique does not exclude those pairs having significantly different propensity scores. *Kernel Matching* improves poor estimation by including all control units in estimation process with weights that are inversely proportional to the distance between the propensity scores of the treated and the control groups.

Stratification Matching: Letting q index showing the blocks defined over intervals of the propensity score, the following equation is computed within each block;

$$\tau_q^S = \frac{\sum\limits_{i \in I(q)} y_{it}^1}{N_q^1} - \frac{\sum\limits_{j \in I(q)} y_{jt}^1}{N_q^0} \tag{3.2}$$

where $I(q)$ is the set of units in block q and N_q^1 and N_q^0 are the numbers of treated

and control units in block q. Then the average treatment is calculated as,

$$\tau_{TT}^{S} = \sum_{q=1}^{N} \tau_{q}^{S} \frac{\sum\limits_{i \in I(q)} D_i}{\sum\limits_{\forall i} D_i} \tag{3.3}$$

where the weight for each block is given by the corresponding fraction of treated units and Q is the number of blocks.

Nearest–Neighbour Matching: Let y_{it}^{1} and y_{jt}^{0} be a set of observed outcomes for treated and control units respectively. In this algorithm, the outcome of treated unit i is matched to a control unit j with the closest propensity score,

$$C(i) = \min_{j} \parallel p(Z_{it}^{1}) - p(Z_{jt}^{0}) \parallel \tag{3.4}$$

Average treatment on the treated is then measured by

$$\tau_{TT}^{N} = \frac{1}{N_T} \sum_{i \in T} \{ y_{it}^{1} - y_{jt}^{0} \} \tag{3.5}$$

Kernel Matching: In this algorithm, the outcome of the treated unit i is matched to a weighted average of the outcomes of all control units, the weights g_{ij} are set to

$$g_{ij} = \frac{K(\frac{p_i - p_j}{h})}{\sum\limits_{j \in C(i)} K(\frac{p_i - p_j}{h})} \tag{3.6}$$

where $K(.)$ is a kernel function such as the Gaussian kernel $K(u) = exp(-u^2/2)$ or the Epanechnikov kernel $K(u) = (l - u^2).l(\mid u \mid < 1)$ with $l(.)$ being the indicator function and h represents the bandwidth. Average treatment effect is calculated as

$$\tau_{TT}^{K} = \frac{1}{N_T} \sum_{i \in T} \left\{ y_{it}^{1} - \sum_{j \in C(i)} g_{ij} y_{jt}^{0} \right\} \tag{3.7}$$

3.3.3 Data

The banking data in this chapter includes Islamic banks and conventional banks in Turkey. There are twenty nine conventional banks and four Islamic banks in this period. Among four Islamic banks three of them are foreign and only one bank is domestic. Table 3.2 provides all the variables and their definitions. The variables include bank ratios and macroeconomic variables.

Table 3.2: Variables Used in the Empirical Analysis

Variable	Notation	Definition
Return on asset	roa	Net Income/Total Assets
Return on equity	roe	Net Income/Total Equity
Asset Quality	nplta	Non–Performing Loans/Total Assets
Capital Adequacy	eta	Equity/Total Assets
Asset Size	lta	Natural Logarithm of Total Assets
Deposits	dpta	Deposits/Total Assets
Net Interest Margin	nim	Net Interest Income/Total Assets
Credit Risk	cr	Loan Loss Provision/Loans
Liquidity Risk	lr	Loans/Deposits
Total Asset Growth	tagr	Growth of total assets
Total Loans Growth	tlgr	Growth of total loans
Inflation Rate	inf	Inflation Rate
Exchange Rate	fx	Exchange rate USD/TL

There is a common agreement in the literature that bank profitability is measured as a function of ROA and ROE (Berger et al., 1987; Berger, 1995; Michelle, 1997; Bennaceur and Goaied, 2008; Athanasoglou et al., 2008; García-Herrero et al., 2009). The banking data is gathered from the quarterly unconsolidated balance sheets of the banks that operated between 2003–Q1 and 2011–Q4. The balance sheets are obtained from The Banks Association of Turkey and Banking Regulation and Supervision Agency.

Macroeconomic variables are gathered from the Central Bank of the Republic of Turkey and Undersecretariat of Treasury which are the institutions responsible for

economy management in the country. As per the effects of macroeconomic variables, inflation and foreign exchange rates to proxy the macroeconomic environment and monetary policy decisions. The foreign exchange rate is the USD/TL and inflation variable is the quarterly consumer price index.

Table 3.3 reports how conventional and Islamic banks perform in terms of asset, equity and loans. The figures belong to market share and growth of asset, equity, and loans. Figures show that Islamic banks are gradually and continuously growing in assets, equity and loans in the system. Islamic banks' share of assets grew steadily and reached almost 4.5% at the end of 2011, similar patterns also exist in equity and lending side. The figures demonstrate that Islamic banks' contribution to financial stability has been more limited than conventional banks in Turkey. For instance, when the growth rates are concerned, the figures suggest that the impact of crisis on Islamic banks' lending has been more severe compared to conventional banks. The growth rates for 2004–2008 was 61.93% but sharply fell to 30.30% after 2008. The drop for conventional banks was more moderate from 41.81% to 25.51%. This is also valid for the figures of assets and equities.

Table 3.3: Market Share and Growth in Assets, Equity and Loans of Islamic and Commercial Banks

	Market share of assets		Growth of assets		Market share of equity		Growth of equity		Market share of loans		Growth of loans	
Years	IB	CB	IB	CB	IB	CB	IB	CB	IB	CB	IB	CB
2011	4.39	95.61	31.25	24.68	4.20	95.80	17.79	12.42	5.76	94.24	30.15	35.51
2010	4.18	95.82	25.21	17.05	4.02	95.98	26.90	22.66	5.98	94.02	28.40	22.91
2009	3.92	96.08	31.32	16.14	3.89	96.11	25.37	25.56	5.74	94.26	24.33	7.30
2008	3.48	96.52	37.18	23.98	3.89	96.11	51.83	14.91	4.99	95.01	38.31	36.32
2007	3.16	96.84	38.68	15.87	2.98	97.02	54.38	22.24	4.93	95.07	51.89	28.00
2006	2.65	97.35	60.47	28.42	2.37	97.63	81.50	12.96	4.18	95.82	67.95	49.86
2005	2.13	97.87	43.65	24.80	1.49	98.51	16.62	21.83	3.75	96.25	60.20	43.62
2004	1.86	98.14	45.21	24.26	1.55	98.45	48.25	26.97	3.38	96.62	67.69	45.87
2004-08	2.45	97.55	47.00	23.34	2.10	97.90	50.19	21.00	4.06	95.94	61.93	41.84
2008-11	3.99	96.01	31.24	20.46	4.00	96.00	30.47	18.89	5.62	94.38	30.30	25.51
2004-11	3.22	96.78	39.12	21.90	3.05	96.95	40.33	19.94	4.84	95.16	46.11	33.67

Notes: Table represents market share and growth of asset, equity, and loans in conventional and Islamic banks. IB and CB denote for Islamic banks and conventional banks respectively. We take 2003 as a baseline for growth figures. We compare the figures before and after 2008 to explore the effect of the global financial crisis.

Table 3.4: Descriptive statistics

	Conventional banks					Islamic banks				
Variable	Obs	Mean	Std Dev	Min	Max	Obs	Mean	Std Dev	Min	Max
roa	1044	0.0051	0.0135	-0.1034	0.1640	144	0.0018	0.0033	-0.0044	0.0112
roe	1044	0.0280	0.0699	-1.1821	0.4021	144	0.0157	0.0308	-0.0463	0.1107
nplta	1044	0.0228	0.0219	0.0000	0.1770	144	0.0360	0.0218	0.0048	0.1351
eta	1044	0.1736	0.1400	0.0365	0.9161	144	0.1181	0.0236	0.0735	0.1831
lta	1044	0.4133	0.2118	0.0008	0.8472	144	0.6940	0.0893	0.4361	0.8350
dpta	1044	0.5128	0.2350	0.0000	0.9030	144	0.7855	0.0680	0.3222	0.8797
nim	1044	0.0301	0.0282	-0.2170	0.1694	144	0.0167	0.0086	0.0046	0.0634
cr	1044	0.0293	0.1463	0.0000	3.0954	144	0.0079	0.0024	0.0013	0.0118
lr	1044	1.1376	1.8825	0.0000	34.5317	144	0.8966	0.1857	0.5183	2.0123
tagr	1044	2.5636	14.5536	-81.2983	10.9856	144	3.1282	12.7917	-81.2983	10.9856
tlgr	1044	4.5102	16.9143	-90.9889	21.6239	144	5.1421	14.9593	-90.9889	21.6239
inf	1044	7.8755	4.3422	3.2625	22.4875	144	7.8755	4.3553	3.2625	22.4875
fx	1044	1.4452	0.1421	1.1851	1.8312	144	1.4452	0.1425	1.1851	1.8312

Table 3.4 provides descriptive statistics for the bank sample showing the number of observations, means and standard deviations of all variables. Observations are divided into two groups as conventional banks with 1044 observations and Islamic banks with 144 observations. Simple inspection of the table shows that conventional banks are likely to perform better in profitability since the means of return on asset, return on equity and net interest margin are higher. For conventional banks, ROA is 0.5% and ROE is 2.8% and for Islamic banks, ROA is 0.2% and ROE is 1.6%. Credit risk and liquidity risk are lower for Islamic banks as this result can be attributable to PLS. Credit risk and liquidity risk are 2.9% and 114% for conventional banks, 0.8% and 89% for Islamic banks. Another issue that is worth underlining is the total cumulative asset growth which is higher for Islamic banks than conventional banks, being 312.8% and 256.4% respectively. Correlation matrix for the variables is presented in Appendix Table B.2. Correlations among the variables are low suggesting that multicollinearity does not create much bias in estimations.

3.3.4 Empirical Results

To estimate the average treatment of being an Islamic bank propensity scores are estimated by a probit model, with the binary dependent variable of being an Islamic bank (0,1) over covariates Z. Table 3.5 presents the covariates Z and defines each variable. To identify the covariates Z of binary response models that are used to es-

timate the propensity scores of being an Islamic bank, I refer to the active literature. The empirical evidences suggest that capital and liquidity management of Islamic banks are different than their peers in the system (Abedifar et al., 2013; Beck et al., 2013). Therefore, several liquidity and capital adequacy measures are defined, *eta*, *cr*, *lr*, and *nim* to account for the impact of these measures. Since banks that reach an extensive depositor base would probably produce more profit, relative deposit size is considered to be another important factor, *dpta*. In addition, some of the conventional banks in Turkey operate more than a year and control relatively bigger asset size. Islamic banks are relatively younger and manage a small stake of assets in the system. Those conventional banks which are comparable with Islamic banks might have similar asset size. This is the rationale to include total assets of the banks, *lta*. During the sample period, the loan and asset growth among Islamic banks is spectacular and potentially have an impact on profitability. Therefore growth measures, *tagr* and *tlgr*, are defined. To control for the impact of monetary policy changes on different banking schemes, inflation and foreign exchange movements, inf and fx, are employed. Once the variables are gathered based on these motivations, this study argues that bank's propensity to being "Islamic" is associated with its capital and liquidity management, deposit size, total asset size, loan and asset growth and monetary policy.

Table 3.5: Covariates for Matching

Variable	Notation	Definition
Capital Adequacy	eta	Equity/Total Assets
Credit Risk	cr	Loan Loss Provision/Loans
Liquidity Risk	lr	Loans/Deposits
Net Interest Margin	nim	Net Interest Income/Total Assets
Deposits	dpta	Deposits/Total Assets
Asset Size	lta	Natural Logarithm of Total Assets
Total Asset Growth	tagr	Growth of total assets
Total Loans Growth	tlgr	Growth of total loans
Inflation Rate	inf	Inflation Rate
Exchange Rate	fx	Exchange rate USD/TL

The probit model specification introduces all the covariates Z in their linear forms. The variables include *eta*, *cr*, *lr*, *nim*, *dpta*, *lta*, *tagr*, *tlgr*, inf and fx.

Probit model results are presented in Table 3.6. The sample obtained after the estimation of probit model passes the standard balancing tests. That is to say, the conventional bank observations which have higher propensity scores do not significantly differ from Islamic bank observation over covariates Z.

Table 3.6: Probit Model Estimates of Being an Islamic Bank

	Estimated Coefficient	Standard error
eta	3.304	(2.459)
cr	-79.81*	(48.34)
lr	0.349***	(0.0760)
nim	-33.78***	(5.136)
dpta	11.41***	(1.105)
lta	10.42***	(1.145)
tagr	-0.0195	(0.0377)
tlgr	0.0255	(0.0331)
inf	0.155***	(0.0320)
fx	0.0970	(0.662)
Constant	-16.31***	(1.724)
LR statistics	633.41***	
Pseudo R^2	0.722	

* p<0.10, ** p<0.05, *** p<0.01

Notes: The dependent variable IB is a (0, 1) variable that takes the value 1 if the bank is defined as Islamic bank and 0 otherwise. The variables *eta*, *cr*, *lr*, *nim*, *dpta*, *lta*, *tagr*, *tlgr*, inf and fx are the covariates Z to estimate the propensity to being an Islamic bank. The variables are the bank ratios defined respectively as equity to total assets, loan loss provision to total loans, loans to deposits, net interest margin to total assets, deposits to total assets, loan to total assets; and other banking characteristics total asset growth, total loan growth and macroeconomic aggregates of quarterly consumer price index and average quarterly foreign exchange rate. Heteroskedasticity and autocorrelation consistent standard errors in parentheses to the right of the point estimates. The Likelihood Ratio (LR) statistic tests the overall significance of the estimated model against a constant–only alternative.

The quality of the matches might be improved by imposing the common support restriction, though, the use of common support restriction may lead to the loss of high quality matches that are at the boundaries of the common support. The analysis in this section estimates the average treatment effect with and without common support and compare the results.

Table 3.7 report the deciles for Islamic banks and conventional banks based on the propensity scores obtained from binary response model. The table shows that the distribution of propensity scores of being an Islamic bank is skewed to the left among conventional bank observation, and skewed to the right among Islamic

Table 3.7: Distribution of Propensity Scores

	Number of observations	
Deciles	Conventional Bank(IB=0)	Islamic Bank (IB=1)
o.20 percentile	984	3
o.40 percentile	31	11
o.60 percentile	15	22
o.80 percentile	8	30
1.00 percentile	6	78

bank observations. According to the probit model results, the predicted probability ranges from 2.13e-06 to 0.9962 with a mean of 0.7455 among Islamic banks. Among conventional banks, the predicted probability ranges from 0 to 0.9818 with a mean of 0.0346. The results reveal that the common support assumption is satisfied in the region of [2.13e-06, 0.9962], enforcing a loss of 469 conventional banks at the lower extreme of the probability distribution [34].

Some concerns may arise with respect to PSM methodology. Specifically, it may not seem straightforward to consider the "Islamic" status as a treatment. In fact, PSM is based on two assumptions: Conditional Independence Assumptions and Common Support Condition. As far as the Conditional Independence Assumptions is concerned, a valid PSM would require that covariates included in the PSM should not be confounded with treatment outcomes (Caliendo and Kopeinig, 2008). This means that variables for bank fundamentals have to be exogenous to the "Islamic" status. There is not a straightforward procedure to test for Conditional Independence Assumptions. I implemented several test in the estimation of propensity scores. Regarding Common Support Condition, I applied Common Support Condition as a robustness check. I obtained very similar results when we do not apply. As also mentioned, the balancing tests were also successful indicating that control and treatment groups are statistically not different from each other based on selected covariates.

Matching estimates of the Islamic bank effect appear in Table 3.8. The results

[34]I follow Becker and Ichino (2002) and define a common support interval for all Islamic bank observations and those conventional bank observations in the vicinity of Islamic banks support region.

are based on *Stratification Matching* , *Nearest–Neighbour Matching*, and *Kernel Matching* using the Gaussian kernel with a bandwidth of 0.06 [35]. The leave–one–out cross–validations is utilised to obtain the optimal bandwidth. I estimate the propensity scores and perform matching for each bootstrapped sample to obtain the standard errors apart from the analytical errors [36]. T–values which correspond to the bootstrapped standard errors based on 100 replications are given in parentheses under each estimate for *Stratification Matching* and *Kernel Matching*. Table 3.9 presents the results with the common support restriction. The results are also in line with the results without this restriction.

Table 3.8: Estimates of Islamic Bank Effect

	Nearest neighbour	Stratification	Kernel
Return on asset (ROA)	0.003	0.003***	0.003***
	(1.215)	(2.679)	(3.483)
Return on equity (ROE)	0.017	0.026**	0.026**
	(0.970)	(1.971)	(1.825)
Non-performing loan (NPL)	0.020***	0.020***	0.020***
	(4.683)	(7.509)	(7.843)

* p<0.10, ** p<0.05

Notes: a) Independent variables are the profitability indicators measured by return on asset (ROA) and return on equity (ROE). b) The figures in the parenthesis are the t–values which correspond to the standard errors obtained via 100 bootstrap replications and 144 Islamic banks are matched with 1044 conventional banks.

Table 3.9: Estimates of Islamic Bank Effect with Common Support

	Stratification	Kernel
Return on asset (ROA)	0.003***	0.003***
	(2.863)	(3.350)
Return on equity (ROE)	0.026**	0.026**
	(2.167)	(1.643)
Non-performing loan (NPL)	0.020***	0.020***
	(6.343)	(7.425)

* p<0.10, ** p<0.05

Notes: a) Independent variables are the profitability indicators measured by return on asset (ROA) and return on equity (ROE). b) The figures in the parenthesis are the t–values which correspond to the standard errors obtained via 100 bootstrap replications.

The results of *Nearest–Neighbour Matching* indicate an insignificant (but very

[35] I also measured the average treatment with Epanechnikov kernel with the same results and around the same significance.

[36] Please refer to Appendix Table B.1 to assess the weights which are assigned to each matched conventional bank observations.

close to significant) positive value of 0.3% profitability differential for Islamic banks when the profitability measure is ROA. Similarly, *Stratification* and *Kernel Matching* yield a significant and positive value of 0.3% for Islamic banks. The profitability differential is estimated higher when the profitability measure is taken as ROE. Stratification and Kernel Matching yield a significant and positive value of 2.6% profitability differential for Islamic banks. Although Nearest–Neighbour matching indicates a positive value of 1.7%, the parameter estimate is insignificant. These results are the evidence of higher profitability in Islamic banks with respect to their matched pairs. The findings of propensity score matching do not confirm the statistics showing that Islamic banks are, on average, less profitable than conventional banks. This is the benefit of using PSM that when Islamic bank observations are matched with conventional bank observations over appropriate bank characteristics, the profitability differential reverses to positive suggesting higher profitability for Islamic banks.

Why Islamic banks show higher profitability than their conventional bank peers is worth exploring. One could reasonably argue that Islamic banks showed significant efficiency with respect to their matched pairs. Profitable banks are those who manage cost control and achieve higher efficiency. The findings of Inanoglu and El-Gamal (2005) suggest that Islamic banks in Turkey utilize the same technology with conventional banks, and use this technology with relatively same efficiency. Hence, the efficiency seems to be a weak explanation for higher profitability. Higher profitability can be associated with the quality of asset portfolio. Banks with higher quality portfolio tend to generate higher profits due to low credit losses. On a separate analysis but with the same selected pairs, whether or not Islamic banks have high quality asset portfolio is explored. The results show that asset quality of Islamic bank observations are lower than of those matched conventional bank observations. Table 3.8 presents the average treatment effect of being an Islamic bank on asset quality measured by non–performing loans (NPL). Measuring asset quality by aggregate non–performing loans to total assets, average treatment effect reveals

that Islamic banks suffered from lower asset quality. All the estimation techniques yield that the ratio of non–performing loans to total assets in Islamic banks is 2.0% higher than their conventional counterparts. The results in this section support the findings of Shaban et al. (2014) who argue that Islamic banks who are able to diversify their products are more susceptible to moral hazard problems since they do not tend to limit their lending capacity by reserving a high amount of capital to cover loan losses. Shaban et al. (2014) find evidence that Islamic banks who are under–capitalised are exposed to moral hazard problems since the intention to earn more through product diversification would result in adverse selection.

All in all, this section showed that Islamic banks in Turkey have been profitable in the last decade. Efficiency and asset quality as the potential reasons for higher profitability seem not to explain why Islamic banks earned high returns. Next subsection examines the possibility that legislative changes improved profitability in Islamic banks. When certain barriers are removed in the Islamic banking sector by legislative changes, these banks might have found a favourable environment to broaden their customer base, increase product differentiation and competition. The ultimate outcome of the favourable environment can be excess profit for Islamic banks. The profitability of Islamic banks might have been affected from rising power of religiously conservative businessman. Since there is a power shift from traditional businessmen located in Istanbul to Anatolian tigers (Hardy, 2012), the legislative changes might have led to a jump in the demand for Islamic bank products and services. If excessive profit even partly stems from favourable legislative changes, then it would not be consistent to conclude that the excessive profitability is the outcome of *Shariah* arbitrage.

3.4 The Consequences of Regulations on Profitability of Islamic Banks

The PSM results show that Islamic banks in Turkey create excessive returns without managing their asset portfolio better. The findings at this stage, however,

do not provide complete evidence that Islamic banks in Turkey exploit *Shariah* arbitrage. The other dimension of the analysis could be to investigate the impacts of legislative changes which can be the main culprit for the excess profitability of Islamic banks. This analysis would also give the initial evidence about the impact of legislative changes on Turkish banking system. Whilst the impact of regulations in banking sectors is examined in many emerging market countries (see e.g. Lee and Hsieh, 2014; Zhao et al., 2010; Park and Sehrt, 2001), we know less about the impact of recent legislative and regulatory changes on Turkish banking sector. This subsection also attempts to fill this gap by investigating the impact of these legislations on the profitability of Islamic banks in Turkey.

To estimate the effects of legislative changes on profitability of Islamic banks, synthetic control method (SCM) proposed by Abadie et al. (2010) is adopted. This method can be applied to experimental settings when a treatment, e.g. regulatory changes in this case, is applied to one unit (Islamic banks) and not to others. SCM proposed by Abadie and Gardeazabal (2003) receives flourishing interest from comparative case studies. In their novel study, Abadie and Gardeazabal (2003) employ SCM to evaluate the effect of terrorism that is effective in the single region of Spain. Likewise, Abadie et al. (2010) estimate the effect of California Tobacco program on tobacco consumption. Iatridis (2012) studies the impact of terrorist activities on the earnings management, whereas Gupta et al. (2004) examine the fiscal consequences of armed conflict and terrorism in low– and middle–income countries.

3.4.1 Synthetic Control Method

In this section, SCM is employed to explore the impact of regulatory changes on the profitability of Islamic banks. SCM estimates the effect of an intervention that is applied to some units in the sample and the remaining units are not exposed to the treatment. SCM estimates the impact of the intervention based on a weighted combination of synthetic units from the pool of donors that are used to approximate the characteristics of the treated unit. In other words, the counterfactual of the

treated unit can be constructed in the absence of the intervention. In SCM, the potential control units which do not receive the treatment are referred to as "donor" and are selected based on a matching estimator. The synthetic control is a weighted average of the available donors which give contribution to the counterfactual of observation under treatment. SCM makes use of the similarities (or lack thereof) between the units affected by the treatment and the synthetic control to estimate the post–treatment outcomes.

This section examines the impact of the treatment during 2003–2006 on Islamic banks which was removed by the Banking Law No 5411 of 2005. In this experiment, the treatment on Islamic banks takes the form of certain regulations that deprived Islamic banks from certain rights. As discussed in earlier sections, by the Banking Law No 5411 of 2005, Islamic banks gained the "bank" status and put under the same deposit insurance coverage with conventional banks. By using conventional bank observations as the control units (donors) to create synthetic controls, I estimate the effect of regulations that deprives Islamic banks from certain rights. Although the law was effective by 2005, the period is relaxed by one year under the assumption that it takes a year for Islamic banks to adjust to the new regulations. This assumption leads to take the treatment period as 2003–2006 and post–treatment as 2006–2011.

Let's suppose there are $J+1$ units and the intervention is exposed only on the first unit ($j=1$) after the time T_0. By construct, the other J units remain as control units. SCM sets Y_{1t}^I as the outcome variable when treatment is effective on the first unit ($j=1$) and sets Y_{1t}^N as the outcome variable when treatments are ineffective at time $t \in [T_{0+1}, T]$. In order to estimate Y_{1t}^I and Y_{1t}^N the following model can be used:

$$Y_{jt} = \delta_t + \tau_{jt} D_{jt} + \Theta_t Z_j + \lambda_t \phi_j + \epsilon_{jt} \tag{3.8}$$

where Z_j is a vector of explanatory variables, Θ_t is a vector of estimated parameters. ϕ_j denotes for a pair–specific unobservable, whereas λ_t is an unknown common

factor. ϵ_{jt} is a transitory shock with zero mean and D_{jt} is a dummy variable that takes value of 1 for the treated unit and 0 for the control unit. Then the treatment effect, τ_{1t}, is estimated for $t = T_0 + 1, T_0 + 2, ..., T$ by,

$$\tau_{1t} = Y_{1t}^I - Y_{1t}^N = Y_{1t} - Y_{1t}^N \tag{3.9}$$

Even though $Y_{1t}^I = Y_{1t}$ are observable, the estimation of the treatment effect is not straightforward due to the unobserved control unit Y_{1t}^N. Abadie and Gardeazabal (2003) offer a vector $W = (w_2, ..., w_{j+1})$ such that $w_j \geq 0$ for $j = 2, ..., J + 1$ and $\sum_{j=2}^{J+1} w_j = 1$. In the vector W, each element represents a weight that will be used to construct a synthetic control unit that is used to approximate the treated unit before the intervention. Hence, for the pre–intervention period ($t \in [1, T_0]$), $W^* = (w_2^*, ..., w_{j+1}^*)$ is determined in such a way that $Y_{1t} = \sum_{j=2}^{J+1} w_j^* Y_{jt}$ and $Z_1 = \sum_{j=2}^{J+1} w_j^* Z_j$ where Z_j is a vector of observed covariates not affected by the intervention. Once W^* is determined, the treatment effect at $t = T_0 + 1, T_0 + 2, ...$ is estimated as:

$$\tau_{1t} = Y_{1t}^I - \sum_{j=2}^{J+1} w_j^* Y_{jt} \tag{3.10}$$

As mentioned above, the weights should ensure that synthetic unit is almost the same as the treated unit before the intervention. Let $X_1 = (Z_1, Y_{11}, ..., Y_{1T_0})$ be a vector of pre–intervention characteristics for the unit $j = 1$ and $X_0 = (Z_j, Y_{jt}, ..., Y_{jT_0})$ be a matrix of the same characteristics for the control units $j \epsilon [2, J + 1]$. Then the vector W minimises the distance between X_1 and $X_0 W$ subject to $w_j \geq 0$ for $j = 2, ..., J + 1$ as follows:

$$\min_W \parallel X_1 - X_0 W \parallel_V = \min_{W(V)} \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)} \tag{3.11}$$

Abadie and Gardeazabal (2003) proposes a diagonal and positive semi–definite matrix to solve the minimisation problem of Equation 3.11, by which the mean squared prediction error of the outcome variable is minimised over the control period.

3.4.2 Synthetic Control Method Results

The figures reported in Table 3.10 demonstrate the optimum weights for ROA, ROE and NPL that reproduce synthetic ROA, ROE, and NPL time series when Islamic banks receive the treatment. I use conventional banks in the system as the donor pool. Regarding ROA, the optimal weights of Fibabanka make the highest contribution in creating "synthetic" series. Fibabanka's contributions are 0.701, 0.349, 0.371, and 0.597 respectively for Al–Baraka, Bank Asya, Kuveyt Turk and Turkiye Finans. During the sample period, the characteristics of Islamic Banks resemble Fibabanka the most. Halk Bank, being a state–owned bank, contributes for all Islamic banks in the creation of synthetic series.

Regarding ROE, again, Fibabanka provides the highest contribution for all the banks. With a slight difference, Fibabanka's contributions are 0.714, 0.399, 0.42, and 0.618 respectively for Al–Baraka, Bank Asya, Kuveyt Turk and Turkiye Finans. Halk Bank contributes for all the Islamic banks in calculating the synthetic series as well. Halk Bank, contributes for all Islamic banks in the calculation of the synthetic bank series for ROE as it did to ROA.

Regarding NPL, Fibabanka's contribution is again the highest with the weights of 0.72, 0.592, 0.706, and 0.735. However, Is Bank replaces Halk Bank and regularly contributes to the calculation of synthetic series. The only exception is the Al–Baraka which does not receive any contribution from Is Bank.

Figure 3.3, 3.4, 3.5, and 3.6 plot the trend in ROA respectively for Al-Baraka, Bank Asya, Kuveyt Turk and Turkiye Finans. In the same way, Figure 3.7, 3.8, 3.9, and 3.10 plot the trend in ROE respectively for Al-Baraka, Bank Asya, Kuveyt Turk and Turkiye Finans. As explained above, I construct the synthetic bank time series as the convex combination of bank observations in the donor pool that most

Table 3.10: Bank Weights for Islamic Banks in SCM

	Al–Baraka			Bank Asya			Kuveyt Turk			Turkiye Finans		
	ROA	ROE	NPL	ROA	ROE	NPL	ROA	ROE	NPL	ROA	ROE	NPL
Akbank	0	0	0	0	0	0	0	0	0	0	0	0
Alternatif	0	0	0	0.06	0.014	0	0.378	0.327	0	0	0	0
Anadolubank	0	0	0	0	0	0	0	0	0	0	0	0
Arap-Turk	0	0	0	0	0	0	0	0	0	0	0	0
Bank Mellat	0	0	0	0	0	0	0	0	0	0	0	0
Birlesik Fon	0	0	0.001	0	0	0	0	0	0	0	0	0
Citibank	0	0	0	0	0	0	0	0	0	0	0	0
Denizbank	0	0	0	0	0	0	0	0	0	0	0	0
Deutsche	0	0	0	0	0	0.181	0	0	0.094	0	0	0.076
Eurobank	0	0	0	0	0	0	0	0	0.074	0	0	0
Fibabanka	0.701	0.714	0.72	0.349	0.399	0.592	0.371	0.42	0.706	0.597	0.618	0.735
Finans Bank	0.057	0.199	0.023	0	0	0	0	0	0	0.31	0.225	0
HSBC	0	0	0.016	0.449	0.422	0	0.025	0	0	0	0	0
Habib Bank	0	0	0	0	0	0	0	0	0	0	0	0
ING Bank	0	0	0	0	0	0	0	0	0	0	0	0
Portigon	0	0	0	0	0	0	0	0	0	0	0	0
RBS	0	0	0	0	0	0	0	0	0	0	0	0
Sekerbank	0	0	0	0	0	0	0	0	0	0	0	0
Societe Gen	0	0	0	0	0	0	0	0	0	0	0	0
TEB	0	0	0	0	0	0	0	0	0	0	0	0
TR Garanti	0	0	0	0	0	0	0	0	0	0	0	0
TR Halk	0.242	0.087	0.241	0.143	0.165	0	0.226	0.252	0	0.093	0.158	0
TR Is	0	0	0	0	0	0.228	0	0	0.127	0	0	0.189
TR Vakiflar	0	0	0	0	0	0	0	0	0	0	0	0
TR Ziraat	0	0	0	0	0	0	0	0	0	0	0	0
Tekstil Bank	0	0	0	0	0	0	0	0	0	0	0	0
Turkish Bank	0	0	0	0	0	0	0	0	0	0	0	0
Turkland	0	0	0	0	0	0	0	0	0	0	0	0
Yapi Kredi	0	0	0	0	0	0	0	0	0	0	0	0

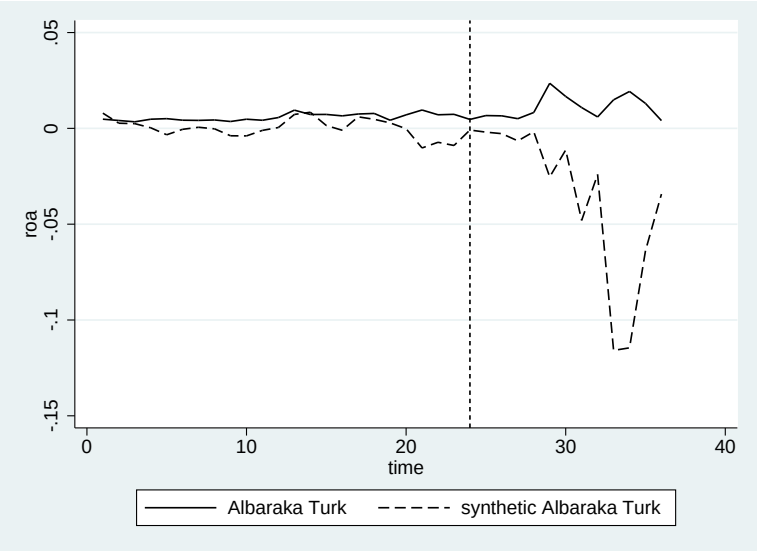
Note: This table reports the optimum weights for ROA, ROE and NPL figures to reproduce synthetic ROA, ROE, and NPL time series when Islamic banks receive the treatment.

closely resemble the Islamic bank in question in terms of being an "Islamic bank". The results are discussed previously and the conventional banks in the system which resemble the Islamic banks are selected, and the weights are calculated accordingly. It is noteworthy here that during the post–treatment period between 2006–2011, actual and the synthetic time series perform similarly. However, after the passage of Banking Law No 5411 of 2005, both time series show considerable divergence. The difference between actual time series and synthetic time series is assessed as the treatment effect in SCM. In this study, the wedge between actual and synthetic bank profitability series suggests that without the presence of new legislations banks achieved to earn higher returns. This is valid for all Islamic banks showing that legislations brought higher discipline to these banks.

Without any exception, Islamic banks perform better in terms of profitability

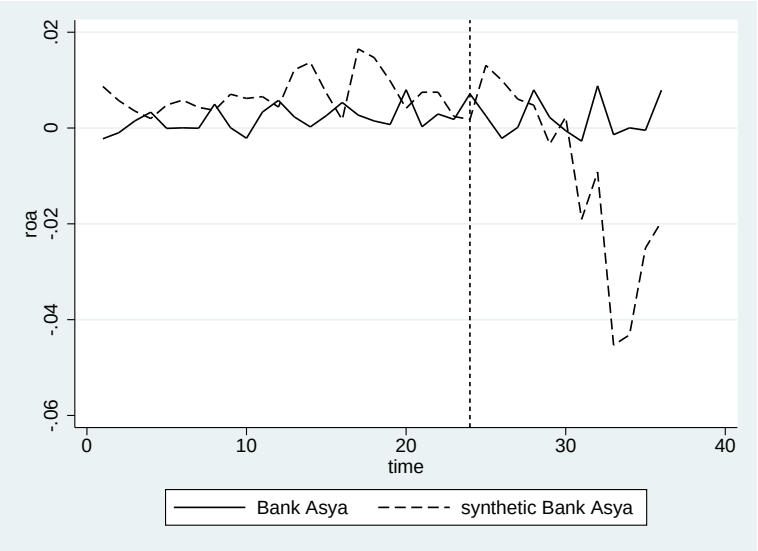
measures of ROA and ROE during the treatment period of 2003–2006. The results suggest that before the passage of the law, Islamic banks recorded higher profitability with respect to post–treatment period of 2006–2011. The results in turn suggest that new law led to clear deterioration in the profitability of Islamic banks.

The findings of NPL (see Figure 3.11, 3.12, 3.13, and 3.14) indicate that the treatment scaled back the NPL ratio which can be read as the rising quality of assets in the post–treatment. Nonetheless, the contributor donors can not explicitly mimic the post–treatment period for NPL ratio, i.e. 2006–2011. Therefore, it is not that much certain, as in ROA and ROE, to argue that Islamic banks enhanced their asset quality after the enactment of law.



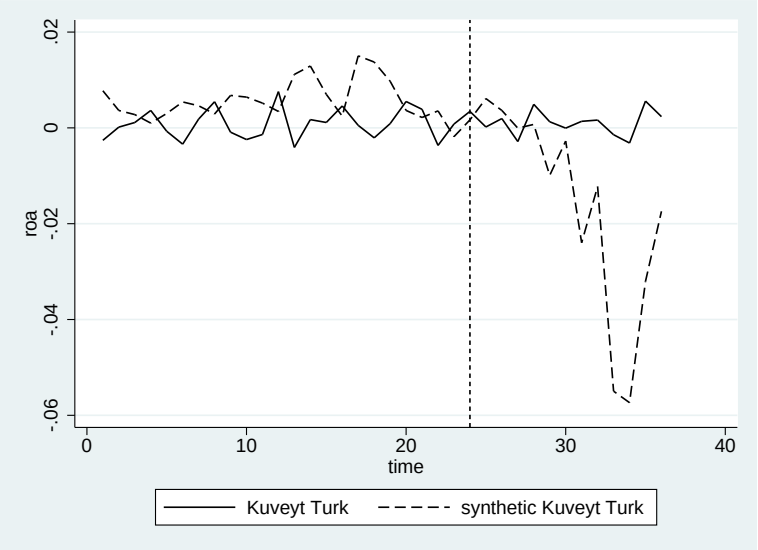
Note: The figure shows the ROA figures of Al–Baraka and synthetic Al–Baraka. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.3: Trends in ROA: Al-Baraka vs. Synthetic Al–Baraka



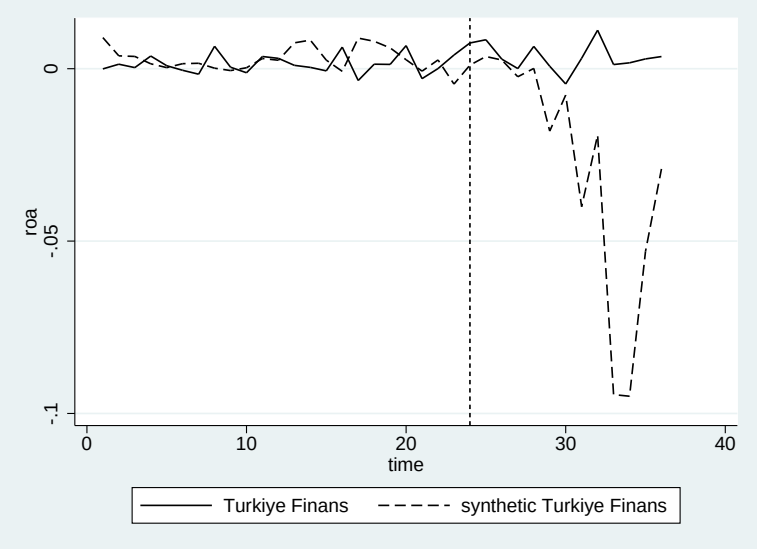
Note: The figure shows the ROA figures of Bank Asya and synthetic Bank Asya. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.4: Trends in ROA: Bank Asya vs. Synthetic Bank Asya



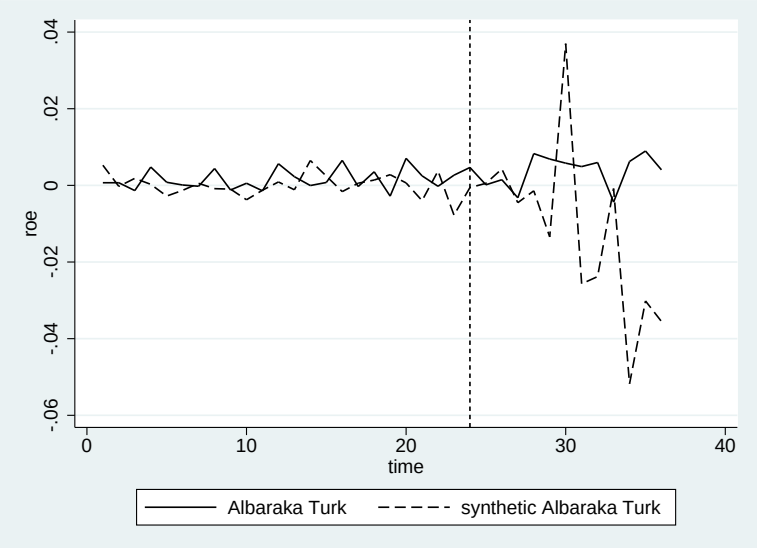
Note: The figure shows the ROA figures of Kuveyt Turk and synthetic Kuveyt Turk. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.5: Trends in ROA: Kuveyt Turk vs. Synthetic Kuveyt Turk



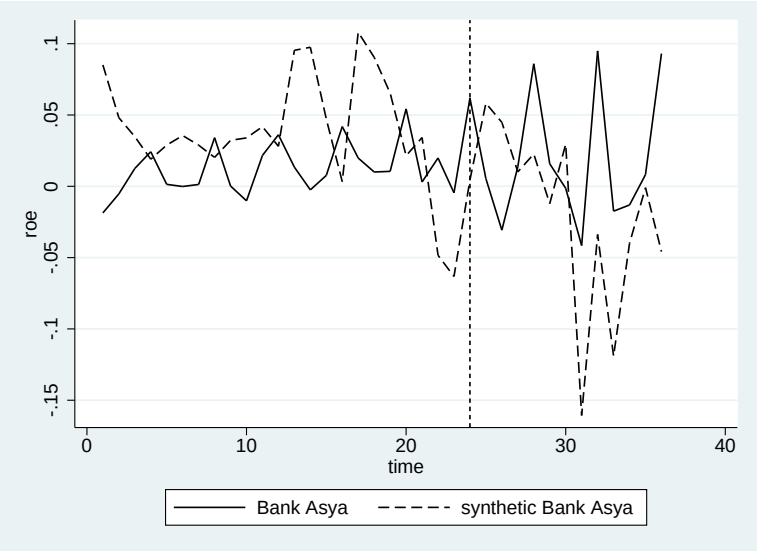
Note: The figure shows the ROA figures of Turkiye Finans and synthetic Turkiye Finans. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.6: Trends in ROA: Turkiye Finans vs. Synthetic Turkiye Finans



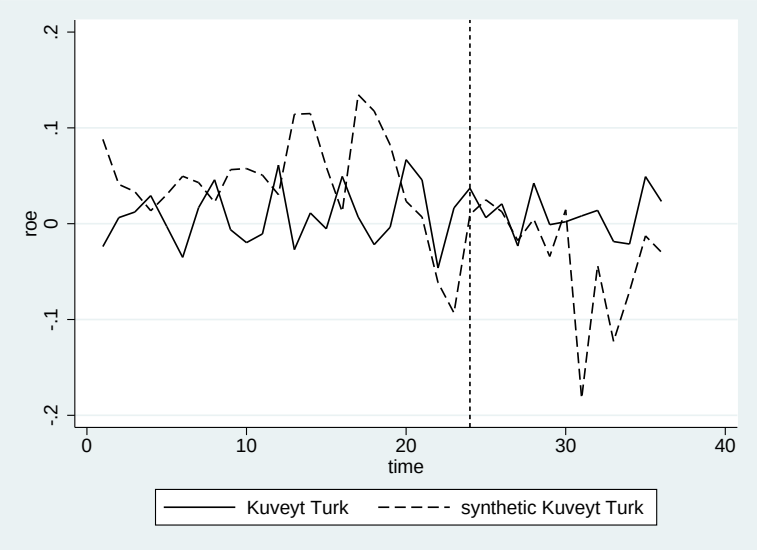
Note: The figure shows the ROE figures of Al–Baraka and synthetic Al–Baraka. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.7: Trends in ROE: Al-Baraka vs. Synthetic Al–Baraka



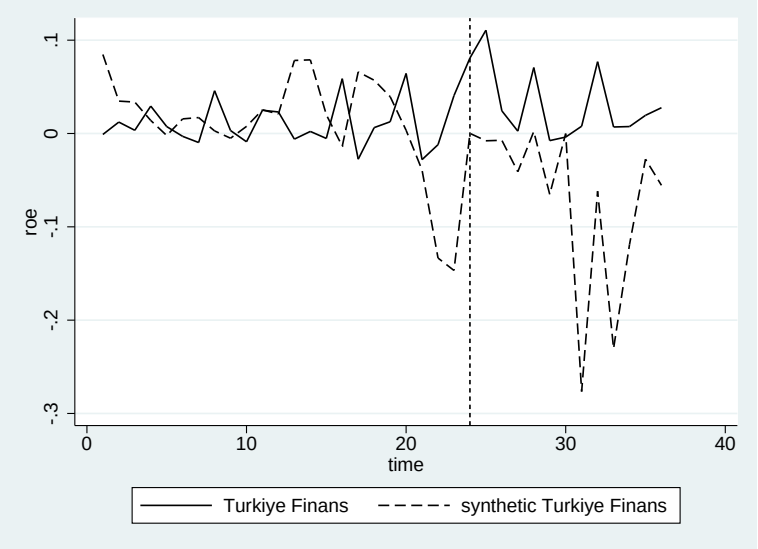
Note: The figure shows the ROE figures of Bank Asya and synthetic Bank Asya. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.8: Trends in ROE: Bank Asya vs. Synthetic Bank Asya



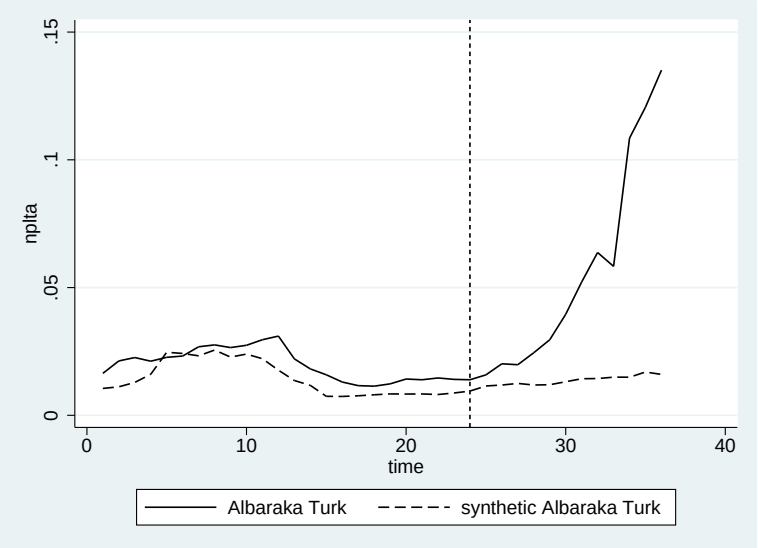
Note: The figure shows the ROE figures of Kuveyt Turk and synthetic Kuveyt Turk. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.9: Trends in ROE: Kuveyt Turk vs. Synthetic Kuveyt Turk



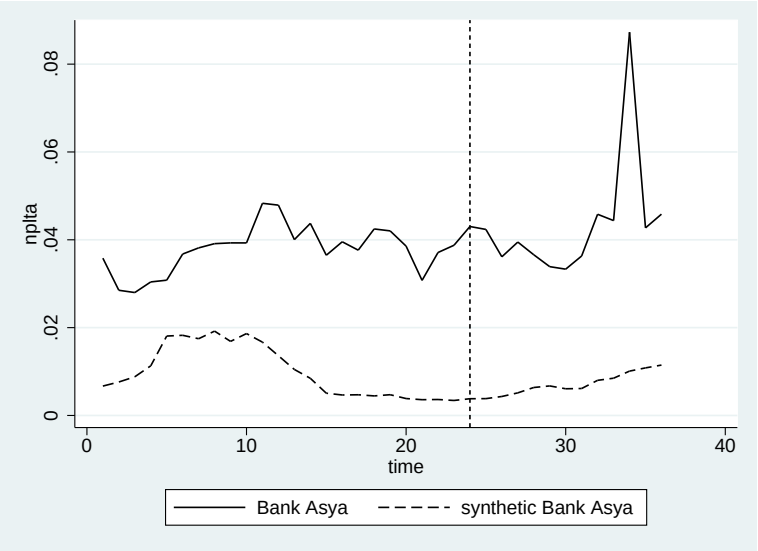
Note: The figure shows the ROE figures of Turkiye Finans and synthetic Turkiye Finans. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.10: Trends in ROE: Turkiye Finans vs. Synthetic Turkiye Finans



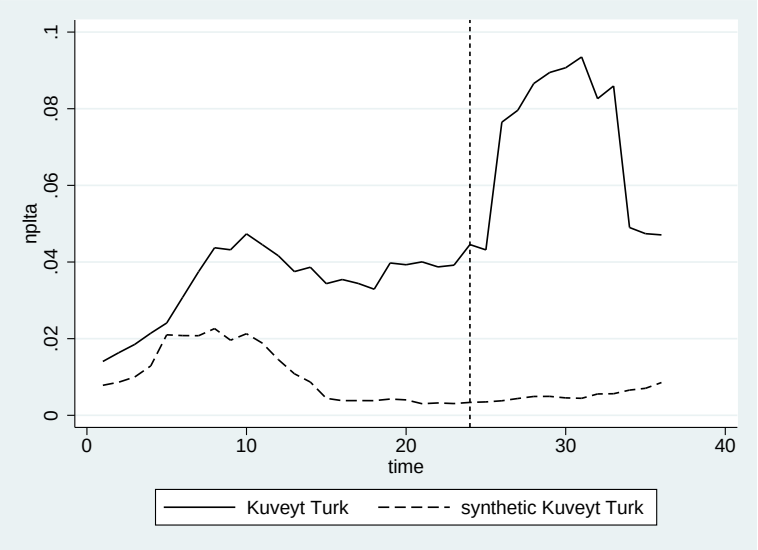
Note: The figure shows the NPL figures of Al–Baraka and synthetic Al–Baraka. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.11: Trends in NPL: Al-Baraka vs. Synthetic Al–Baraka



Note: The figure shows the NPL figures of Bank Asya and synthetic Bank Asya. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

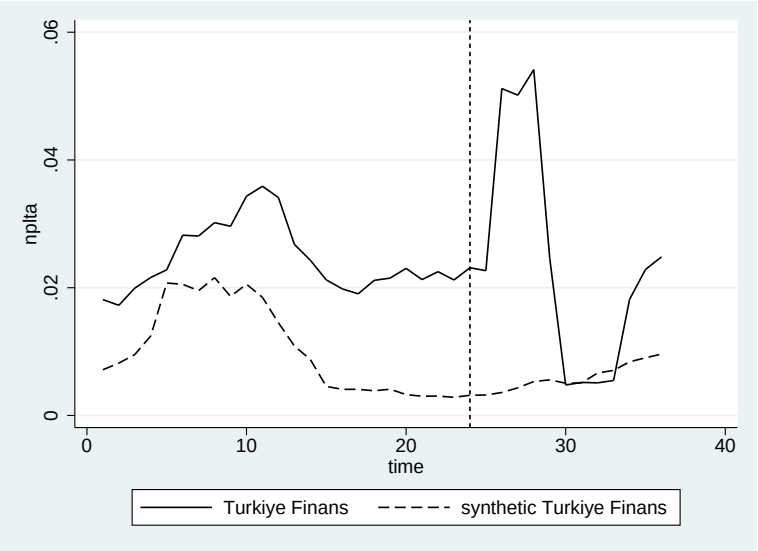
Figure 3.12: Trends in NPL: Bank Asya vs. Synthetic Bank Asya



Note: The figure shows the NPL figures of Kuveyt Turk and synthetic Kuveyt Turk. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.13: Trends in NPL: Kuveyt Turk vs. Synthetic Kuveyt Turk

Similar to Abadie and Gardeazabal (2003) and Abadie et al. (2010), placebo tests are performed by applying SCM to conventional banks. If the placebo tests create gaps of magnitude similar to the one estimated for Islamic banks, then it



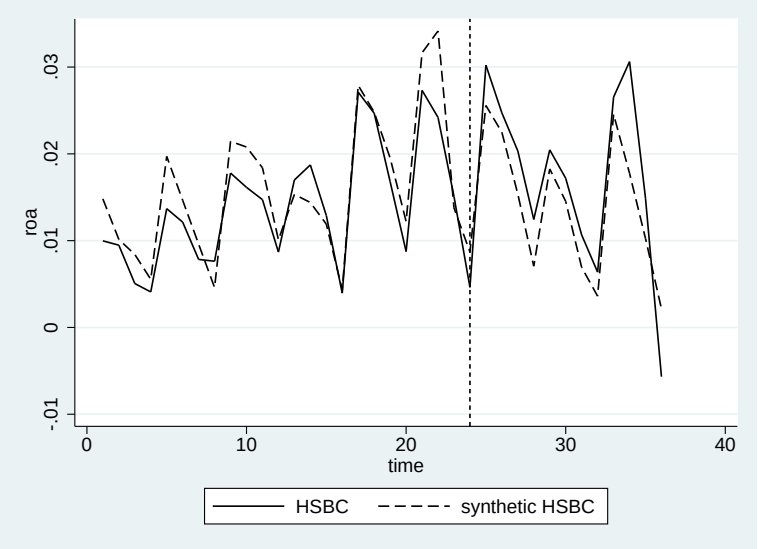
Note: The figure shows the NPL figures of Turkiye Finans and synthetic Turkiye Finans. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.14: Trends in NPL: Turkiye Finans vs. Synthetic Turkiye Finans

could be concluded that the analysis does not provide significant evidence of a positive/negative treatment effect. On the other hand, if the placebo tests show that the gap estimated for Islamic banks is unusually large relative to the gaps for the conventional banks, then the interpretation would be that the analysis provides significant evidence of a positive/negative effect of being an "Islamic bank" on profitability and asset quality.

Abadie et al. (2010) assess the robustness of their estimates by conducting a series of placebo tests by iteratively applying SCM to every other state in the donor pool. They point out that this iterative procedure provides them with a distribution of estimated gaps for the units where no intervention took place. Similar to their application, SCM is applied to banks in our sample that resemble Islamic bank. This allows one to assess whether the estimated effect is also operative on similar units which do not receive the treatment. If a similar effect is observed for conventional banks, then it will be argued that the effect does not originate form the treatment. Placebo analysis confirms that estimated effects for Islamic banks are unusually large relative to the estimates for the banks in the donor pool. Figure 3.15 and

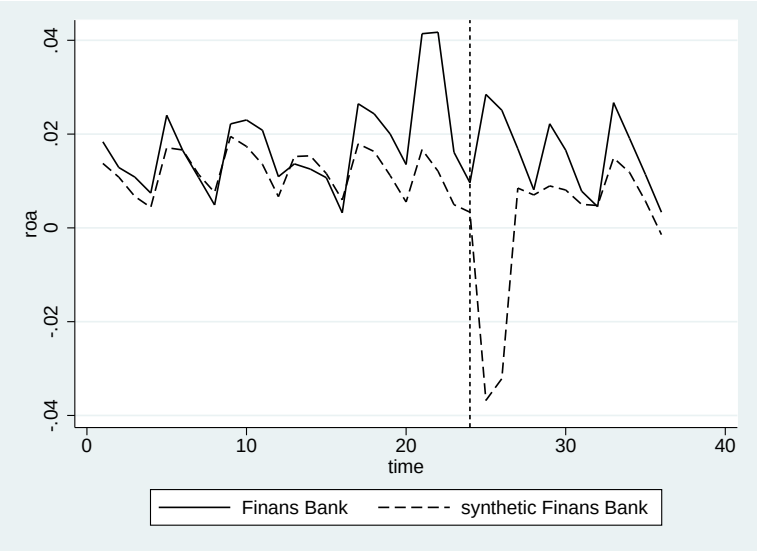
Figure 3.16 plot two samples of placebo tests pertaining to Bank Asya and Kuveyt Turk respectively when the dependent variable was ROA. Figure 3.15 presents the results of SCM to HSBC that is in the donor pool and resembles to Bank Asya which receives the treatment. Similarly, Figure 3.16 presents the results of SCM when it is applied to Finans Bank when Turkiye Finans receives the treatment. Evidently, these two banks do not show significant changes in their synthetic series. These findings confirm that the impact of regulatory changes on Islamic banks is significant and robust.



Note: The figure shows the ROA figures of HSBC and synthetic HSBC. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.15: Placebo Test to HSBC: Bank Asya is the Treatment Unit

The results obtained from SCM in this section suggest that the profitability of Islamic banks diminished after the enactment of several legislations. This finding can be explained in two ways. First, the finding can be consistent since these banks have shown significant growth in asset and equity which might have reduced the ROA and ROE measures in the corresponding years. Second, the finding is not unexpected since legislative changes could have put implicit scrutiny on Islamic banks despite the favourable nature of the legislations. Islamic banks might have felt under pressure of the heavy regulatory agenda in the last decade which gave them impetus to



Note: The figure shows the ROA figures of Finans Bank and synthetic Finans Bank. The sample period includes 36 quarter-points in time. The first 20 quarter–points indicate post–treatment (2006–2011) and the remaining 16 quarter-points indicate pre–treatment (2003-2006).

Figure 3.16: Placebo Test to Finans Bank: Kuveyt Turk is the Treatment Unit

discipline their activities. The SCM results underpin the findings of PSM results in the previous section. The results demonstrate that the higher profitability of Islamic banks can not be attributable to the effect of regulations in the last decade. This finding further supports the overall argument of this chapter that excessive profitability is an outcome of *Shariah* arbitrage. The overall picture which stems from the hitherto analysis in this chapter is that "Islamic" brand created excessive returns for Islamic banks in Turkish banking system. The oligopolistic structure of Islamic banking might sweeten the conditions for excessive profitability since Islamic banks are conducive to collude. Next section will investigate the market structure among Islamic banks in a dual banking system. The analysis will consider the effect of legislative changes and complement the findings related to excess profitability.

3.5 The Consequences of Regulations on Competition in Turkish Banking

The legislative changes in the last decade in Turkish banking system have been supportive for Islamic banks to integrate into the banking system. Due to the

legislative changes backed up by the emerging religiously conservative businessmen (Hardy, 2012), Islamic banks in Turkey expand their customer base. Next to four fully fledged Islamic banks two state–owned banks have been awarded licenses to establish business lines known as "Islamic windows", in order to accommodate the new and growing demand for Islamic products. Although positive developments with the introduction of these recent changes are noticeable, empirical research concerning the impact of legislative changes on Islamic banks in general is still to come. This section continues to investigate the impact of regulatory changes on Islamic banks by exploring the potentially changing market power of Islamic banks in Turkey, both in their sector and in total banking system.

Banks play an essential role in intermediary activities and the transmission of monetary policy. The vital role of banks in the economy makes the issue of banking competition important, since a strong relation between banking market structure and economic growth is evident (Levine et al., 2000; Cetorelli and Gambera, 2001; Collender and Shaffer, 2003; Valverdie et al., 2003). Furthermore, from the findings of a newly flourishing area of research, it is apparent that market competition leads to financial stability (De Jonghe and Vennet, 2008; Schaeck et al., 2009; Berger et al., 2009; Turk Ariss, 2010).

Recent studies employing P–R models come from single country cases or cross–country experiences. Carbó et al. (2009) provide cross country comparisons of competition within the banking system of fourteen European Union countries. Casu and Girardone (2009) also examine the impact deregulatory changes on the competitive conditions of the selected EU banking markets. Schaeck et al. (2009) investigate the competition in the banking system of 45 countries to find out the answer of as to whether competition in banking systems is more conducive to financial stability. On the other hand, Coccorese (2009) studies the market power of Italian local banking monopolies. Gischer and Stiele (2009) examine the market structure of German savings banks.

While a number of previous studies investigated the banking market structure

in developed countries, the empirical evidences regarding developing country cases are still relatively rare. Gelos and Roldos (2004) investigate the market structure in eight emerging market countries from Latin America and Eastern Europe. Turk-Ariss (2009) studies the competitive condition in several Middle East and North African countries. The regulatory reforms in India are examined by Zhao et al. (2010). The authors find evidence of increased competition in lending market after the reforms. As an interesting study that investigates the impact of foreign entries on market structure, Yuan (2006) examines Chinese banking system and finds a near state of perfect competition in the industry before foreign banks began to enter into the industry.

In Turkey, Gunalp and Celik (2006) study the market structure in Turkish banking system. They find that the banking system operates under monopolistic competition and emphasise that there is still to be done to improve the competition in the market. Studies analysing the market structure of Turkish banking had an exclusive focus on the conventional banking system (see e.g. Gunalp and Celik, 2006). This chapter aims to extend the insights by prior research by including Islamic banking market, i.e., whether the regulatory changes affected the market structure in this banking segment. It is known that studies investigating competition among Islamic banks are rather limited with recent papers (see e.g. Al-Muharrami et al., 2006; Berger et al., 2009; Weill, 2011). This chapter contributes to relevant literature by investigating Islamic banks in Turkey. Specifically, by employing the P–R model, this section examines the degree of competition separately among Islamic banks banks and the whole banking sector for the period of January 2001–January 2013. The duality as conventional and Islamic bank allows one to differentiate the market structure in the Turkish Islamic banking (see e.g. Weill, 2011, for similar comparison among Islamic banks and conventional banks). As a separate analysis, the sample is divided into two sub–samples as pre–regulation and post–regulation to assess the impact of regulatory changes.

The study of competition is important since, as Zhao et al. (2010) argue, lack of

competition leads bank managers to exploit potential consumer surplus. Hence, the exploration of to what extent regulatory changes affects the market structure is associated with the welfare of bank customers. Regarding the banking market structure and growth nexus, increasing market power translates into a higher cost of financial intermediation, a lower volume of savings and investment, and therefore lowers economic growth (Maudos and de Guevara, 2007; Solís and Maudos, 2008). The overall result of monopoly power is then welfare loss of interest–sensitive customers.

The legislative changes in Turkish banking can bring increased competition which might improve Islamic banks' ability to attract more conventional bank customers. Increased competition could then introduce more room for Islamic banks to grow if Islamic banks introduce sufficient incentives for conventional banks to switch their banks [37]. In contrast, with the effect of favourable climate, Islamic banks could exert more monopoly power in intermediation and non–intermediation activities. In this case, banks abuse their power by generating high profit from a firm via high financing costs.

A well–known problem in calculating the competition in banking industry is that competition cannot be measured directly. As Leuvensteijn et al. (2011) argue cost and price data of single banking products are occasionally available. Therefore, the literature of competition in banking industry relies on indirect measures, i.e. derived indices. For instance P–R H statistic, Herfindahl–Hirschmann Index, and Lerner Index etc. measure the overall market competition in banking system, whereas, Boone indicator measures competition in specific bank market segments. Recently proposed by Tabacco (2013), D indicator addresses the shortcomings of several competition indices and provides a more compact way of measuring competition in banking system.

Empirical estimation of the degree of competition generally takes two forms of

[37]Banking services have switching costs if a customer purchases it regularly and finds costly to change the bank and switch to another. Large switching costs lock–in bank customer if the customer has a long track record in the bank and adverse selection is resolved with repeated transactions (Farrell and Klemperer, 2007). Therefore, it will be consistent for the customer to stay at the bank and not to switch unless certain incentives higher than switching costs are introduced.

techniques. As the first form, the structural approach underpins the Structural Conduct Performance (SCP) paradigm and derives degree of competition from market concentration. This approach simply assumes that in concentrated markets the degree of competition would be low. Concentration based measures are criticised by Demsetz (1973) who argues that concentration can be the outcome of greater efficiency and competition. As the second form, non–structural models popularised under the New Empirical Industrial Organisation (NEIO) approach infers the degree of market competition from market behaviour.

The SCP paradigm is rarely employed due to mentioned weaknesses, whereas, the empirical estimates of market competition of NEIO tradition has been refined to two approaches: the Bresnahan–Lau method (Bresnahan, 1982; Lau, 1982) and the P–R reduced–form revenue test (Panzar and Rosse, 1987, 1977). Bresnahan (1982) and Lau (1982) suggest a procedure that comprises the estimation of a simultaneous equations model based on industry-level data where a parameter representing the degree of market power of firms is incorporated. An alternative method within NEIO approach that has the advantage of using bank-level data involves the estimation of the P–R model.

The P–R model is an approach to measure competition that is based on a reduced–form revenue equation. The model unravels the level of competition in the market through the summation of input price elasticities. The choice of P–R model to measure the competition is based on three virtues. First, aside from the long–run equilibrium assumption, it does not require a priori assumptions. Second, it has strong theoretical background and formal proof. Third, the data employed in estimating the revenue and profit functions are highly standard and easily accessible bank-level data. Despite the benefits, Goddard and Wilson (2009) and Bikker et al. (2012) indicate several drawbacks in the estimation of P–R H statistic. Goddard and Wilson (2009) argue that the estimation of reduced form P–R model leads H statistic to be biased toward zero if the estimation assumes instant correction toward market equilibrium in response to factor input price shocks. They suggest partial

adjustment toward market equilibrium and propose a dynamic approach to estimate P–R model. Bikker et al. (2012) raise the concern against the misspecification of various P–R models in the literature. Bikker et al. (2012) provide evidence that controlling for firm scale in the equations, i.e. total assets as either an independent exogenous variable or a scaling factor in independent or dependent variables, does not provide valid measurement of P–R H statistic.

According to P–R model, banks have revenue and cost functions, respectively given as $R_i(y_i, n, z_i)$ and $C_i(y_i, w_i, t_i)$, where R_i and C_i are respectively the revenue and cost of bank i; y_i is the output of bank i; w_i is a vector of input prices for bank i; n is the number of banks; and z_i and t_i are vectors of exogenous variables belonging to revenue and cost functions. Marginal revenue should be equal to marginal cost as the first order profit maximisation condition requires. First order condition implies that, $R_i^{'}(y_i, n, z_i) = C_i^{'}(y_i, w_i, t_i)$, where $R_i^{'}$ and $C_i^{'}$ are respectively marginal revenue and marginal cost of bank i. Long–run equilibrium in the product market imposes a zero profit constraint, that is $R_i^*(y_i^*, n^*, z_i) = C_i^*(y_i^*, w_i, t_i)$, where the asterisk denotes for the equilibrium values of the first order condition.

Based on the definitions, the H statistic is derived as the sum of factor price elasticities, $\sum_{k=1}^{m} \frac{\partial R_i^*}{\partial w_{ki}} \frac{w_{ki}}{R_i^*}$ where $\frac{\partial R_i^*}{\partial w_{ki}}$ is the derivative of total revenue with respect to the price of the k^{th} input. According to the value of H the market structure condition, i.e. monopoly, monopolistic competition, and perfect competition, is identified. The identification process is as follows:

i. Monopoly: H statistic is zero or negative ($H \leq 0$), implying that an increase in factor prices leads to a fall in revenue. This is due to monopolistic market condition where the monopolist operates at the price elastic portion of the demand curve. In the vicinity of the point where monopolist produces, an increase in input price leads to a disproportionate fall in sold out units which causes revenue fall.

ii. Monopolistic competition: H statistic is between zero and one ($0 < H < 1$). Here, an increase in factor prices increases average and marginal costs which

lead to an increase in revenue arising from the exit of some market players from the market.

iii. Perfect competition: The market operates under perfect competition, if an increase in factor prices causes revenue to increase proportionally which implies $H = 1$.

3.5.1 Estimation of a P–R Model

Following Bikker and Haaf (2002) and Bikker et al. (2012), the P–R model is applied by devising the marginal cost and marginal revenue functions, imposing an equilibrium condition, and solving for the equilibrium output as a function of input prices and exogenous control variables. Assuming a Cobb–Douglas technology, the generic log–linear marginal cost and log–linear marginal revenue functions can be defined as:

$$lnMC = \alpha_0 + \alpha_1 lnOUT + \sum_{i=1}^{3} \beta_i lnW_i + \sum_{j=1}^{z} \gamma_j EXOG_{COST_j} \tag{3.12}$$

$$lnMR = \mu_0 + \mu_1 lnOUT + \sum_{j=1}^{k} \vartheta_j EXOG_{Rev_j} \tag{3.13}$$

where OUT is output of the bank, W are the factor input prices (regarding e.g. funding, personnel expenses and other non-interest expenses). $EXOG_{COST}$ are other variables that are exogenous to the cost function C_i and similarly $EXOG_{Rev}$ are the variables related to the bank–specific demand function. In equilibrium condition, a profit–maximising bank equalizes marginal revenue to marginal cost and yields the equilibrium value of output as:

$$lnOUT^{*} = \frac{\alpha_0 - \mu_0 + \sum_{i=1}^{3} \beta_i lnW_i + \sum_{j=1}^{z} \gamma_j EXOG_{COST_j} - \sum_{j=1}^{k} \vartheta_j EXOG_{Rev_j}}{\mu_1 - \alpha_1} \quad (3.14)$$

The reduced–form equation for revenues of bank i is the product of the equilibrium values of the output of bank i that is specified in Equation (3.14) and the common price level, determined by the corresponding inverse demand equation.

To explore the degree of competition among Islamic banks and the impact of regulations on the competition, the revenue function of bank i at time i is estimated as follows:

$$lnRev_{it} = \alpha + \sum_{j=1}^{3} \beta_i lnW_{j,i,t} + \sum_{k=1}^{3} \delta_k lnW_{k,i,t} * Regulation_t + \sum_{l=1}^{m} \eta_i X_{l,i,t} + \varepsilon_{i,t} \quad (3.15)$$

where subscripts i and t refer to bank i at time t; Rev_{it} is total revenue of bank i at time t; W_k and W_j are a three-dimensional vector of input prices, namely, the unit price of fund (PF), unit price of labour (PL) and the unit price of capital (PC); X_l is a vector of bank specific and macroeconomic explanatory factors which may shift the revenue and cost functions; and $\varepsilon_{i,t}$ is the IID error term with mean 0 and variance $\sigma^2_{i,t}$. This part of the empirical analyses follows Aysan et al. (2013a) in the variable selection and definition. Table 3.11 presents the data and their definition.

Table 3.11: Variables and Definitions used in P–R Models

Variable	Definition
PF	the ratio of total interest expenses to total deposits
PL	the ratio of personnel expenses to number of personnel
PC	the ratio of other operating expenses to fixed assets
Liquidity Risk	$\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$
Solvency risk	$\frac{shareholders\ equity}{total\ assets}$
Relationship Banking	the ratio of total number of bank personnel to total assets
Bank age	the natural logarithm of the number of months the bank operates
Bank branch	the natural logarithm of the number of bank branches
Regulation	the dummy that takes 1 for the years 2006 and onwards, 0 otherwise
Credit quality	the ratio of non–performing loans to total credits
Recession	the dummy variable which takes 1 for the years 2008, 2009, 2010 and 0 otherwise

Note: Although interest based financial transaction is forbidden in Islamic finance, I try to use a common terminology in this literature. Total interest expense is the equivalent for the expenditures of the Islamic banks to collect funding.

I expect the sign of *Liquidity risk* to be negative since having abundant liquidity reduces the revenues generated from lending activities. A bank's higher equity base with respect to its total assets is associated with it's high potential to produce revenue. Banks with high equity can safely leverage the capital, however high leverage ratios can lead to a deterioration in loan portfolio. Therefore, I do not expect a specific sign for *Solvency risk*. *Relationship banking* is expected to enter into the equations with negative sign, since banks' motivation to grow in personnel size to reach wider customer base can have negative impact on revenues. *Bank age* proxies banks' reputation which directly consolidates confidence among customers, hence I expect that this variable positively relates to bank revenues. The expected sign for *Bank branch* is positive since banks with higher number of branches can have access to large numbers of people that can foster efficient resource allocation within the bank (Aysan et al., 2013b; Rajan and Zingales, 2003).

To test for the long–run equilibrium, the Equation 3.15 is estimated with return on asset (ROA) as the dependent variable:

$$lnROA_{it} = \alpha + \sum_{j=1}^{3} \beta_i lnW_{j,i,t} + \sum_{k=1}^{3} \delta_k lnW_{k,i,t} * Regulation_t + \sum_{l=1}^{m} \eta_i X_{l,i,t} + \varepsilon_{i,t} \quad (3.16)$$

Subsequent to the estimation of the Equation 3.16, P–R H statistic is obtained for pre–regulation period as the sum of the coefficients of factor prices as follows: $H = \sum_{j=1}^{3} \beta_j$. The P–R H statistic for post–regulation period is obtained by including the sum of the coefficients of interaction terms: $H = \sum_{j=1}^{3} \beta_j + \sum_{k=1}^{3} \delta_k$. The long–run equilibrium is tested under the null hypothesis $H^{ROA} = 0$. The long-run equilibrium condition is confirmed if the null hypothesis is not rejected.

3.5.2 Data and Estimation Results

3.5.2.1 Data

The database used in this subsection of the chapter is composed of information from monthly balance sheet and income statement of all Islamic banks and conventional banks in Turkey from January 2001 to January 2013. Actually, the number of Islamic banks before 2005 was five yet Anadolu Finans and Family Finans in the system had decided to merge. Therefore, the financial accounts of these two institutions which have merged during our sample period were added up and reported as a single bank. The rationale behind following this procedure is that the merger date fell in the exactly the same date of the *Regulation* dummy which takes 1 after November 2005 when Banking Law No 5411 of 2005 was enacted. Our methodological approach is designed

- to estimate the market structure of Islamic banking before the legislative and regulatory changes have taken place, and
- to observe the competitive changes after the introduction of the legislative changes in the banking sector.

Ahead of using the raw data, the dependent variables and bank variables are winsorised at the 2% level in both tails to moderate the excessive influence of extreme values.

3.5.2.2 Results

The models in this section are estimated with bank fixed effects to control for the unobserved bank heterogeneity. The estimations employed heteroscedastic and autocorrelation consistent standard errors to control for potentially heteroscedastic and potentially correlated error terms within a cross section. In the P–R model, the dependent variable is the natural logarithm of either interest revenue or total revenue, where the latter includes non–interest revenues to account for the increase in revenue coming from fee–based products and off–balance–sheet activities (Bikker

et al., 2012). As Aysan et al. (2013a) state that the volume of non–interest revenue over total revenue is increasing on Islamic banks' balance sheet in Turkey, Equation 3.15 is estimated separately for interest income, non–interest income and total income respectively. Table 3.12 reports the estimation results when total revenue is the dependent variable and Table 3.13 presents the Wald–test statistics to decide the market structure. The results are obtained by the fixed effect estimator both for group dummies and time dummies. The estimations that exclude time dummies include year dummies. In the same way, the Tables 3.14 and 3.15 present the estimation results and Walt–test statistics respectively for non-interest revenue as being the dependent variable. Table 3.16 and 3.17 belong to the models for interest revenue.

As for input prices, unit prices of funds, capital and labour prices are expected to have positive. Tables 3.12, 3.14, 3.16 demonstrate that estimates for PF are always positive but statistically insignificant, while the coefficient estimates of PK and PL are positive and statistically significant, the sole exception is the parameter estimate of PK which is insignificant when the dependent variable is interest revenue. It is noteworthy that the parameter estimates of $PF * Islamic$ interaction term is always positive and significant capturing the importance of cost of funds for Islamic banks in generating revenues. The coefficient estimates of *Liquidity risk* is negative as expected and significant. The negative sign suggests that the banks that have much liquid assets fell behind to generate high revenues. The models capture negative relationship between *Solvency risk* and dependent variables, indicating that those banks which have high leverage achieved high revenues during the sample period. *Relationship banking* enters into equations with negative signs as expected and significant. Surprisingly, *Bank age* is estimated to have negative impact on bank revenue, showing that, young banks are able to earn more revenues. This finding may be explained by the new entrants which were equipped with higher technology and better risk management. Finally, the estimate of *Bank branch* is positive in all estimations at changing levels of significance.

Tables 3.13, 3.15, and 3.17 present Wald–test statistics testing for the degree of competition in Turkish banking system when the dependent variables are total revenue, non–interest revenue, and interest revenue respectively. When total revenue is the dependent variable, the Wald–test results confirm that the H statistics are significantly different from both zero and unity for conventional banks. The findings suggest that conventional banks operate under monopolistic competition. The market structure turns out to be perfect competition for Islamic banks. After the implementation of various regulations that are deemed to affect the Islamic banking, the market power of Islamic banks increases and Wald–test results indicate the condition of monopoly, the H statistics are significantly different from unity but not zero. It is worthwhile to mention that the Wald–test results appear to be robust to different specifications.

When the dependent variable is non–interest revenue and interest revenue, the Wald–test results suggest similar findings. The results confirm the monopolistic competition for conventional banks as it was found when total revenue was the dependent variable. In the pre–regulation period when non–interest revenues were taken as the dependent variable, it is found that the market operated under monopolistic condition for Islamic bank. Yet, conditions change to monopoly in the post–regulation period, indicating a increasing market power. Regarding the interest revenue as the dependent variable, increasing market power for Islamic banks in the post–regulation period is confirmed. Hence, the common findings of different regression analyses with different revenue definitions suggest that conventional banks operated under monopolistic competition and Islamic banks increased their market power throughout the regulation period in the banking system. The long–run equilibrium test for the value of H^{ROA} statistic is performed by using ROA as the dependent variable. In all regressions, the null hypothesis of $H^{ROA} = 0$ cannot be rejected even at the 10% level. Therefore, the data for Islamic banks appear to be in long–run equilibrium supporting the evidences of market condition in Islamic banking sector.

Table 3.12: P–R Model–Fixed Effect Estimation Results for Total Revenue

PF	0.0398	0.0604	0.0391	0.0579
	(-0.696)	(-1.166)	(-0.681)	(-1.118)
PL	0.3921***	0.4676***	0.4071***	0.4735***
	(-5.633)	(-7.281)	(-5.96)	(-7.4)
PK	0.0792***	0.0967***	0.0811***	0.0987***
	(-3.473)	(-4.801)	(-3.557)	(-4.895)
PF*Islamic	0.4486***	0.3351***	0.5176***	0.3988***
	(-3.433)	(-3.139)	(-4.658)	(-3.867)
PL*Islamic	0.0102	-0.21	0.177	-0.0118
	(-0.062)	(-1.491)	-0.875	(-0.068)
PK*Islamic	-0.0853	-0.0665	-0.2435***	-0.1900***
	(-1.555)	(-1.096)	(-4.106)	(-2.867)
PF*Islamic*Regulation			-0.2870***	-0.2158***
			(-4.066)	(-3.889)
PL*Islamic*Regulation			-0.6660**	-0.4929**
			(-2.478)	(-2.134)
PL*Islamic*Regulation			0.2604***	0.2134***
			-2.812	-2.918
Liquidity risk	-0.0042***	-0.0040***	-0.0041***	-0.0039***
	(-2.750)	(-2.845)	(-2.700)	(-2.759)
Solvency risk	-0.9854**	-0.8622*	-1.0283**	-0.8902**
	(-2.178)	(-2.003)	(-2.300)	(-2.092)
Relationship banking	-0.2217*	-0.2440*	-0.2064	-0.2385*
	(-1.790)	(-1.877)	(-1.680)	(-1.839)
Bank age	-0.4639**	-0.3814*	-0.3005	-0.2455
	(-2.083)	(-1.718)	(-1.596)	(-1.277)
Bank branch	0.5564***	0.5880***	0.5472***	0.5822***
	(-5.228)	(-5.903)	(-5.191)	(-5.851)
Bank fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	No	Yes	No
Constant	10.3299***	8.4733***	9.7101***	8.1023***
	(-10.927)	(-10.242)	(-12)	(-11.025)
Observations	4,636	4,636	4,636	4,636
R-squared	0.667	0.651	0.671	0.653
Number of banks	45	45	45	45

* p<0.10, ** p<0.05, *** p<0.01

Notes: *PF* is the unit price of fund, *PL* is the unit price of labour and *PC* is the unit price of capital. *Regulation* is the dummy that takes 1 for the years 2006 and onwards, 0 otherwise to capture the impact of legislative changes. *Liquidity Risk* measures banks' credit risk exposure and defined as $\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$. *Solvency Risk* is defined as $\frac{shareholders\ equity}{total\ assets}$ and used to proxy for solvency risk. *Relationship Banking* variable is calculated as the ratio of total number of bank personnel to total assets. *Bank age* is the natural logarithm of the number of months the bank exists in the banking system. *Bank Branch* is the natural logarithm of the number of bank branches. In the estimations that exclude time fixed effects, the year dummies are estimated. All the year dummies are statistically significant. The robust t–statistics are in parenthesis.

Table 3.13: Market Structure for Total Revenue

Conventional Banks	MC	MC	MC	MC
Islamic Banks	PC	PC	PC	PC
Post–regulation	-	-	M	M
F-Statistic $(\beta_1 + \beta_2 + \beta_3 = 0)$	25.69***	55.58***	27.53***	56.22***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 = 1)$	23.52***	20.06***	22.12***	19.38***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 0)$	11.74***	7.96***	18.75***	23.49***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 1)$	0.2	1.71	0.01	1.03
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 = 0)$	-	-	1.76	2.83
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 = 1)$	-	-	10.97***	11.51***

* p<0.10, ** p<0.05, *** p<0.01

Note: In the estimations that exclude time fixed effects, the year dummies are estimated. All the year dummies are statistically significant. MC, PC, and M denote for "monopolistic competition", "perfect competition", and "monopoly" respectively.

Table 3.14: P–R Model–Fixed Effect Estimation Results for Non–Interest Revenue

PF	-0.0169	-0.0019	-0.0232	-0.0134
	(-0.283)	(-0.034)	(-0.405)	(-0.254)
PL	0.2657***	0.3694***	0.3127***	0.3926***
	(-3.251)	(-4.672)	(-4.188)	(-5.139)
PK	0.1305***	0.1531***	0.1382***	0.1605***
	(-4.497)	(-5.652)	(-4.846)	(-6.02)
PF*Islamic	0.5383***	0.3982***	0.6581***	0.5172***
	(-2.929)	(-3.536)	(-6.974)	(-7.889)
PL*Islamic	0.7533**	0.3126	1.2383***	0.7839
	(-2.675)	(-1.53)	(-2.811)	(-1.549)
PK*Islamic	-0.0461	-0.0475	-0.3545**	-0.2537
	(-0.323)	(-0.378)	(-2.663)	(-1.658)
PF*Islamic*Regulation			-0.7533***	-0.5475***
			(-5.122)	(-3.813)
PL*Islamic*Regulation			-2.1639***	-1.5873**
			(-3.295)	(-2.510)
PL*Islamic*Regulation			0.3165***	0.1525
			(-2.759	(-0.992
Liquidity risk	-0.0034*	-0.0032*	-0.0030*	-0.0027*
	(-1.949)	(-1.995)	(-1.872)	(-1.828)
Solvency risk	-0.6303	-0.5284	-0.7575	-0.6094
	(-1.175)	(-1.042)	(-1.528)	(-1.287)
Relationship banking	-0.1114	-0.1147	-0.0646	-0.0976
	(-0.892)	(-0.877)	(-0.542)	(-0.752)
Bank age	-0.7063***	-0.6690***	-0.2817*	-0.2595
	(-3.717)	(-4.368)	(-1.762)	(-1.567)
Bank branch	0.4718***	0.4998***	0.4400***	0.4771***
	(-5.396)	(-5.965)	(-5.397)	(-6.011)
Bank fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	No	Yes	No
Constant	9.9771***	7.9370***	8.5595***	6.8442***
	(-10.259)	(-13.573)	(-10.666)	(-11.129)
Observations	4,635	4,635	4,635	4,635
R-squared	0.488	0.468	0.506	0.479
Number of banks	45	45	45	45

* p<0.10, ** p<0.05, *** p<0.01

Note: Notes: PF is the unit price of fund, PL is the unit price of labour and PC is the unit price of capital. *Regulation* is the dummy that takes 1 for the years 2006 and onwards, 0 otherwise to capture the impact of legislative changes. *Liquidity Risk* measures banks' credit risk exposure and defined as $\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$. *Solvency Risk* is defined as $\frac{shareholders\ equity}{total\ assets}$ and used to proxy for solvency risk. *Relationship Banking* variable is calculated as the ratio of total number of bank personnel to total assets. *Bank age* is the natural logarithm of the number of months the bank exists in the banking system. *Bank Branch* is the natural logarithm of the number of bank branches. In the estimations that exclude time fixed effects, the year dummies are estimated. All the year dummies are statistically significant. The robust t–statistics are in parenthesis.

Table 3.15: Market Structure for Non–Interest Revenue

Conventional Banks	MC	MC	MC	MC
Islamic Banks	MC	PC	MC	PC
Post–regulation	-	-	M	M
F-Statistic $(\beta_1 + \beta_2 + \beta_3 = 0)$	9.99***	23.58***	15.05***	27.47***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 = 1)$(1+2+3=1)	26.74***	20***	26.97***	19.99***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 0)$	81.02***	50.55***	20.48***	10.8***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 1)$	11.98***	1.22	4.96**	1.48
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 = 0)$	-	-	3.12	2.12
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 = 1)$	-	-	20.86***	26.43***

* p<0.10, ** p<0.05, *** p<0.01

Note: In the estimations that exclude time fixed effects, the year dummies are estimated. All the year dummies are statistically significant. MC, PC, and M denote for "monopolistic competition", "perfect competition", and "monopoly" respectively.

Table 3.16: P–R Model–Fixed Effect Estimation Results for Interest Revenue

PF	0.1159	0.1323	0.1168	0.1333
	(-1.224)	(-1.5)	(-1.237)	(-1.509)
PL	0.3104**	0.3838***	0.3030**	0.3796***
	(-2.582)	(-3.651)	(-2.499)	(-3.601)
PK	0.0224	0.0317	0.0209	0.0304
	(-0.516)	(-0.847)	(-0.476)	(-0.805)
PF*Islamic	0.3336**	0.2653*	0.3073*	0.2617*
	(-2.102)	(-1.919)	(-1.814)	(-1.718)
PL*Islamic	-0.202	-0.3528**	-0.0532	-0.163
	(-0.885)	(-2.050)	(-0.215)	(-0.931)
PK*Islamic	-0.0792	-0.0323	-0.0729	-0.0567
	(-1.472)	(-0.547)	(-0.845)	(-0.700)
PF*Islamic*Regulation			0.0179	-0.0303
			(-0.288	(-0.640)
PL*Islamic*Regulation			-0.0346	-0.1274
			(-0.164)	(-0.897)
PL*Islamic*Regulation			0.0303	0.0878
			(-0.263)	(-1.072)
Liquidity risk	-0.0042*	-0.0041*	-0.0043*	-0.0042*
	(-1.822)	(-1.864)	(-1.834)	(-1.877)
Solvency risk	-1.3075*	-1.2459*	-1.3032*	-1.2385*
	(-1.767)	(-1.729)	(-1.756)	(-1.715)
Relationship banking	-0.3961*	-0.4053*	-0.3973*	-0.4059*
	(-1.876)	(-1.880)	(-1.869)	(-1.886)
Bank age	-0.0659	-0.0552	-0.1394	-0.0956
	(-0.381)	(-0.300)	(-0.778)	(-0.524)
Bank branch	0.5108***	0.5508***	0.5132***	0.5539***
	(-3.422)	(-3.912)	(-3.407)	(-3.905)
Bank fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	No	Yes	No
Constant	9.4207***	7.5739***	9.5815***	7.7435***
	(-9.842)	(-9.607)	(-10.163)	(-10.271)
Observations	4,529	4,529	4,529	4,529
R-squared	0.663	0.648	0.664	0.648
Number of banks	45	45	45	45

* p<0.10, ** p<0.05, *** p<0.01

Note: PF is the unit price of fund, PL is the unit price of labour and PC is the unit price of capital. *Regulation* is the dummy that takes 1 for the years 2006 and onwards, 0 otherwise to capture the impact of legislative changes. *Liquidity Risk* measures banks' credit risk exposure and defined as $\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$. *Solvency Risk* is defined as $\frac{shareholders\ equity}{total\ assets}$ and used to proxy for solvency risk. *Relationship Banking* variable is calculated as the ratio of total number of bank personnel to total assets. *Bank age* is the natural logarithm of the number of months the bank exists in the banking system. *Bank Branch* is the natural logarithm of the number of bank branches. In the estimations that exclude time fixed effects, the year dummies are estimated. All the year dummies are statistically significant. The robust t–statistics are in parenthesis.

The same estimation procedure with the same econometric assumptions is applied to panel data that is solely composed of Islamic banks. The number of banks has reduced considerably, so time and bank fixed effects are not estimated. To control for the impact of recession, *Credit quality* and *Recession* enter into the equation interchangeably under the assumption that the banks are faced with high non–performing loans during when the impacts of the 2008 financial crisis was in effect. The estimation results for recession controls are negative in line with the expectations, however, the parameter estimates are insignificant. The result may indicate that the credit quality is not a big concern for Islamic banks in generating revenues. This is also plausible in a sense that these banks did not have significant amount of non-performing loans during the sample period. The same logic applies for *Recession*, since the global financial crisis has relatively less adverse effects on banks' loan portfolio. The slight difference also comes from the parameter estimates of *Bank age* that is positively associated with revenues, indicating that the maturity of institution positively affect bank revenues. As per the remaining control variables, *Relationship banking* and *Bank branch* enter into equation with expected signs at changing significance levels.

Tables 3.18, 3.20, and 3.22 present the results for P-R models estimated only for Islamic banks. Tables 3.19, 3.21, and 3.23 present the Wald–test statistics to test for the degree of competition in Islamic banking. The Wald–test results confirm that the H statistics are significantly different from both zero and unity when the dependent variable is total revenue. The findings suggest that Islamic banking is characterised by monopolistic competitive behaviour. After the implementation of various regulations, the market power of Islamic banks increases and Wald–test results turn out to indicate the condition of monopoly, the H statistics are significantly different from unity but not zero. It is worthwhile to mention that the Wald–test results appear to be robust to different specifications.

When the dependent variable is non-interest revenue, the Wald–test results suggest similar findings. In the pre–regulation period when non–interest revenues are

taken as the dependent variable, the perfect competition is confirmed. The estimated values of the H statistics are always significantly different from zero but not one in the pre–regulation period. The findings of perfect competition changes to monopolistic competition in the post–regulation period. The estimated values of the H statistics are always significantly different from both zero and one in the post–regulation period. Hence, the increasing power is confirmed in the estimation of P–R model when the dependent variable is non–interest revenue. The similar findings of increasing market power for non–interest revenue and total revenue may be the result of increasing portion of non–interest revenues in total revenue for Islamic banks.

Interestingly, when interest revenue enters into the equations as the dependent variable, the Wald–test results show that the H statistics are not statistically different from zero but different from unity, suggesting that the banks are observed under monopolistic condition in the pre-regulation period. The condition reverses to perfect competition by the introduction of regulations. The H statistics are not statistically different from unity but different from zero.

The long–run equilibrium test for the value of H^{ROA} statistic is performed by using ROA as the dependent variable. In all regressions, the null hypothesis of $H^{ROA} = 0$ cannot be rejected even at the 10% level. Therefore, the data for Islamic banks appear to be in long–run equilibrium supporting the evidences of market condition in Islamic banking sector.

Table 3.17: Market Structure for Interest Revenue

Conventional Banks	MC	MC	MC	MC
Islamic Banks	Indefinite	M	PC	PC
Post–regulation	-	-	MC	MC
F-Statistic $(\beta_1 + \beta_2 + \beta_3 = 0)$	6.49**	14.05***	6.21**	13.71***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 = 1)$	9.79***	9.57***	10.01***	9.69***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 0)$	2.71	2.69	3.78*	5.91**
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 1)$	2.68	4.81**	1.4	2.96
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 = 0)$	-	-	15.21***	9.67***
F-Statistic $(\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 + \beta_9 = 1)$	-	-	5.01**	8.54***

* p<0.10, ** p<0.05, *** p<0.01

Note: In the estimations that exclude time fixed effects, the year dummies are estimated. All the year dummies are statistically significant. MC, PC, and M denote for "monopolistic competition", "perfect competition", and "monopoly" respectively.

Table 3.18: P–R Model Estimation Results for Total Revenue–Islamic Banks

	Model I	Model II	Model III	Model IV
PF	0.3622**	0.3575**	0.3639**	0.3532**
	(-3.429)	(-3.676)	(-4.008)	(-3.242)
PL	-0.004	-0.01	-0.0515	-0.017
	(-0.032)	(-0.081)	(-0.502)	(-0.136)
PK	-0.0271	-0.0183	-0.03	-0.0163
	(-0.218)	(-0.159)	(-0.272)	(-0.136)
PF*Regulation	-0.1659*	-0.1879*	-0.1871*	-0.1728
	(-2.521)	(-2.657)	(-2.503)	(-1.736)
PL*Regulation	0.1053	0.116	0.1701	0.1309
	(-0.497)	(-0.551)	(-1.012)	(-0.619)
PK*Regulation	-0.0908	-0.1008	-0.0949	-0.1105
	(-0.482)	(-0.565)	(-0.525)	(-0.554)
Regulation	-0.8941	-1.0307	-1.0668	-0.9793
	(-1.215)	(-1.569)	(-1.775)	(-1.472)
Bank age	1.3439**	1.2881**	1.3503*	1.2892**
	(-4.797)	(-3.591)	(-2.463)	(-3.549)
Bank branch	0.5211***	0.5225***	0.4840**	0.5224***
	(-8.126)	(-8.169)	(-3.4)	(-8.327)
Relationship banking	-0.6094*	-0.6046*	-0.5884*	-0.6051*
	(-3.055)	(-3.047)	(-2.381)	(-3.048)
Liquidity risk	-0.2839	-0.2863	-0.126	-0.3123
	(-1.180)	(-1.219)	(-0.731)	(-1.084)
Solvency risk		0.5254	0.6338	0.6472
		(-0.612)	(-0.9)	(-1.034)
Credit quality			-0.6082	
			(-0.426)	
Recession				-0.0213
				(-0.369)
Constant	3,4759	3.5119	3.3412	3.4937
		(-1.795)	(-1.294)	(-1.739)
Observations	562	562	562	562
R-squared	0.933	0.933	0.933	0.933
Number of banks	4	4	4	4

* p<0.10, ** p<0.05, *** p<0.01

Note: PF is the unit price of fund, PL is the unit price of labour and PC is the unit price of capital. *Regulation* is the dummy that takes 1 for the years 2006 and onwards, 0 otherwise to capture the impact of legislative changes. *Liquidity Risk* measures banks' credit risk exposure and defined as $\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$. *Solvency Risk* is defined as $\frac{shareholders\ equity}{total\ assets}$ and used to proxy for solvency risk. *Relationship Banking* variable is calculated as the ratio of total number of bank personnel to total assets. *Bank age* is the natural logarithm of the number of months the bank exists in the banking system. *Bank Branch* is the natural logarithm of the number of bank branches. *CreditQuality* is ratio of non–performing loans to total credits, *Recession* is the dummy that takes 1 for the years 2008, 2009, and 2010, otherwise 0. The robust t–statistics are in parenthesis.

Table 3.19: Market Structure for Total Revenue–Islamic banks

Post–Regulation	MC	MC	MC	MC
Pre–Regulation	M	M	M	M
F-Statistic ($\beta_1 + \beta_2 + \beta_3 = 0$)	20.84**	18.99**	12.95**	17.47**
F-Statistic ($\beta_1 + \beta_2 + \beta_3 = 1$)	85.00***	78.84***	83.66***	78.95***
F-Statistic ($\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 0$)	1.32	1.13	1.54	1.58
F-Statistic ($\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 1$)	27.38**	32.93**	36.51***	38.93***

* p<0.10, ** p<0.05, *** p<0.01

Note: MC, PC, and M denote for "monopolistic competition", "perfect competition", and "monopoly" respectively.

Table 3.20: P–R Model Estimation Results for Non–Interest Revenue–Islamic banks

	Model I	Model II	Model III	Model IV
PF	0.4593*	0.4467**	0.4689*	0.4197**
	(-2.83)	(-3.719)	(-2.965)	(-3.447)
PL	0.9121*	0.9005*	0.7285	0.8633*
	(-2.558)	(-2.581)	(-1.936)	(-2.641)
PK	-0.0536	-0.036	-0.0929	-0.0256
	(-0.350)	(-0.289)	(-0.935)	(-0.199)
PF*Regulation	-0.5291*	-0.5748	-0.5605	-0.4821
	(-3.172)	(-2.223)	(-1.780)	(-1.978)
PL*Regulation	-1.2949**	-1.2710**	-1.0428*	-1.1865**
	(-3.542)	(-3.511)	(-2.811)	(-3.506)
PK*Regulation	-0.1204	-0.1408***	-0.1053*	-0.1964***
	(-1.514)	(-10.465)	(-2.585)	(-9.289)
Regulation	-0.9273	-1.2149	-1.2967	-0.8847
	(-1.238)	(-0.912)	(-0.848)	(-0.683)
Liquidity risk	-0.7285*	-0.7332*	-0.012	-0.8854**
	(-2.792)	(-2.535)	(-0.059)	(-3.426)
Solvency risk		1.1817	1.7049	1.9218
		(-0.271)	(-0.394)	(-0.45)
Bank age	1.0817	0.9566	1.2315	0.9622
	(-1.052)	(-0.937)	(-1.417)	(-0.96)
Relationship banking	-0.5616**	-0.5511*	-0.4761	-0.5532*
	(-3.217)	(-3.002)	(-2.132)	(-2.977)
Bank branch	0.6239*	0.6290*	0.4602*	0.6276*
	(-2.5)	(-2.522)	(-2.478)	(-2.605)
Credit quality			-2.6957*	
			(-2.635)	
Recession				-0.1277*
				(-2.937)
Constant	2.3842	2.8572	2.0387	2.736
	(-0.553)	(-0.632)	(-0.537)	(-0.611)
Observations	550	550	550	550
R-squared	0.883	0.883	0.887	0.884
Number of banks	4	4	4	4

* p<0.10, ** p<0.05, *** p<0.01

Note: PF is the unit price of fund, PL is the unit price of labour and PC is the unit price of capital. *Regulation* is the dummy that takes 1 for the years 2006 and onwards, 0 otherwise to capture the impact of legislative changes. *Liquidity Risk* measures banks' credit risk exposure and defined as $\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$. *Solvency Risk* is defined as $\frac{shareholders\ equity}{total\ assets}$ and used to proxy for solvency risk. *Relationship Banking* variable is calculated as the ratio of total number of bank personnel to total assets. *Bank age* is the natural logarithm of the number of months the bank exists in the banking system. *Bank Branch* is the natural logarithm of the number of bank branches. *CreditQuality* is ratio of non–performing loans to total credits, *Recession* is the dummy that takes 1 for the years 2008, 2009, and 2010, otherwise 0. The robust t–statistics are in parenthesis.

Table 3.21: Market Structure for Non–Interest Revenue–Islamic Banks

Post–Regulation	PC	PC	PC	PC
Pre–Regulation	MC	MC	MC	MC
F-Statistic ($\beta_1 + \beta_2 + \beta_3 = 0$)	11.19**	11.65**	6.26*	11.66**
F-Statistic ($\beta_1 + \beta_2 + \beta_3 = 1$)	0.65	0.66	0.06	0.49
F-Statistic ($\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 0$)	30.42**	14.94**	8.83*	18.99**
F-Statistic ($\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 1$)	204.97***	91.94***	62.27***	132.96***

* p<0.10, ** p<0.05, *** p<0.01

Note: MC, PC, and M denote for "monopolistic competition", "perfect competition", and "monopoly" respectively.

Table 3.22: P–R Model Estimation Results for Interest Revenue–Islamic Banks

	Model I	Model II	Model III	Model IV
PF	0.2260**	0.2230**	0.2283**	0.2269**
	(-5.274)	(-4.974)	(-4.673)	(-4.157)
PL	-0.1941	-0.1978	-0.233	-0.1913
	(-0.859)	(-0.858)	(-1.078)	(-0.821)
PK	-0.0549	-0.0491	-0.059	-0.0509
	(-0.819)	(-0.561)	(-0.662)	(-0.554)
PF*Regulation	0.1564	0.1417	0.1425	0.1281
	(-1.761)	(-0.929)	(-0.997)	(-0.997)
PL*Regulation	0.4691	0.4759	0.5219	0.4623
	(-1.81)	(-1.765)	(-1.917)	(-1.603)
PK*Regulation	0.0168	0.0103	0.0155	0.0191
	(-0.161)	(-0.079)	(-0.119)	(-0.128)
Regulation	0.3451	0.2552	0.2244	0.2089
	(-0.396)	(-0.21)	(-0.188)	(-0.187)
Liquidity risk	-0.2518	-0.2533	-0.1189	-0.2297
	(-1.114)	(-1.125)	(-0.835)	(-0.770)
Solvency risk		0.3449	0.4375	0.2337
		(-0.234)	(-0.287)	(-0.138)
Relationship banking	-0.7281**	-0.7249**	-0.7116*	-0.7244**
	(-3.264)	(-3.306)	(-2.782)	(-3.310)
Bank age	1.0292	0.992	1.0433	0.9912
	(-2.332)	(-2.108)	(-1.72)	(-2.116)
Bank branch	0.6664***	0.6671***	0.6352**	0.6671***
	(-6.922)	(-7.045)	(-3.703)	(-7.135)
Credit quality			-0.5108	
			(-0.467)	
Recession				0.0193
				(-0.306)
Constant	3.5626	3.7114	3.5714	3.7279
	(-1.689)	(-1.603)	(-1.321)	(-1.605)
Observations	566	566	566	566
R-squared	0.948	0.948	0.948	0.948
Number of banks	4	4	4	4

* p<0.10, ** p<0.05, *** p<0.01

Note: PF is the unit price of fund, PL is the unit price of labour and PC is the unit price of capital. *Regulation* is the dummy that takes 1 for the years 2006 and onwards, 0 otherwise to capture the impact of legislative changes. *Liquidity Risk* measures banks' credit risk exposure and defined as $\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$. *Solvency Risk* is defined as $\frac{shareholders\ equity}{total\ assets}$ and used to proxy for solvency risk. *Relationship Banking* variable is calculated as the ratio of total number of bank personnel to total assets. *Bank age* is the natural logarithm of the number of months the bank exists in the banking system. *Bank Branch* is the natural logarithm of the number of bank branches. *CreditQuality* is ratio of non–performing loans to total credits, *Recession* is the dummy that takes 1 for the years 2008, 2009, and 2010, otherwise 0. The robust t–statistics are in parenthesis.

All the empirical findings imply that the new regulatory environment stimulates competition in lending activities probably due to the intention of Islamic banks to expand their customer base. The results also imply that banks compensate their potential losses by increased revenues from non–lending activities. After the establishment of new regulations, Islamic banks possibly find suitable conditions to diversify their products that results in more competitive conditions for the interest generating income. The potential losses are absorbed by non–interest generating facilities of which the customers are unable to monitor the costs. Overall findings suggest that recent regulatory changes have led to competitive environment of interest rates and credit markets. As the main findings would suggest, Islamic banks in the market enter into competitive business with conventional counterparts in the credit market, though they still do operate under imperfect competition in non–interest bearing activities. These findings provide a caution for policymakers in the country to monitor the non–interest revenues more rigorously. It would also be consistent in the near future if the country provides more Islamic bank licences.

In order to check the robustness of the test results, the models are estimated in light of the criticism raised against the estimation of static P–R models of Panzar and Rosse (1987). Equation (3.15) is modified by taking the dynamics into account as proposed by Goddard and Wilson (2009), and the lagged dependent variable is included in the model as follows:

$$lnRev_{i,t} = \alpha_0 + \alpha_1 lnRev_{i,t-1} \sum_{j=1}^{3} \beta_i lnW_{j,i,t} + \sum_{k=1}^{3} \delta_k lnW_{k,i,t} * Regulation_t + \sum_{l=1}^{m} \eta_i X_{l,i,t} + \varepsilon_{i,t} \tag{3.17}$$

The dynamic panel estimation enables us to measure the speed of adjustment to equilibrium by estimating the lagged dependent variable. Positive and significant coefficients would imply short–run persistence. The unobserved bank–specific effects in Equation (3.17) are removed by first differencing as follows:

$$\Delta lnRev_{i,t} = \alpha_0 + \alpha_1 \Delta lnRev_{i,t-1} + \sum_{j=1}^{3} \beta_i \Delta lnW_{j,i,t} + \sum_{k=1}^{3} \delta_k \Delta lnW_{k,i,t} * Regulation_t + \sum_{l=1}^{m} \eta_i \Delta X_{l,i,t} + \Delta \varepsilon_{i,t} \tag{3.18}$$

In this case the H statistic is computed as follows: $H = \frac{\sum_{j=1}^{3} \beta_j}{1-\alpha}$. A corresponding test for equilibrium is also modified as:

$$\Delta lnROA_{i,t} = \alpha_0 + \alpha_1 \Delta lnROA_{i,t-1} + \sum_{j=1}^{3} \beta_i \Delta lnW_{j,i,t} + \sum_{k=1}^{3} \delta_k \Delta lnW_{k,i,t} * Regulation_t + \sum_{l=1}^{m} \eta_i \Delta X_{l,i,t} + \Delta \varepsilon_{i,t} \tag{3.19}$$

The computation of H^{ROA} statistic is obtained by taking ROA as dependent variable as previously described.

I estimate the model with the one–step difference dynamic panel data estimator. In this approach, lagged levels of endogenous variables are used as instruments for differenced equations (see e.g. Blundell and Bond, 1998). The models are estimated using a first difference transformation to remove the individual firm effects. The reliability of econometric methodology depends significantly on the validity of the instruments, which can be evaluated with Sargan's test of over–identifying restrictions, asymptotically distributed as χ^2 in the number of restrictions. A rejection of $H_0 = instruments\ are\ orthogonal\ to\ errors$ would indicate that the estimates are not consistent. I present test statistics for second–order serial correlation. In a dynamic panel data context, second–order serial correlation should not be observed if the instruments are appropriately uncorrelated with the error terms.

Bikker et al. (2012) present evidence of possible false measurement of H statis-

tic due to upward bias toward unity arising from the estimation of scaled revenue equation. Apparently, the computed H statistics would create Type–1 and Type–2 errors if the misspecification creates upward bias. In the estimation of dynamic model, I do not use any variable scaled by total assets as suggested by Bikker et al. (2012). Moreover, total assets are not used as an independent in any specification. Two exceptions are *Relationship banking* and *Solvency risk* variables. By definition, the use of scale was necessary for the variable construction. I used alternative constructions for these variables but the results remain unchanged.

Table 3.24 and 3.25 report the results for dynamic estimation of P–R model and corresponding market structure respectively. The results clearly confirm the fixed effects estimation results. The increasing market power in total revenues after the establishment of various legislative changes reverses when interest revenues are concerned. The long–run equilibrium test for the value of H^{ROA} statistic is performed by using ROA as the dependent variable. In all regressions, long–run equilibrium is not rejected with satisfactory diagnostic tests results.

Table 3.23: Market Structure for Interest Revenue–Islamic banks

Post–Regulation	M	M	M	M
Pre–Regulation	PC	PC	PC	PC
F-Statistic ($\beta_1 + \beta_2 + \beta_3 = 0$)	0.01	0.01	0.1	0
F-Statistic ($\beta_1 + \beta_2 + \beta_3 = 1$)	21.40**	21.07**	28.46**	20.68**
F-Statistic ($\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 0$)	24.23**	10.25**	10.70**	11.70**
F-Statistic ($\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 = 1$)	9.15*	4.4	4.15	5.46

* p<0.10, ** p<0.05, *** p<0.01

Note: MC, PC, and M denote for "monopolistic competition", "perfect competition", and "monopoly" respectively.

Table 3.24: P-R Dynamic Model Estimation Results–Islamic Banks

	Total Revenue	Non–Interest Revenue	Interest Revenue
PF	0.2955***	0.7900***	0.5366***
	(-2.887)	(-2.599)	(-6.145)
PL	0.108	0.8104**	-0.6158***
	(-0.824)	(-2.477)	(-3.535)
PK	-0.2500***	-0.0803	-0.2787***
	(-2.652)	(-0.428)	(-4.938)
PF*Regulation	-0.0909	-0.9270**	0.0852
	(-1.608)	(-2.202)	(-1.58)
PL*Regulation	-0.0204	-1.2113**	0.8084***
	(-0.099)	(-2.570)	(-4.383)
PK*Regulation	0.1401**	0.0667	0.2608***
	(-2.361)	(-0.495)	(-3.506)
Regulation	-0.3509*	0.7898*	-0.6429**
	(-1.920)	(-1.819)	(-2.108)
Solvency risk	-2.2418	2.1716	-1.8259*
	(-1.078)	(-1.496)	(-1.731)
Relationship banking	-1.2470***	-0.0708	-0.8508***
	(-4.199)	(-0.175)	(-5.291)
Bank age	-2.0964	0.4148	1.9409**
	(-1.543)	(-0.184)	(-2.108)
Bank branch	1.2029***	0.5458	0.4313*
	(-3.03)	(-1.522)	(-1.716)
Total Revenue(-1)	0.2919***		
	(-4.04)		
Non–Interest Revenue(-1)		0.1590**	
		(-2.307)	
Interest Revenue(-1)			0.3494***
			(-6.605)
Observations	550	529	556
AR(2)	0.25	0.23	0.37
Sargan P-value	0.97	0.99	0.85
Number of banks	4	4	4

* p<0.10, ** p<0.05, *** p<0.01

Note: PF is the unit price of fund, PL is the unit price of labour and PC is the unit price of capital. *Regulation* is the dummy that takes 1 for the years 2006 and onwards, 0 otherwise to capture the impact of legislative changes. *Liquidity Risk* measures banks' credit risk exposure and defined as $\frac{total\ assets - total\ credits - fixed\ assets}{deposits}$. *Solvency Risk* is defined as $\frac{shareholders\ equity}{total\ assets}$ and used to proxy for solvency risk. *Relationship Banking* variable is calculated as the ratio of total number of bank personnel to total assets. *Bank age* is the natural logarithm of the number of months the bank exists in the banking system. *Bank Branch* is the natural logarithm of the number of bank branches. The robust t–statistics are in parenthesis. Sargan p-value is the p-value of the Sargan test statistic of over–identifying restrictions, while AR(2) is the p–value of the second order autocorrelation test statistic.

Table 3.25: Market Structure for Interest Revenue–Islamic banks

Post–Regulation	M	PC	MC
Pre–Regulation	M	M	C
F-Statistic $((\beta_1 + \beta_2 + \beta_3)/(1 - \beta_0) = 0)$	1.85	4.87**	6.58***
F-Statistic $((\beta_1 + \beta_2 + \beta_3)/(1 - \beta_0) = 1)$	7.26***	1.59	57.13***
F-Statistic $((\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6)/(1 - \beta_0) = 0)$	0.43	1.00	18.98***
F-Statistic $((\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6)/(1 - \beta_0) = 1)$	14.15***	4.76**	0.00

* p<0.10, ** p<0.05, *** p<0.01

Note: MC, PC, and M denote for "monopolistic competition", "perfect competition", and "monopoly" respectively.

The empirical findings in this section reveal increasing monopoly power for Islamic banks after the implementation of regulatory changes. The monopolistic competitive environment for conventional banks is also confirmed (Gunalp and Celik, 2006). For Islamic banking sector in particular, different market conditions are found when interest revenue, non–interest revenue, and total revenue are individually concerned. In the equations in which total revenue is included as the dependent variable, the results suggest the presence of monopolistic competition across Islamic banks in Turkey in the pre–regulation period. The structure just changes to monopoly in the post–regulation period. When the dependent variable is changed with non–interest revenue, the results indicate slightly different market structures yet without significant departure from the basic finding of increasing monopoly power. On the other hand, when total interest revenue is the dependent variable the scenario reverses. The results indicate a reverse trajectory, from monopoly to perfect competition. This finding may be an indication that they have started to contract less risky loans after the regulations. That is, the regulations vanishes the arbitrage opportunity. The results may also imply that the new regulatory environment stimulates competition in lending activities probably due to the intention of participation banks to expand their customer base. The results also imply that banks compensate their potential losses by increased revenues from non–lending activities. When the whole banking system is concerned, it is evident that Islamic banks gain more market power after the implementation of several legislations. This may suggest an attempt of Islamic banks to reduce the impact of competition by concentrating on fee–based non–lending activities to lessen the adverse impact of regulations on overall profitability.

The traditional conceptualisation of the association between bank competition and growth asserts that the existence of monopoly power gives bank managers the opportunity to capture consumer surplus. The dead–weight losses arising from the monopoly power tend to reduce welfare and growth. Berger et al. (2000) and Berger (1995) provide theoretical and empirical evidence that impediments to competition

results in the persistence of high revenues. If profits tend to persist, this can be an indication of entry barriers in the market (Zhao et al., 2010). The legislative framework governing Islamic banks in Turkey faced significant changes in the last decade, however the oligopolistic structure of Islamic banking remained unchanged. The findings in this section show that Islamic banks in their sector and in the whole system gained more monopoly power after the introduction of legislative changes. The findings in this section also demonstrate that Islamic banks exploit their power strategically. While these banks increasingly compete with their conventional counterparts, at the same time, they compensate their losses through non–lending activities. High profitability found in previous sections tend to persist in Islamic bank market since there still exists lack of tendency toward competition.

The findings in this section are in conflict with the findings of Weill (2011) who do not find significant difference between Islamic banks and conventional banks in terms of their market power. This sections proposes that the conflicting finding in Turkish banking system stems from the impact of legislative changes in Turkey. The findings in this section provide a clear recommendation concerning policies. Increasing monopoly power could enable these banks to grow and earn more than conventional banks. This growth and profitability pattern, however, should continue without capturing welfare of customers. It would be consistent if the policymakers remove entry barriers and encourage new entries. The new entries would potentially remove monopoly rents in this market. Proactive interests of the government in the last decade to invigorate Islamic banking in Turkey (Hardy, 2012), should entail more Islamic banking licences. Moreover, a rigorous supervision and monitoring on the part of Islamic banks could end possible ways to create excessive returns.

3.6 Summary and Conclusion

There is an active controversy in banking literature to what extent Islamic banks are akin to conventional banks. The academic debate swings between religious principles or rational preferences, whether or not religious doctrines motivate Islamic

banks to produce *Shariah* compliant financial products and services. While it is expected that Islamic banks differentiate from their conventional counterparts, the existing evidence show conflicting results.

In principle, the main difference between Islamic banking and conventional banking is the prohibition of interest rate in Islamic finance. Given that Islamic banks' customers are sensitive to interest rate credentials in financial products and services, Islamic banks work in a demand driven market that introduce them significant flexibility to put huge fees and commissions on their products and services. The traditional conceptualisation of the association between Islamic banking and profitability asserts that Islamic banks are able to directly exploit their brand name to produce excessive returns (see e.g. El-Gamal, 2006, 2007; Khan, 2010; Garner, 2013).

This chapter studies Turkish banking system where Islamic banks and conventional banks operate side by side. Besides the classical link between Islamic banking and profitability, operational circumstances of Islamic banking in Turkey may have an enforcing effect on the Islamic banking and profitability nexus. Only a handful of Islamic banks are operating in Turkey, which give them a strong market power in the business. In other words, strong market power enables Islamic banks to heavily exploit the *Shariah* arbitrage opportunities. Given this background, religiously driven Islamic bank customers do not have any alternative than Islamic banks.

This chapter investigated Islamic banks in Turkey from several angles. These banks are compared with conventional banks in terms of their profitability at first stage. The results suggested that Islamic banks in Turkey have been more profitable than their conventional counterparts in terms of ROA and ROE indices. On the exploration whether higher profitability is due to better asset quality, the results indicated that the quality of Islamic banking assets have not been the reason for higher profitability. At second stage, this chapter explored the effect of regulations on profitability. SCM results demonstrated that the impact of regulatory changes on Islamic banking downsized profitability after 2006. The results in turn suggest that under new regulatory regime, the profitability measures exhibit clear deteriora-

tion for Islamic banks that can be explained by the scale effect, i.e. the tremendous increase in the assets size scaled back the ROA and ROE measures considerably. Despite the deterioration in profitability measures after the regulations took place, the profitability on average is still higher for Islamic banks. The impact of regulations on market structure of Turkish banking has been another research topic in this section. The results indicated that the regulatory changes stimulated competition in lending activities, probably due to the intention of Islamic banks to expand their customer base. The results also implied that Islamic banks compensate their potential losses by increased revenues from non–lending activities. When the total revenues were concerned, it was evident that Islamic banks gain more market power after the implementation of various regulations.

The findings in this chapter provide several policy implications that have general applicability to other dual–banking systems. Since Islamic banks are assumed to target religiously conservative customers who consider *Shariah* compliant product and services as a viable means to avoid interest, Islamic banking is mainly demand–driven. This fact opens very much room for excessive profits for Islamic banks. The results in this chapter suggest that Islamic banking remained profitable confirming the presence of *Shariah* arbitrage. The rents exercised through *Shariah* arbitrage tend to reduce customer surplus and overall welfare. Since the market structure gained more monopolistic power after legislative changes in the last decade, it is likely that Islamic banks keep generating excessive profit in the system. A clear policy implication arising from this chapter is the need for comprehensive regulation on Islamic banks. An important step in dealing with these banks could be allowing new entries into the market, e.g. Islamic windows of conventional banks, to stimulate a competitive environment. This exercise might also be conducive to proper risk management in Islamic banks which is deemed to be one of the drawbacks in current Islamic banking practices (see e.g. Akkizidis and Khandelwal, 2008).

Appendices

B Tables & Figures

Table B.1: Bank Matches for Islamic Bank Observations

Kernel			Nearest neighbour		
Bank	Propensity score	Weight	Bank	Propensity score	Weight
Alternatif 2010-Q1	0.415	1.494	Alternatif 2010-Q1	0.415	3
Alternatif 2009-Q1	0.506	1.487	Alternatif 2007-Q3	0.036	1
Fibabanka 2011-Q4	0.986	9.128	Arap-Turk 2011-Q3	0.000	1
Fibabanka 2011-Q3	0.689	5.716	Fibabanka 2011-Q4	0.986	5
Fibabanka 2011-Q2	0.528	1.916	Fibabanka 2011-Q3	0.689	8
Fibabanka 2010-Q4	0.682	4.669	Fibabanka 2011-Q2	0.528	4
Fibabanka 2010-Q3	0.820	4.191	Fibabanka 2010-Q4	0.682	2
Fibabanka 2010-Q2	0.915	12.660	Fibabanka 2010-Q3	0.820	2
Fibabanka 2010-Q1	0.948	12.224	Fibabanka 2010-Q2	0.915	18
Fibabanka 2009-Q4	0.498	1.246	Fibabanka 2010-Q1	0.948	10
Fibabanka 2009-Q3	0.802	3.786	Fibabanka 2009-Q4	0.498	1
Fibabanka 2009-Q2	0.922	12.699	Fibabanka 2009-Q3	0.802	5
Fibabanka 2009-Q1	0.961	11.748	Fibabanka 2009-Q2	0.922	8
Fibabanka 2008-Q4	0.788	4.529	Fibabanka 2009-Q1	0.961	14
Fibabanka 2008-Q3	0.785	4.845	Fibabanka 2008-Q4	0.788	2
Fibabanka 2008-Q2	0.506	1.484	Fibabanka 2008-Q3	0.785	7
Fibabanka 2008-Q1	0.983	9.468	Fibabanka 2008-Q1	0.983	14
Fibabanka 2007-Q1	0.508	1.534	Fibabanka 2007-Q1	0.508	2
Fibabanka 2006-Q4	0.848	7.692	Fibabanka 2006-Q4	0.848	10
Fibabanka 2006-Q3	0.599	3.444	Fibabanka 2006-Q3	0.599	4
Fibabanka 2006-Q2	0.823	4.346	Fibabanka 2006-Q2	0.823	2
Fibabanka 2006-Q1	0.389	1.263	Sekerbank 2007-Q2	0.215	1
HSBC 2006-Q1	0.382	1.060	Sekerbank 2003-Q3	0.159	1
Tekstil 2011-Q2	0.503	1.390	Sekerbank 2003-Q2	0.294	1
Tekstil 2011-Q1	0.626	3.193	Tekstil 2011-Q3	0.281	1
Turkland 2010-Q2	0.498	1.220	Tekstil 2011-Q2	0.503	1
Turkland 2010-Q1	0.604	3.384	Tekstil 2011-Q1	0.626	4
			Tekstil 2010-Q1	0.358	3
			Turkland 2011-Q1	0.310	1
			Turkland 2010-Q3	0.287	1
			Turkland 2010-Q2	0.498	3
			Turkland 2010-Q1	0.604	2
			TEB 2006-Q1	0.011	1
			Yapi Kredi 2003-Q2	0.223	1

Note: Table represents the matching pairs for Islamic banks, their propensity scores and total weights used in the specific propensity score matching technique.

Table B.2: Correlation matrix

	roa	roe	nim	eta	lta	nplta	logta	lqd	dpta	cr	lr	tagr	tegr	tlgr	gdpgr	inf	fx	ir
roa	1																	
roe	0.64	1																
nim	0.25	0.17	1															
eta	0.42	0.02	0.23	1														
lta	-0.19	0.05	-0.04	-0.46	1													
nplta	0.17	0	0.25	0.38	-0.02	1												
logta	0.02	0.27	0	-0.42	0.38	-0.03	1											
lqd	0.14	-0.08	0.11	0.42	-0.55	0.02	-0.51	1										
dpta	-0.25	-0.01	-0.08	-0.52	0.58	0	0.36	-0.41	1									
cr	0.13	-0.02	0.07	0.42	-0.26	0.14	-0.11	0.2	-0.2	1								
lr	-0.07	-0.14	0	-0.06	-0.02	-0.09	-0.08	0.04	-0.37	-0.07	1							
tagr	0.09	0.1	0.08	0.01	0.12	-0.06	0.08	-0.03	0.02	-0.03	0.01	1						
tegr	0.09	0.09	0.11	0	0.14	-0.06	0.09	-0.02	0.02	0	0.03	0.45	1					
tlgr	0.07	0.08	0.05	0	0.11	-0.07	0.06	-0.04	0.02	-0.03	0.02	0.98	0.42	1				
gdpgr	-0.08	-0.08	-0.11	-0.04	-0.07	-0.02	-0.05	-0.05	-0.01	0.03	0	-0.02	-0.05	0.1	1			
inf	-0.02	-0.01	-0.02	0.01	-0.26	0.07	-0.2	0.01	-0.03	-0.01	-0.04	-0.53	-0.64	-0.53	0.02	1		
fx	-0.05	-0.03	-0.01	0	0.02	0.07	0.1	0.07	0.01	0.05	-0.05	-0.28	-0.19	-0.32	-0.12	0.05	1	
ir	-0.03	-0.03	-0.02	-0.03	-0.25	0	-0.22	-0.01	-0.03	-0.01	-0.02	-0.68	-0.58	-0.66	-0.03	0.82	-0.11	1

4 Interconnections in Turkish REPO and Reverse REPO Market

4.1 Introduction

4.1.1 Motivation of the Chapter

The 2008 financial crisis that initially started in the USA had spillover and contagion effects across global financial markets. The rapidly spreading crisis has prompted new policy measures in central banking by which the focus of central banks shifted towards financial stability. Central bankers started to put special emphasis on financial stability since the recent experience emphasises that financial stability is a prerequisite for well–functioning financial markets.

The 2008 financial crisis demonstrated that microprudential regulations that aimed at the supervision of individual institutions in the system were far from adequate (Allen and Carletti, 2013; Canuto and Ghosh, 2013). Problems that arise from interconnections are challenging and need vast set of measures in a macroprudential framework. Joint international initiatives highlight the importance of close regulation and supervision of the financial system in a holistic manner. The spillover and contagion effects can become systemically devastating if an individual shock spreads to the whole system rapidly.

The reasons of the 2008 financial crisis may be ascribed to housing bubbles and thus the mortgage related exposures of the financial institutions, but complexity and the depth of the crisis are related to interconnections in financial markets. The financial contagion originating from the collapse of a single institution demonstrates that being a systemically important financial institution (SIFI) may not be solely related to its size, interconnections and substitutability are also crucial elements of being a SIFI (FSB, 2012). That's why the phrase of "too big to fail" that was used to call SIFIs on early days of the crisis has turned out to be "too interconnected to fail" (Markose et al., 2012).

The past experiences showed that drained market liquidity during a financial turmoil is at least partly responsible for financial contagion. One of the pre–emptive action of central banks during the early days of the 2008 financial crisis was to disseminate liquidity to solvent financial institutions who suffered from liquidity shortage. Brunnermeier and Pedersen (2009) study the link between market liquidity and funding liquidity during financial mayhem. Their findings suggest that market liquidity and funding liquidity are mutually reinforcing to destabilize the markets through downward liquidity spirals. This explains why central bankers did not hesitate to provide ample liquidity to eradicate sudden shocks just after 2008. One of the hot topics of central banking after 2008 has been to predict liquidity shocks and estimate likely outcomes of liquidity shocks in the system for effective interventions. The measurement of interconnections between market players was indispensable for a successful prediction, since the degree of interconnections directly influence the depth and the speed of contagion (see e.g. Krause and Giansante, 2012).

The initiatives under the auspices of many acclaimed international organisations provide continuous guidance to monitor interconnections in financial markets. G–20 and the Financial Stability Board (FSB) jointly debate how to detect SIFIs (FSB, 2012). European Central Bank emphasises the importance of interconnections and call European Union (EU) countries to take necessary measures to tame highly connected institutions. The issue of detecting SIFIs precipitated the search for viable technical tools for regulatory efforts. Network theory provides technical tools to investigate bilateral fund flows in interbank markets. This requires a vast set of data that enables a thorough inspection of the system. European Central Bank praises network theory for regulatory purposes and encourage its members to collect necessary data for intensive regulation (ECB, 2010). Network theory, arguably, provides useful insights to learn about interconnections and helps avoid systemic crisis arising from complex networks (ECB, 2010).

At the earlier stages of the 2008 financial crisis, there was a common belief that the crisis was solely related to developed countries. Emerging market countries were

thought to be more or less decoupled from the problems of developed countries (see e.g. IMF, 2006, for a detailed discussion). Even more than a year after the outbreak of the crisis, it was widely accepted that emerging market countries have shown a degree of resilience because of their limited inclusion in complex derivative instruments that were accepted to be the culprits of the 2008 financial crisis (World Bank, 2008). These predictions turned out to be optimistic when the actual outcomes showed that the crisis also hit the emerging market countries through several ways. Allen and Giovannetti (2011) present the channels through which the crisis has transmitted to Sub–Saharan Africa. Essers (2013) presents a more general survey how the emerging market countries were affected from the crisis. According to the survey results, trade channel adversely affected the emerging markets. As global demand slumped due to postponed consumption and investment in developed countries, the volume of world trade has slowed down too. Slowing private capital flows, deceleration of remittances and international aids were another transmission channels through which the crisis hit emerging market economies.

The overall dim picture for emerging market countries shows that these countries can not escape from the effects of the crisis. Trade and financial linkages play a significant role in the transmission of domestic shocks in a highly connected global market structure. The central banks of emerging market countries, therefore, contribute to various joint global initiatives to manage the ongoing financial crisis. Regarding interconnections, the complex networks in financial markets prove not to be a matter for developed countries solely but for emerging market countries as well. It is well accepted that local SIFIs have systemic importance for local and international financial markets. Therefore, the efficacy of addressing systemic risk at domestic level is of interest to a wider group of countries especially when these countries have closer economic and financial interaction (FSB, 2012).

This chapter examines the interconnections in a domestic financial market composed of complex networks: Repo and Reverse Repo Market (RRRM) of Turkey between 4 January 2007 and 28 December 2012. Turkey is situated as a bridge

between Asia and Europe and is a significant trade partner for the countries in both continents. As a member of Group of 20 countries, the economic influence of the country in the region is visible. The country is also an emerging economy and shows significant progress in financial development. More liberal policies that resulted in the deepening of financial markets linked Turkey to the global markets more tightly. At this conjuncture, any problem in Turkish economy would have a potential to adversely affect the other countries. The influence on neighbouring countries would be severer considering more intense trade relations.

4.1.2 Objectives and Contribution of the Chapter

This chapter has two broad aims. First, it aims to present network topology of RRRM between 4 January 2007 and 28 December 2012. Second, it aims to empirically investigate the drivers of interconnections in the market. This chapter considers that RRRM is dominated by a few players that is regarded as SIFIs in network terminology (Celik, 2013; Kuzubas et al., 2014). I investigate whether the tools provided by network theory confirms the existence of a few SIFIs in RRRM. Moreover, this chapter examines how external and domestic factors impact interconnections in RRRM. This chapter also studies whether or not policymakers are succesful in mitigating the adverse impacts of external and internal factors on the interconnections of RRRM. Several hypotheses are tested to accomplish these aims:

1. *Hypothesis 1*: Network theory reveals the dominant structure of Repo and Reverse Repo Market in Turkey which is heavily used by a few institutions.

2. *Hypothesis 2*: External and domestic factors drive connectivity in Repo and Reverse Repo Market in Turkey.

3. *Hypothesis 3*: Turkish policymakers are experienced to curb the adverse effects of external and domestic factors on the connectivity in financial networks.

The empirical analysis in this chapter proceeds in two steps: first, a *connectivity* measure is computed and second a time series analysis is employed to explore the

drivers of *connectivity* measure. Specifically, this part of the chapter examines the long–run relationships between *connectivity* measure and local and international risk indicators, paying particular attention to the sub–period that the central bank in the country has introduced several policy interventions after 2011. Daily time series for daily transactions in RRRM, local equity index, benchmark bond yield and daily credit default swap quotes of the country are used in the analyses. International uncertainty is proxied by Chicago Board Options Exchange volatility index (VIX). A regime–switching autoregressive conditional heteroscedasticity (SWARCH) model is employed to estimate the volatilities in local credit default swap (CDS) market to proxy for domestic uncertainties.

The functioning of RRRM is simple. The borrower in RRRM exchanges certain amount of collateral in return for the borrowed money. The securities in the form of collateral are kept in a custody in the name of the party entering into the transaction. During the life of transaction, a daily re–appraisal is conducted on the securities according to the market condition, i.e. if any depreciation is determined additional collateral is asked. The settlement of the transaction on the ending date is executed over an automatic system.

Researches in the area of financial network analysis mostly employ simulation exercises to detect important shock transmission mechanisms in the system. Simulation exercises' contribution to this literature has been revealing the parts of the systems which are vulnerable to sudden failure(s). The notion of "cascaded failures" is the key in this literature. The trades in a network, however, may be collateralised and may not follow successive failures. Still the interconnections matter, since the liquidity squeeze due to payment failure of a participant in the market can yield harmful effects if not predicted successfully [38]. Although various studies examine interconnections in different aspects, how potential market movements; e.g. uncertainties, interventions, external shocks etc., drive interconnections is yet to be inves-

[38]The 2001 crisis of Turkey well proves that a problem directly related with a bank can cause system–wide damages, although the transactions in the network are collateralised by secured assets (Kuzubas et al., 2014).

tigated. In terms of the efficacy of macroprudential policies, the association between interconnections and other financial market indicators is of critical importance for policymakers to manage systemic risk. This chapter fills this gap in the literature and provides several insights to policymakers in emerging market countries.

This chapter contributes to the literature in three–fold. Firstly, this chapter presents the network characteristics of RRRM which is not done in Turkey related literature. The investigation of RRRM is important since the central bank operationally uses this market for policy intervention and injects liquidity. Secondly, this chapter investigates the presence of SIFIs in RRRM over centrality measures of network theory. The closely supervision of SIFIs in Turkey is of vital importance, since the latest domestic crisis in 2001 was found to be the outcome of high connections of a financial institution in the repo market (Kuzubas et al., 2014). Finally, this chapter examines the association between interconnections and several other financial and macroeconomic factors. The findings will shed light on the importance of the macroprudential measures after 2008 financial crisis which assesses the financial sector in its entirety.

4.1.3 Structure of the Chapter

The overall organisation of the chapter can be categorised into two main bodies. This chapter first discusses the importance of macroprudential policies after the 2008 financial crisis in the second section along with a brief literature review. Third section defines several interconnection measures and discusses the findings over daily bilateral fund flows in RRRM. Fourth section introduces several cointegration estimation techniques and the data. The results and several policy implications are discussed in the fourth section as well. The last section concludes.

4.2 Interconnections and Systemic Crisis

The 2008 financial crisis is accepted to be originated from the problems in the US sub–prime mortgage market. The root cause of the prevalence of the problems

is related to the securitisation of mortgage–linked debt instruments that was placed in banks' off–balance–sheet vehicles (Blundell-Wignall and Atkinson, 2009; Adrian and Shin, 2009). The flexibility of banks' off–balance–sheet vehicles, huge turnover figures in the markets, and lax regulation easily transmitted the problems to other financial and non–financial sectors.

Evidently, the 2008 financial crisis was facilitated by financial innovations, especially securitisation of numerous debt instruments, and the expansion of shadow banking (Adrian and Shin, 2009). Securitisation can be considered as a way to diversify credit risk, though it can increase the fragility of financial system by allowing intense leverage [39]. High leverage ratios of financial institutions indicate that these banks have complex bilateral relations with the others in the system. The complexity of the relations becomes problematic if an institution fails and the failure causes cascaded failures. If this happens, the propagation of failures can not be resolved thoroughly in a short time period due to complex interconnections.

At the earlier stages of the 2008 financial crisis, severe funding pressures arising from the losses in securitised debt markets and uncertainties quickly impaired the institutions' balance sheets. Price declines followed by rating downgrades asset portfolios created severe capital shortages through valuation losses [40]. Liquidity needs of financial institutions especially in the USA and the EU rose sharply when reputation risks coerced many banks to carry previously off–balance–sheet obligations to their balance sheets. Given the large reliance on wholesale funding, liquidity needs rose so sharply that interbank market spreads widened dramatically.

Financial distress can be devastating, as in the collapse of Lehman Brother's case, if the problems spread to other segments of financial markets and create cross–border effects. The identification of the channels of financial contagion becomes complicated and costly. Upper (2011) provides a survey about possible channels of

[39]Securitisation is a means to create assets that were packaged, and then re–packaged, into new layers such as collateralised debt obligations, and each new layer further spread risks while reducing the clarity of risk exposures of each party in the system.

[40]Pazarbasioglu et al. (2011) report that by the end of 2007, over 70% of banks' losses originated from structured products and securitised positions.

contagion. By separating possible channels as asset side and liquidity side, he provides only the direct effects due to losses on interbank loan exposures. Disentangling various potential channels of contagion is important, yet deciding on which particular channel is more effective is difficult to answer. After the collapse of Lehman Brother's, it is obvious that the individual level analysis may not be adequate to identify the main contagion channels with the caveat that seemingly healthy institutions can jointly create huge havoc. Insolvency is surely closely related with contagion risk. When a financial institution can not pay its debt, it is straightforward for authorities to recapitalize the bank. Unpaid liabilities can be detrimental if payment failures in the system propagate to other institutions and increase systemic risk.

There is a long–lasting debate around the definition of systemic crisis (Dumontaux and Pop, 2013). Systemic risk refers to the possibility that a triggering event such as a bank failure or a market disruption can have huge and widespread damage in the financial system. During a financial distress, the nature of market players' behaviour creates coordination failure (Agénor and Aizenman, 2005) that consecutively causes knock–on effects (Lee, 2013; Upper, 2011) and ultimately huge negative externalities (Canuto and Ghosh, 2013) [41].

The impact of systemic risk depends to high extent on the degree of interconnections in the markets. There is wide agreement that the complexity of the financial linkages is partly responsible for the severity of the 2008 crisis (Gai et al., 2011; Caballero, 2010). Gai et al. (2011) argue that under presence of higher complexity in the markets the system becomes more fragile. They suggest that policy measures that include stricter regulation on liquidity management, macroprudential policy, and surcharges for SIFIs could make the financial system more resilient. Caballero (2010) also admits that macroeconomics provide limited insights about financial

[41] The knock–on effects compel many financial institutions to close their transactions and resize their balance sheets. Negative externalities related to fire sales then come into play. Since sudden sell–offs cause a decline in security prices, financial institutions face balance sheets anomalies that amplify economic downturn. During the process of deleveraging, each institution responds rationally under available information, nonetheless each rational response has repercussions for the whole system.

markets when the interactions are too complex. He argues that without robust models that take into account of huge uncertainties, macroeconomics will fall behind the real financial world. As macroprudential policies gain further impetus around the world, the special interest is put on complex networks and SIFIs. Under tranquil times, interbank markets work well by managing adequate liquidity provision, nonetheless during heightened distress, interbank markets stop functioning properly whereby causing a gridlock in cash flows [42]. Central banks generally intervene in order to restore normal conditions and prevent any liquidity shortages. Once interconnections get more complex and SIFIs were not identified properly, the resolution can be costly and time consuming.

4.2.1 Systemically Important Financial Institutions and Policy Measures

The regulatory framework for determining SIFIs before the collapse of Lehman Brother's has been to rank the institutions by the size of their balance sheets. Institutions with the largest balance sheets are deemed to be "too big to fail". Gup (2004) notes that this convention traces back to the collapse of Continental Illinois Bank in 1984 when regulators considered that the failure of the bank might trigger a systemic crisis. The bank suffered from several defaults in its energy loans portfolio and losses from other non–performing loans. As a result, Moody's downgraded Continental Illinois Bank from its Aaa rating that led to huge and rapid withdrawal of funds form the bank. Regulators were concerned that the financial distress would spillover to the others. As a result, the bank and ten other large banks in the USA were considered too big to fail and were capitalised.

The importance of interconnections with respect to SIFIs gained further appreciation after Long Term Capital Management (LTCM) crisis (Dungey et al., 2006;

[42]In current financial architecture, there are several examples of complex networks in banking transactions. Payment systems, interbank markets, repo markets etc. are among the common forms of complex networks. Interbank markets function as a medium of transaction for liquidity transfers between financial institutions. They are the focus of central banks' monetary policy implementation and have a significant effect on the whole economy (Allen et al., 2009).

Jorion, 2000). LTCM has attracted overwhelming interest from investors who have underestimated its off–balance–sheet structure. When the institution's huge off–balance–sheet assets and leverage exacerbated negative sentiment in the markets, LTCM suffered from illiquidity. LCTM proved to be insolvent after the liquidity problems and rescued by a government–led program. The issue of LTCM once again showed the uncertainty and fear in the markets cause immense illiquidity that needs government intervention. The example of LTCM has also put an emphasis on the importance of interconnections in assessing the systemic risk of SIFIs which can not be merely measured by size.

The 2008 financial crisis has been the latest example of these incidents showing that an institution with a relatively stable balance sheet but complex networks can also have significant contagion risk once its assets are hit by sudden shocks. The collapse of Lehman Brothers was triggered by the burst of the housing bubble but interconnections in SIFIs should be regarded as another fundamental cause. Interconnections is especially crucial when the shortage of liquidity rapidly spreads to other segments of financial markets and triggers cascaded failures.

Authorities in many developed countries failed to anticipate the scope of the havoc that serial defaults could cause due partly to the lack of regulations on the complexity in financial system. Limited awareness on the complexity of the financial system also hindered regulators to develop necessary tools to monitor systemic risk. The complexity of the financial system made it a challenge to define adequate indicators to assess systemic risk arising from possible defaults of SIFIs. Therefore, the nature of the 2008 financial crisis made it complicated to resolve the problem easily. Authorities in developed countries in particular, has spent huge amount of resources to prevent system–wise defaults and their devastating impact on economy.

Pazarbasioglu et al. (2011) state that policy responses in the aftermath of the 2008 financial crisis have been similar to those in previous crises at its initial stage, but showed significant changes over time. According to the authors, responses in the past crisis typically involved three phases:

i. practical solutions to deal with liquidity stress,

ii. resolution and restructuring of insolvent financial institutions and recapitalizing the sound ones, and

iii. restoration of the financial soundness.

The recent crisis also followed the same pattern. Authorities in developed countries responded quickly with liquidity supports on a more massive and widespread scale than in the past crises (see e.g. Ishi et al., 2011). They extended huge liquidities with favourable terms and at longer maturities. Liquidity supports followed by asset purchases and other unconventional quantitative easening facilities. Expansionary monetary policies during the 2008 financial crisis were critical in supporting banks and financial markets in developed countries (Werner, 2014), although one of the root causes of the crisis was accepted to be loose monetary policy (Catte et al., 2011). Almost all central banks around the world followed the central banks in the USA and the EU in providing cheap money supply. Several central banks also coordinated swap facilities to supply dollar liquidity in the markets. Accommodative monetary policies supported overall asset values and thus protected further losses in balance sheets. Accommodative monetary policies were also bolstered by expansionary fiscal policies that would be instrumental in maintaining aggregate demand stable [43].

The supportive environment created by monetary and fiscal policies were also backed by private sector. Pazarbasioglu et al. (2011) report that the ratio of private capital injections to the announced losses for the USA, the EU, and Asian institutions have been realised around 71%, 78%, and 94% respectively. The authors convey that foreign banks that dominated the markets significantly contributed to the recapitalisation process in small countries as well. *Ad hoc* changes to accounting

[43] Aghion et al. (2014) empirically show that fiscal policies have a greater effect on firms that are relatively dependent on external finance. By supporting aggregate demand, fiscal stimulus helped reduce expected defaults on bank loans and thus reduced banks' recapitalisation needs. Therefore, monetary and fiscal policies adopted in the 2008 financial crisis were different in its nature. In previous crises that had contagious effects, the monetary policies were not supportive. Fiscal policies were often contractionary as well.

and valuation practices also relaxed capital pressures to certain level, since the fair valuation could have induced fire sale of assets and worsen solvency and liquidity conditions. These changes, for instance, enabled to value complex structured securities that were held to maturity at their historical values (Huizinga and Laeven, 2009).

As Pazarbasioglu et al. (2011) argue, the range and the sequence of policy responses in the past crises show key differences. Whilst the liquidity support and government guarantees were also employed in previous crises, the extent of measures has been broader to mitigate the real effect of the crisis in the 2008 financial crisis. After these extensive interventions, policy approaches became less forceful than those typically followed in the past. In particular, progress in comprehensive resolution and asset restructuring have been slower. This gradual improvement in policy responses might be the direct consequence of *higher interconnections* in the financial markets. Claessens et al. (2010) argue that the comparison of the 2008 financial crisis with the previous ones should consider increased financial integration and interdependence that are liable for the amplification and global spread of crisis.

As Pazarbasioglu et al. (2011) convey, nonviable institutions were either shut down or viable parts of them were sold off on a definite and organised restructuring plan in previous experiences [44]. Such a plan could not be exercised in the aftermath of the 2008 financial crisis, since complex networks in financial markets complicated devising thorough policy action towards troubled banks. Governments' inability to completely address interconnections that led to contagion and spillovers has weakened the possibility of prompt and effective intervention. Rather, policymakers in major developed countries focused on reducing possible consequences of systemic effects of cascaded failures and therefore often opted for providing quick support to all institutions, regardless of being viable or nonviable (Claessens et al., 2010).

Although governments took control over the banks by extensive liquidity support facilities, at the same time, various stress scenarios were conducted to assess the

[44]Pazarbasioglu et al. (2011) provides the example of the Indonesian crisis in which the process of restructuring took slightly more than a year.

impact of possible failures of SIFIs. Systematic assessments of risky institutions disseminated a coordinative action toward giant financial institutions in the USA and the EU. The stress tests restored short–term investor confidence to some extent, but an ultimate compromise could not be established at full satisfaction since the impact of interconnections proved to be significant due to its breadth and complexity. The need for international dialogue was expressed frequently to combat interconnections which have significant potentiality of evolving into a global disaster. It is well noticed that a remedial action solely covering national financial systems would not bring a full–fledged solution in a global financial architecture.

4.2.2 Literature Review

In a complex network, cascaded failures are likely if interbank exposure of a lender is larger than its capital. When a combination of shocks in the form of repayment failures hits a financial institution, its capital may not cover its liabilities which lead to its default (Dasgupta, 2004; Goldstein and Pauzner, 2005). Since financial institutions are linked to each other with bilateral exposures, the default of a financial institution also crates another shock to the others. Once the payment failures accumulate to a certain level, it might pose a threat to the whole system. The systemic risk stemming from interbank market losses has been popular after the 2008 financial crisis. The recent literature on interbank markets deals with systemic effects and mainly examines the impact of possible failure of SIFIs. From policy perspective, due consideration is paid on devising early warning measures to avoid systemic crisis.

There is a widespread agreement in the virtues of globalisation in finance, nonetheless, the 2008 financial crisis once again demonstrated the role of financial linkages in propagating financial shocks across global financial markets. The sell–offs in whole emerging markets securities after the Mexican crisis in late 1994, the Asian crisis in 1997, and Turkey crisis in 1999 and 2001 had already initiated an active debate in literature (see e.g. Forbes and Rigobon, 2002; Bae et al., 2003; Rigobon, 2003;

Gerlach and Smets, 1995), but the interest in financial contagion rekindled after the 2008 financial crisis.

The 2008 financial crisis gave rise to scholarly interest toward complex networks. The empirical evidences are mainly from developed countries. Memmel and Sachs (2013) apply stress testing exercises in the German banking sector starting from the first quarter of 2008 to the second quarter of 2011. The findings of this study show that the German interbank system becomes less vulnerable to direct interbank contagion over time. The important determinants of contagion in German system are the banks' capital, their interbank lending in the system, the loss given default and the degree of equality in the distribution of interbank exposures.

Boss et al. (2004) examine the topological properties of Austrian interbank market. They test how the network structure affects the stability of the whole system when a single institution in the market fails. They do not consider the impact of external shock in their model. Their simulation exercises show that Austrian interbank market is resilient to internal shocks.

The complex networks in Italian banking system are examined by a number of papers (Angelini et al., 1996; Iori et al., 2008). Iori et al. (2008), for instance, analyse the network topology of the Italian segment of the European overnight money market through network theory. They find that the Italian banking system is highly heterogeneous with large banks borrowing from a high number of small creditors. They warn policymakers against the risk of contagion and systemic failure due to centralised structure.

Soramaki et al. (2007) study the interbank payments between commercial banks in the USA Fedwire Funds Service over 62 daily networks. Just like many empirical papers investigating the topological properties of interbank market, this paper finds a scale–free degree distribution, high clustering coefficient and the small world phenomenon. On the impact of the attacks of September 11, this study reveals that the topology of the network has significantly changed. The number of nodes and links in the network and its connectivity was reduced considerably, while the average path

length between nodes was significantly increased.

The interbank market's transaction and settlement flows in Japan is examined by Imakubo and Soejima (2010). Studying the data on interbank transaction from BOJ-NET's settlement data, they observe the structural changes in interbank transactions with different time intervals. This study investigated the changing network topology over the introduction real–time gross settlement in January 2001, the implementation of the quantitative easing policy, the emergence of asset management trusts, the increase in direct-dealing transactions, and the abolishment of settlements through money brokers' accounts. They find significant changes over these dates and authors conclude that network structure can provide valuable input to central banks' liquidity policies.

Degryse and Nguyen (2007) investigate the dynamics of contagion risk in the Belgian banking system during 1993–2002. They find that the potential contagion risk arises from foreign banks, whereas exposures between Belgian banks constitute a small portion. Rordam and Bech (2008) examine Danish money market and the payments network separately. The network analysis shows that the structure of these two separate markets exhibit different characteristics. They ascribe this difference to their differing nature of transactions in the networks. They argue that transactions in the money market network are driven by banks' behaviour. On the other hand, transactions in the payments network are composed of banks' proprietary transactions and customer driven transactions. In the payments network, they detect that two commercial banks provide a large share of the total activity, whereas the banks in the money market contribute equally.

Those studies examining the network topology and interconnections are relatively new in emerging market countries (see e.g. Cajueiro and Tabak, 2008; Kares et al., 2008; Kuzubas et al., 2014). Kuzubas et al. (2014) model a financial network in repo market in Turkey where the fund flows across the banks are perfectly known. They apply this model to a banking crisis in Turkey to observe the changing interconnections. They analyse the financial crisis by using various network tools such

as links, interconnectivity, and reciprocity. In addition, they propose a centrality measure to monitor and detect the SIFI in the financial system. Their empirical analysis strongly signals the crisis. They conclude that these network measures can be used for monitoring purposes. Cajueiro and Tabak (2008) analyse the Brazilian interbank network structure through network theory. Their results suggest a weak evidence of community structure and high heterogeneity in the network. They also reveal that the interbank market is dominated by money centres having exposures to many banks. Kares et al. (2008) discuss liquidity channel in the transmission of contagion in the Russian interbank market. They find that liquidity contributes to a better understanding and prediction of actual interbank market crises in Russia. From stability perspective the authors find that stability Granger causes the interbank market structure. This confirms the understanding that interbank market structure is endogenously formed, i.e. significantly affected from external conditions. They conclude that microprudential regulation is inadequately equipped to prevent systemic crises.

4.3 Network Theory

The approach this study examines RRRM in Turkey is an example of a temporal network, a time ordered sequence of transactions in the system represented as a graph. These systems are represented as nodes and edges over a time interval δt. In light of topological properties of network theory, this chapter tries to identify SIFIs in RRRM and examines the drivers of interconnections.

To uncover the topological properties of the network and to compute several centrality measures, I follow Cajueiro and Tabak (2008) and Li et al. (2010), and briefly define basic properties for network topology.

Definition 1: A network (graph) G consists of a non–empty set of elements $V(G)$ called vertices, and list of unordered pairs of these elements, called edges $E(G)$. I call the set of vertices (nodes) of the network as vertex set and the list of edges as edge list. If i and j are vertices of G, then an edge of the form ij is said to join or

connect i and j.

Definition 2: The adjacency matrix $A(G) = [a_{ij}]$ assigns the value 1, if there is an edge starting in vertex i and going to vertex j. If there is no edge starting in vertex i and going to vertex j, then $a_{ij} = 0$.

$$A = \begin{bmatrix} 0 & a_{12} & a_{13} & a_{ji} & ... & a_{1n} \\ a_{21} & 0 & a_{23} & . & ... & a_{2n} \\ . & . & 0 & ... & ... & . \\ a_{i1} & . & . & 0 & & a_{in} \\ . & . & . & & 0 & \\ a_{n1} & . & . & a_{ni} & ... & 0 \end{bmatrix}$$

Definition 3: The connection matrix $C(G) = [c_{ij}]$ assigns the number of connections, if there is an edge starting in vertex i and going to vertex j. If there is no edge starting in vertex i and going to vertex j, then $c_{ij} = 0$.

$$C = \begin{bmatrix} 0 & c_{12} & c_{13} & c_{ji} & ... & c_{1n} \\ c_{21} & 0 & c_{23} & . & ... & c_{2n} \\ . & . & 0 & ... & ... & . \\ c_{i1} & . & . & 0 & & c_{in} \\ . & . & . & & 0 & \\ c_{n1} & . & . & c_{ni} & ... & 0 \end{bmatrix}$$

Definition 4: The matrix of bilateral exposures $W(G) = [W_{ij}]$ of an interbank market G is the nxn matrix (where n is the number of institutions) whose w_{ij}s denote exposure of bank i to bank j, and $a_i = \sum_{j=1}^{n} w_{ij}$ and $I_j = \sum_{i=1}^{n} w_{ij}$ are respectively

interbank assets and liabilities of bank i.

$$G = \begin{bmatrix} 0 & w_{12} & w_{13} & w_{ji} & ... & w_{1n} \\ w_{21} & 0 & w_{23} & ... & ... & w_{2n} \\ . & . & 0 & ... & ... & . \\ w_{i1} & . & . & 0 & & w_{in} \\ . & . & . & & 0 & \\ w_{n1} & . & . & w_{ni} & ... & 0 \end{bmatrix}$$

The same definitions can be extended to directed networks. The same topological properties can be defined with 6 matrices A^b, A^l, C^b, C^l, W^b, W^l . a^b_{ij} takes 1 if there is a connection from bank j through to bank i, otherwise 0. Whereas, a^l_{ij} takes 1 if there is a connection from bank i through to bank j, otherwise 0. c^b_{ij} and c^l_{ij} demonstrate the number of connection from bank j to bank i, and from bank i to bank j. Similarly, w^b_{ij} and w^l_{ij} adjusts c^b_{ij} and c^l_{ij} with bilateral exposures.

4.3.1 Topological Measures

The topological measures of a network can be defined over matrix definitions. These measures give us the idea of many properties of a network, e.g. size of the network and the density of the connections.

Connectivity: The ratio of the number of edges, l, to the number of possible maximum edges, $n(n-1)$, is called connectivity [45], C, and can be defined for directed networks as follows:

[45] Dorogovtsev et al. (2001) argue that in voluminous network relations it is possible to partition the network into components. They define the components of a network. The *disconnected components* are the zero degree nodes or weakly connected small components. The *giant weakly connected component (GWCC)* is the largest component in which every pair of nodes is connected by a path. The GWCC does not regard the direction. The *giant strongly connected component (GWCC)* contain the connected pairs. In these components there should exist a double path between pairs. The *the giant out–component (GOUT)* is the set of nodes which can be connected from the GSCC by a directed path. The *the giant in–component (GIN)* contains all nodes from which the GSCC is approachable. Finally, *tendrils* are the nodes which can not connect to the GSCC and can not be connected from it.

$$C = \frac{l}{n(n-1)} \tag{4.1}$$

In complete graphs $C = 1$, whereas the graph with no edges has $C = 0$. The closer the C is to 1, the closer the graph is to being fully connected.

For measuring the connectivity Martinez-Jaramillo et al. (2012) employ a *Completeness Index*, $C(G)$, of an undirected graph, G, which is defined in the following equation:

$$C(G) = \frac{\sum_{i=1}\sum_{j=1} a_{ij}}{n(n-1)} \tag{4.2}$$

The same index for directed graph can be defined as follows:

$$C(G) = \frac{\sum_{i=1}\sum_{j=1} a_{ij}}{2n(n-1)} \tag{4.3}$$

As simply observed *Completeness Index* and *Connectivity* are the same in calculating the completeness of a network.

Degree: The number of nodes that a node is connected to is measured by its degree. The degree, $d(i)$, of a node i in a network is defined as:

$$d(i) = \sum_{j \in N(i)} a_{ij} \tag{4.4}$$

where $N(i)$ is the set of neighbours of node i. The inner degree, d_i^b, and the outer degree, d_i^l of a node i are defined as:

$$d_i^b = \sum_{j \in N^b(i)} a_{ij} \tag{4.5}$$

$$d_i^l = \sum_{j \in N^l(i)} a_{ij} \tag{4.6}$$

where $N^b(i)$ is the set of inner neighbours of node i and $N^l(i)$ is the set of outer neighbours of node i.

Flow: The flow of a node is associated with the exposures. In a network, the elements w_{ij}^b and w_{ij}^l of the borrowing and lending matrices express the exposures between bank i and bank j. The flow between the nodes of i and j is defined as: $f_{ij} = w_{ij}^l - w_{ij}^b$ which is the net exposure of bank i to bank j.

Strength: The total strength of a node shows how intensely a node interact with other nodes. The strength of a node, s_i, is represented by the total exposure of that node with other nodes.

$$s_i = \sum_{j \in N(i)} w_{ij} \tag{4.7}$$

Inner and outer strength can be defined as follows:

$$s_i^b = \sum_{j \in N^b(i)} w_{ij} \tag{4.8}$$

$$s_i^l = \sum_{j \in N^l(i)} w_{ij} \tag{4.9}$$

The strength of a node's connectivity is defined as :

$$s_i^c = \sum_{j \in N(i)} c_{ij} \tag{4.10}$$

Affinity: Affinity classifies the nodes according to their tendency to have a link and basic topological properties. This measure shows how connected financial conglomerates are to other financial conglomerates with the same degree. It is defined as follows:

$$a_i = \frac{1}{d_i} \sum_{j \in N(i)} d_j \tag{4.11}$$

Reciprocity: This measure shows the tendency of node pairs to form mutual connections between each other (Garlaschelli and Loffredo, 2004). In a directed graph, in general $a_{ij} \neq a_{ji}$, and the reciprocity is defined as:

$$r = \frac{\sum_{i \in V} \sum_{j \in N(i)} a_{ij} \mathbf{1}_{\Omega}^{i,j}}{\sum_{i \in V} \sum_{j \in N(i)} a_{ij}} \tag{4.12}$$

in which $\Omega = \{(i,j) \in V \times V : a_{ij} = a_{ij}\}$ and

$$\mathbf{1}_{\Omega}^{i,j} = \begin{cases} 1, & \text{if } (i,j) \in \Omega \\ 0, & \text{if } (i,j) \notin \Omega \end{cases}$$

is the indicator function over the Ω set.

The Average Path Length and Diameter: The diameter of a graph is the maximum distance between any pair of its nodes (Albert and Barabási, 2002; Iori et al., 2008). In a graph the distance between two nodes is given by the length of the shortest path connecting them. In a connected graph the average distance is the average overall paths. If the graph is not connected, the average path length is defined as the

average distances between pairs belonging to the same connected component. If the diameter of a network is substantially different from that of a random network, then this indicates that there might be preferential paths between institutions. Average path length can be defined as the average length between all nodes in the network. Consider an unweighted graph, G with the set of vertices (nodes), V, and let $d(v_1, v_2)$ denotes the shortest distance between v_1 and v_2. Assume that $d(v_1, v_2) = 0$ if v_2 cannot be reached from v_1, then, the average path length l_G is:

$$l_G = \frac{1}{n(n-1)} \sum_{i \neq j} d(v_i, v_j) \tag{4.13}$$

The Clustering Coefficient: The Clustering Coefficient, c_i, shows the degree of connection density and can be defined as:

$$c_i = \frac{2}{d_i(d_i - 1)} \sum_{j,h} a_{ij} a_{ih} a_{jh} \tag{4.14}$$

This measure shows that if node i and node j are connected with a third node h, they constitute triangular. The average clustering coefficient measures the density of these kinds of triangular connections in the graph.

The Herfindahl–Hirschman Index: This index is used for showing the concentration of lending or borrowing of nodes in the network. Martinez-Jaramillo et al. (2012) argue that the concentration in borrowing and lending activities can be used to identify the degree of contagion. The Herfindahl–Hirschman Index informs about the possibility of contagion and can be defined separately for borrowing and lending. For lending it is defined as:

$$HHI_i^l = \sum_{j \in N(i)} \left(\frac{w_{ij}^l}{\sum_j w_{ij}^l}\right)^2 \tag{4.15}$$

whereas for borrowing it is defined as:

$$HHI_i^b = \sum_{j \in N(i)} (\frac{w_{ij}^b}{\sum_j w_{ij}^b})^2 \tag{4.16}$$

Preference Index: Interbank markets are the platforms for liquidity transmission. The preference is important especially in times of liquidity scarcity. Having a strong relationship with a particular institution would mean that such a relationship will be also available during a financial stress. Cocco et al. (2009) propose an index to measure the intensity of the interaction between each pair of nodes in a network. Similar to the Herfindahl–Hirschman Index, this index can be defined for lending and borrowing separately as LPI and BPI. As per lending or borrowing, the Preference Index is calculated as the ratio of the total amount of fund a bank has lent to or borrowed from a bank to overall fund that is lent to or borrowed from the other institutions in the network during a specific time period k [46]. It is straightforward that if L is highly preferred by B or vice versa, the index gets closer to 1. The index for lending is defined as:

$$LPI_{L,B,t} = \frac{\sum_{s=1}^{k} F_{t-s}^{L \to B}}{\sum_{s=1}^{k} F_{t-s}^{L \to system}} \tag{4.17}$$

where $F^{L \to B}$ is the total amount which L has lent to B and $F^{L \to system}$ is the total amount which L has lent to all its counterparts. For borrowing, the index is defined as:

$$BPI_{L,B,t} = \frac{\sum_{s=1}^{k} F_{t-s}^{L \to B}}{\sum_{s=1}^{k} F_{t-s}^{system \to B}} \tag{4.18}$$

[46] Cocco et al. (2009) use 30 days for k.

4.3.2 Centrality Measures

Centrality is referred to being a SIFI in this chapter. Centrality measures offer various interpretations pertaining each node with respect to their relevance in a network. I consider that each centrality measure has valuable information content to determine the relevance of a node in the network. I define various centrality measures and employ them to identify potential SIFIs in RRRM.

Degree Centrality: Degree Centrality measures centrality based on the number of connections that nodes have. It is clear that the elimination of a node from the network (the failure of an institution) which have many connections would have an adverse impact on many other participants. Degree Centrality of a node, v, is defined as:

$$C_D(v) = d_v \tag{4.19}$$

Strength Centrality: The Strength Centrality of a node, v, is defined as the sum of its interbank operations (assets and liabilities). In the case of total strength:

$$C_S(v) = s_v \tag{4.20}$$

In the case of inner strength, it is the sum of its interbank total assets, and, in the case of outer strength, it is the sum of its total interbank liabilities. Such differentiation gains importance when systemic risk rises. A bank can be very important as a lender but not as a borrower, or vice versa, in the network. Martinez-Jaramillo et al. (2012) note that this metric fails to consider the relevance of its counterparts and the number of possible affected neighbours in case of a failure.

Closeness Centrality: In network theory, the distance of two nodes is measured by the closest path they can be combined with. Then, the distance of a node is

measured by the sum of distance of a node to all other nodes in the system. The closeness centrality can be measured as:

$$C_C(v) = \sum_{j \in V \setminus \{v\}} \frac{1}{d_G(v,j)} \tag{4.21}$$

where $d_G(v,j)$ denotes the length of the shortest path that joins v and j. Although a node might be connected to many other nodes, it might not reach others quickly to access funding (Opsahl et al., 2010). To capture this feature, Closeness Centrality is defined as the inverse sum of shortest distances to all other nodes from a focal node. In the context of systemic risk and financial contagion, this measure can be interpreted as how quickly a contagion will be transmitted through a specific node.

Betweenness Centrality: Betweenness Centrality demonstrates how strategically the node is located on the paths of many other nodes in the network. Opsahl et al. (2010) argue that since this metric measures centrality as a function of shortest path between two other nodes, it can measure how a specific node can be able to channel the flow in the network. A node with high Betweenness Centrality would have an important influence on other nodes as it can stop or distort the information that passes through it.

Let $\sigma_{ij} = \sigma_{ji}$ denote the total number of shortest paths between nodes i and j, and $\sigma_{ij}(v)$ be the total number of paths between i and j that pass through node v, then Betweenness Centrality can be defined as:

$$C_B(v) = \sum_{i \neq v \neq j \in V} \frac{\sigma_{ij}(v)}{\sigma_{ij}} \tag{4.22}$$

Eigenvector Centrality: Eigenvector Centrality was first proposed in Bonacich (1972) and used by Martinez-Jaramillo et al. (2012) with an extended version, *Entropic Eigenvector Centrality*. Bonacich (1972) proposes the eigenvector, $\mathbf{e}$, of the adjacency matrix, A, as the centrality measure of node i.

$$\lambda \mathbf{e} = A\mathbf{e} \tag{4.23}$$

Martinez-Jaramillo et al. (2012) argue that this measure has several advantages since it takes into consideration the centrality of nodes' neighbourhood to compute the centrality. Martinez-Jaramillo et al. (2012) further contend that Entropic Eigenvector Centrality uses not only direct connections of a node but also its indirect connections in any length as weighted sums.

In this newly proposed measure, instead of the adjacency matrix, the use of eigenvector is associated with the largest eigenvalue of a matrix referred as P. This matrix is the weighted adjacency matrix, W, additionally weighted with the value of the entropy of exposures of the corresponding node [47]. Entries, p_{ij}, of matrix P are defined as:

$$p_{ij} = (1 + \frac{\tau_i}{\tau^{max}})w_{ij} \tag{4.24}$$

where τ_i is the entropy calculated over the rows of a normalised version of the weighted adjacency matrix:

$$\tau_i = -\sum_{j=1}^{n} w_{ij}^{norm} \ln(w_{ij}^{norm}) \qquad \forall i \in \{1, ..., n\} \tag{4.25}$$

where $w_{ij}^{norm} = \frac{w_{ij}}{\sum_{j=1}^{n} w_{ij}}$ and τ^{max} is the maximum value possible for the entropy defined as:

$$\tau_{max} = -\sum_{j=1}^{n} \frac{1}{n} \ln(\frac{1}{n}) = \ln(n) \tag{4.26}$$

[47] Refer to (Martinez-Jaramillo et al., 2012) for detailed discussion of entropy.

In order to obtain strictly positive entries for the eigenvector, each zero entry in W is transformed for some non–zero low value in Equation 4.25.

Page Rank Centrality: Page Rank Centrality is based on Google's algorithm proposed in Page et al. (1999). Unlike other centrality measures (degree, closeness, betweenness, etc.) it considers the relevance of neighbours to determine the relevance of a node in the network, as in the case of the entropic eigenvector centrality. Page Rank is defined in the following way:

$$PR(i) = \frac{(1-d)}{N} + d \sum_{j \in N^{-(i)}} \frac{PR(j)}{L(j)} \tag{4.27}$$

where $i \in V = \{1, ..., n\}$ is the set of nodes and $L(u)$ is the number of links which depart from node u and d is a factor which is set to 0.85 in Page et al. (1999). A $n \times 1$ vector, $\mathbf{PR}$, with entries $PR(i)$ solves the equation of :

$$\mathbf{PR(i)} = \frac{(1-d)}{N}\mathbf{Col} + d\mho\mathbf{PR} \tag{4.28}$$

where $\mathbf{Col}$ is a column vector with dimension n with the entries all equal to one and $\mho$ is the matrix of $n \times n$ given by

$$\mho_{ij} = \begin{cases} \frac{1}{L(j)} & \text{if there exists an arc from } \ j \ \text{ to } \ i \\ 0 & \text{otherwise} \end{cases} \tag{4.29}$$

Let $\mathbf{E}$ is defined as the $n \times n$ matrix with all entries equal to one and $\sum_{i \in V} PR(i) = 1$, then the equation 4.29 can be rewritten as:

$$\mathbf{PR(i)} = (\frac{(1-d)}{N}\mathbf{E} + d\mho) =: \widehat{\mho}\mathbf{PR} \tag{4.30}$$

Therefore, **PR** is the eigenvector of the matrix $\widehat{\mho}$ associated to the first eigenvalue.

In a financial network, the weights associated with the arcs provide useful information, though Page et al. (1999) do not consider weights in its study since web search has no weights. Martinez-Jaramillo et al. (2012) assert that weights should be incorporated in the centrality algorithms in order to avoid losing information. Their approach is similar to Saltoglu and Yenilmez (2010) who suggest that the Page Rank of each node should be multiplied by the dominant weight. For example, if i has links with j, then the largest weight between w_{ij} and w_{ji} should be used by the algorithm. In this way the centrality of a bank will increase in the direction of its dominant weights.

$$PR(i) = \begin{cases} (1-d) + d \sum\limits_{j \in N(i)} \left(PR(j) \frac{w^l_{ji}}{\sum\limits_{z \in N(j)} w^l_{jz}} \right) & \text{if } w^l_{ji} > w^b_{ji}, \\ (1-d) + d \sum\limits_{j \in N(i)} \left(PR(j) \frac{w^b_{ji}}{\sum\limits_{z \in N(j)} w^b_{jz}} \right) & \text{if } w^l_{ji} < w^b_{ji}, \\ (1-d) + d \sum\limits_{j \in N(i)} \left((PR(j) \left(\frac{\frac{w^l_{ji}}{\sum\limits_{z \in N(j)} w^l_{jz}} + \frac{w^l_{ji}}{\sum\limits_{z \in N(j)} w^l_{jz}}}{2} \right) \right) & \text{if } w^l_{ji} = w^b_{ji}. \end{cases} \tag{4.31}$$

Principal Component Centrality: Given that several different centrality measures compute different aspects of the relevance of a node in the network, it is important to preserve all the information provided by such measures in a single metric. Principal Component Centrality gathers all the information via principal components of different centrality measures.

4.3.3 The Findings of Network Topologies and Centrality Measures

This study examines the bilateral fund flows in RRRM which is composed of Repo and Reverse Repo Market and Interbank Repo and Reverse Repo Market in Turkey between 4 January 2007 and 28 December 2012. Central Bank of the Republic of Turkey (CBRT) has announced a new regulation stating that all funds

from repo transactions that are materialised on portfolio account are subject to 8% required reserve ratio except the ones that occur between institutions. Due to this required reserve regulation, on 7 January 2011, a new repo market where only Central Bank and institutions (that are already operating in Repo-Reverse Repo Market) can trade on their portfolio account has been inaugurated (Coskun, 2012).

The Interbank Repo and Reverse Repo Market in Turkey was established for institutions to facilitate the repo and reverse repo transactions in an organised market, without having to meet the reserve requirement of the CBRT, which is applicable when a bank carries out repo transactions with a non-bank party (Raina et al., 2003). It is noteworthy that the establishment of Interbank Repo and Reverse Repo Market has facilitated the CBRT's policy interventions through interbank market. In this study we use solely Repo and Reverse Repo Market till 7 January 2011, and both Repo-Reverse Repo Market and Interbank Repo-Reverse Repo Market afterwards.

Repo and reverse repo transactions of various financial securities like government bonds, treasury bills and the liquidity bills of the CBRT are carried out among the member institutions and the CBRT. The institutions can only carry out transactions for their own portfolios; they cannot perform trades on behalf of their investment funds, mutual funds or clients. Traded securities, order types, order validity rules, value dates, repo rate tick, order amendment/ cancellation and matching rules are the same as those applied in the Repo and Reverse Repo Market. In the framework of Capital Market Legislation and the CBRT regulations, notification of repo and reverse repo transactions that intermediary firms and institutions have made apart from Borsa Istanbul and the previously made transactions that have come to maturity are sent to Incorporation of Istanbul Settlement and Custody Bank Bank Incorporation, *Takasbank*. Also the transacted assets are stored in *Takasbank*.

This section discusses the findings related with network topologies and centrality measures in RRRM. The network topologies of RRRM describe the network as a whole, whereas the centrality measures describe the participants individually. This

section will initially discuss the findings of several measurements reported in Table 4.1. Ahead of the discussion on the findings of the network topologies, I provide circular layout representations in RRRM for two operations days in which the links have been the lowest and the highest respectively. In these representations, the sizes of the nodes are proportional to their degrees, and the thicknesses of the links are proportional to the volume of transaction. 38 institutions have created 49 links on 27 January 2009 as shown in Figure 4.1, whereas 61 institutions have created 310 links on 31 January 2011 as shown in Figure 4.2.

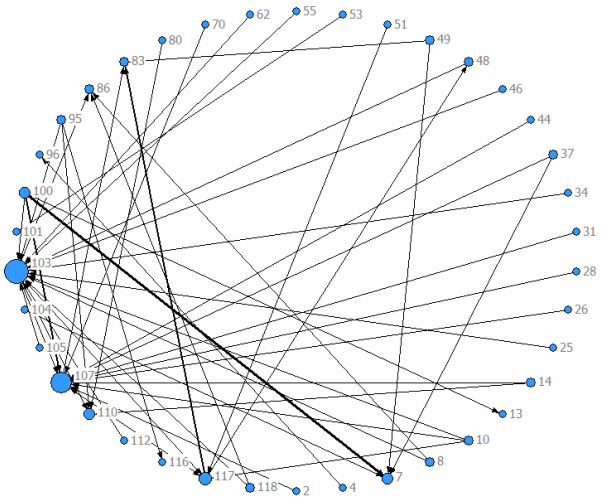


Figure 4.1: Circular Layout Representation of RRRM on 27 January 2009

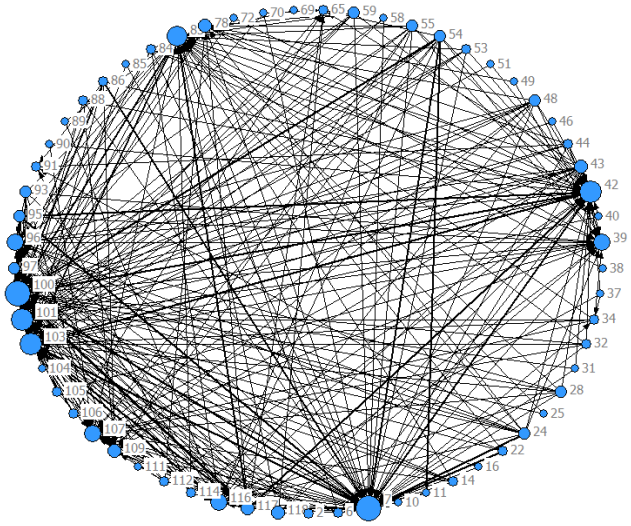


Figure 4.2: Circular Layout Representation of RRRM on 31 January 2011

Table 4.1: Network Topology–Summary

	Mean	Median	Min.	Max.	Std.
Transactions					
Number of Transactions	2234	2039	341	4855	834
Volume of Transactions (Billion TL)	12.0	9.9	1.5	32.5	6.3
Average Volume of Transactions (Million TL)	5.2	4.9	4.4	7.4	0.7
Number of Links	196	201	48	310	46
Components					
GWCC	61.1	62.0	33.0	74.0	6.2
DC	56.9	56.0	44.0	85.0	6.1
GSCC	7.8	8.0	1.0	15.0	2.5
GIN	42.5	43.0	0.0	60.0	8.4
GOUT	6.1	6.0	0.0	16.0	2.8
TE	4.71	4.00	0.00	49.00	4.32
Network					
Average Degree	3.3	3.4	0.8	5.3	0.8
Max In Degree	37.0	38.0	11.0	58.0	8.4
Max Out Degree	12.0	12.0	4.0	21.0	3.1
Connectivity/Completeness Index(%)	1.4	1.5	0.3	2.2	0.3
Reciprocity(%)	9.5	9.1	0.0	28.2	3.9
Average Path Length	0.10	0.10	0.01	0.21	0.04
Average Eccentricity	1.20	1.19	0.37	2.03	0.23
Diameter	3.88	4.00	2.00	7.00	0.75
Average Clustering Coefficient	0.18	0.19	0.00	0.38	0.06

Note: The table reports the network topologies of RRRM over 1476 networks that was composed of 118 institutions, 48 of which are banks and the remaining are mutual and investment funds.

4.3.3.1 Volume, Link and Number of Transactions

Table 4.1 provides the summary of network topologies of RRRM related to the volume, link and number of transactions. In network topology, the number of transactions is the total number of fund flows occurred between nodes in the network. The volume of transactions represents the total volume of fund flows between nodes. The figures span the whole operational days in RRRM during the sample period. The average volume of transactions gives the information related to each operational day. The number of links shows the number of connection either starts at or ends with a node. High volume of fund flows and high number of links might be regarded as risky since institutions borrowing from more institutions and in large amounts imply that they are intensely connected and fragile in to contagion (Kuzubas et al., 2014).

Over the sample period, I observe a total of 1476 network that was composed of

118 institutions, 48 of which are banks and the remaining are mutual and investment funds. It can be argued that the outlook of this market is sparse. The average links that was established between the participants is 196 out of potential 13,806 links ($n.n-1$). This is perhaps due to rare use of this market especially before the 2010s (see Figure 4.4). Soramaki et al. (2007) also report that the Federal Reserve Wire System stands as a sparsely used network. 9.5 % of these links are reciprocal. Table 4.1 describes the network the network topologies. During the sample period, there has been on average 2,234 transactions (links) constructed in the network. The average worth of transactions per links in RRRM has been 5.2 million Turkish Liras, which makes average volume of transactions in the market around 12 billion Turkish Liras.

4.3.3.2 Components of the Network

Table 4.1 provides information about the components of the network. There are four types of giant component, the giant in– and giant out–components, and giant weakly and giant strongly connected components. While giant weakly connected components (GWCC) span the nodes that have single path between them, the giant strongly connected components (GSCC) is the set of nodes linked each by each with a directed path. If there exists a path from the GSCC to a node, that node is included in giant out – components (GOUT). Conversely, if a path from a node goes to GSCC, it is included in giant in – components (GIN).

I observe that 61.1 ± 6.2 participants involved in GWCC whereas 56.9 ± 6.1 of the participants are disconnected components out of 118 participants. In addition, on average 6.58 % of participants involve in GSCC. On average, 6.1 ± 2.8 of the total participants are identified as GOUT. When it is considered that GOUT participants only receive flows from GSCC participants, any payment problem arising from the participants in GOUT in this market scarcely impact GSCC. Regarding GIN, on average, 42.5 ± 8.4 participants can be described as GIN. The total number of participants in GIN is relatively high suggesting that any payment problem among GIN will increase the problems within GIN. The size of GSCC is a concern in case

of repayment problems. Having considered that, the size of GSCC participants out of all participants is relatively small, any repayment problem can have an impact on a narrow area in the system.

During the year 2008 when the financial crisis was in effect and 2011 when the Eurozone crisis was at its peak, the GSCC and the *Completeness Index* shows significant decrease (see Figure 4.3. The decrease in *Completeness Index* and GSCC does not pose significant threat to the network, since, the network at these episodes also experiences low links and low volume of transactions. Nier et al. (2007) mention that decreasing completeness with rising connections increase the risk of contagion, whereas, rising completeness accompanied with high connections increase the robustness of the system to systemic shocks.

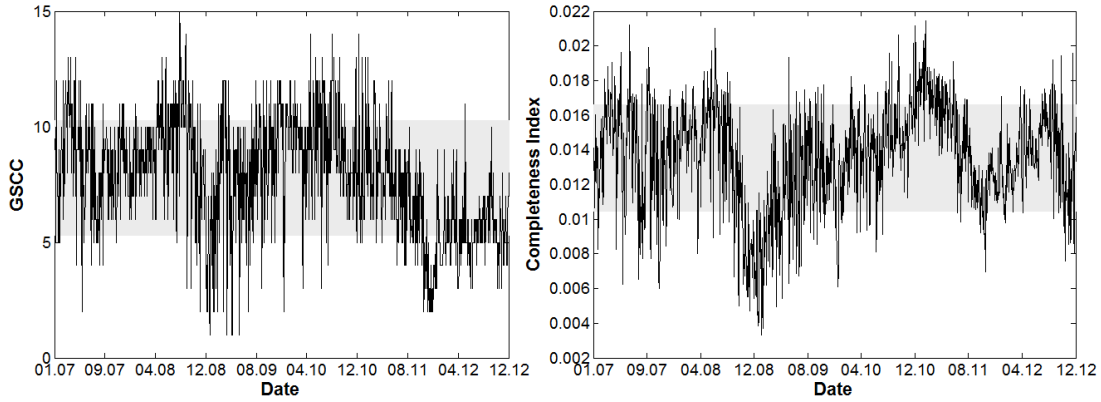


Figure 4.3: GSCC and Completeness Index 2007–2012

4.3.3.3 Evolution of Measures

Figures 4.4 – 4.6 present the evolution of the network measures for the RRRM in Turkey. Obviously, the impact of the introduction of a new repo market can be followed by the Figure 4.4 which demonstrates that the number of links and volume of transactions jumps around 2011 when the new repo market was introduced. Since then, the CBRT intervenes to the repo market more heavily. The figures show various trends before, during, and after 2008. For instance, the impact of the 2008

financial crisis can be observed in Figure 4.5 where the minimum average and average in–out degree figures pertain to 2008.

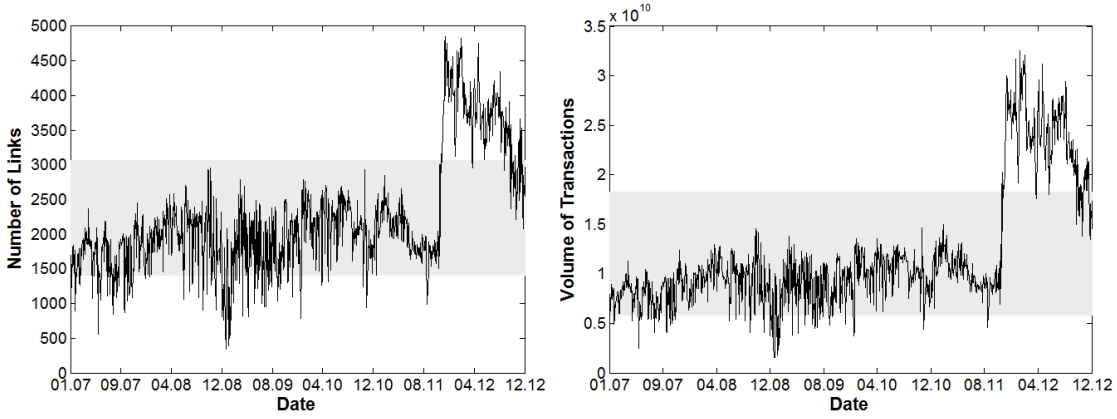


Figure 4.4: Number of Links and Volume of Transactions 2007–2012

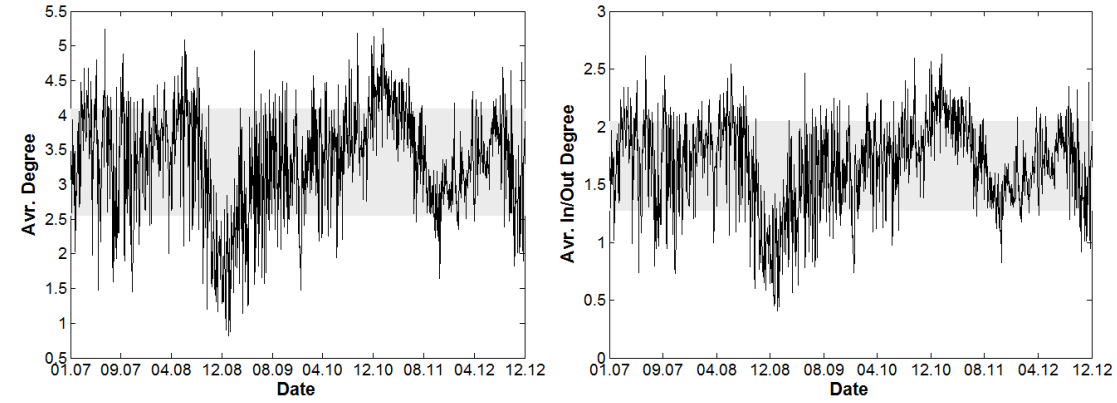


Figure 4.5: Average and Average In-Out Degree 2007–2012

The information of the possibility of having a connection of a node with another node can be obtained from affinity and reciprocity measures. If the degree of a node is independent from the degree of connected nodes, then it would be less likely to have any association. Figure 4.6 shows the affinity and reciprocity structure of the network. Soramaki et al. (2007) argue that increased reciprocity on large links is probably the result of either complementary business activity or the risk manage-

ment of bilateral exposures. Arguably, the increasing reciprocity in the network of RRRM reflects the relationship funding, i.e. participants transact with their best known peers.

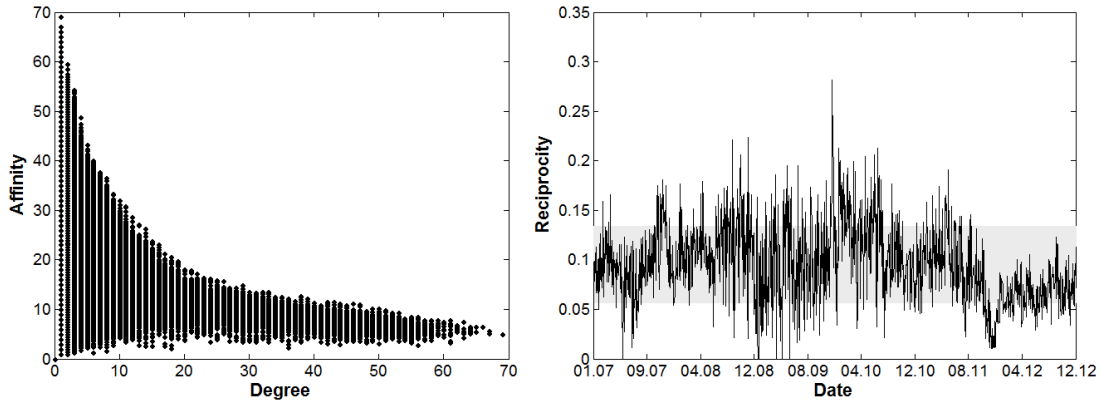


Figure 4.6: Affinity and Reciprocity 2007–2012

The average path length, the average eccentricity, and the diameter of the network is measured as 6.1 ± 2.8, 1.2 ± 0.23, 3.9 ± 0.75. In the highlight of these characteristics, the network can be defined as a "small world network – short paths between any two nodes" type of mathematical graph in which most nodes are not neighbours of one another, but most nodes can be reached from every other by a small number of steps (Strogatz, 2001). Lago-Fernández et al. (2000) argue that neural network models with small world structure facilitate fast response in the network. The average clustering coefficient is computed as 0.18 ± 0.06, that is average of 18 % of the nodes have connections between all neighbours.

4.3.3.4 Correlation

Table 4.2 presents the correlation between several basic network properties. Interestingly, the connectivity is not correlated with volume of transactions. This can be explained that on high transaction activity, the network not only grows but it also becomes denser as the level of interactions between institutions increases faster than size. The same is also valid for reciprocity. Reciprocity is weakly correlated

with volume of transactions and connectivity. The extent to which the relationships between institutions are bilateral does not appear to depend on either the overall level of repo activity or the connectivity between institutions. Another interesting point is the high and positive correlation between average clustering coefficient and the volume of transactions. The network is conducive to clustering with increasing number and volume of transaction. In a network, the clustering coefficient measures the degree of fund flows between a bank's counterparties. In terms of resilience, one could hypothesize that disturbances in institutions with a higher clustering coefficient might have a larger impact on their counterparties, as some of the disturbance may be transmitted to the bank's neighbours to each other (Soramaki et al., 2007).

Table 4.2: Correlations of Basic Network Properties

ρ_{xy}	Links	Transactions	Clustering	Connectivity	Reciprocity
Links	1.00				
Transactions	0.16	1.00			
Clustering	0.46	0.61	1.00		
Connectivity	1.00	0.16	0.46	1.00	
Reciprocity	0.31	-0.26	0.19	0.31	1.00

4.3.3.5 Test for Scale–free Network

It is known that the topology of a network affects its functionality and stability (Albert and Barabási, 2002; Clauset et al., 2009; Dang and Li, 2011). Purely "random networks", i.e. the networks constructed by randomly drawn edges between pairs of nodes, are characterised by a degree (the number of links of a vertex) distribution that is peaked around a finite mean value, and has finite variance (Iori et al., 2008). Iori et al. (2008) argue that in these structures the system is resilient to targeted attacks. On the contrary, scale free networks, i.e. networks with a power law distribution of degrees, are vulnerable to intentional attacks. A scale free network can collapse even when a small part of the hubs are removed by the attacks. Nonetheless as Iori et al. (2008) argue, scale free networks can recover the impact of attacks rapidly if the numbers of removed hubs are relatively insufficient. This issue is important in terms of financial stability, since the recovery period of scale

free networks can be relatively low. Scale free networks are vulnerable to epidemics. As argued by Barthélemy et al. (2005), heavy–tailed degree distribution represented by power law distribution causes this vulnerability. During a sudden attack, an unexpected number of nodes with very large degrees are removed from the network. In random networks, however, epidemics need to surpass a critical threshold (the number of nodes infected) before the propagation reaches a critical level. Below the threshold, the epidemic dies out, above the threshold, the epidemic spreads exponentially. Recent evidence indicates that the threshold for epidemics on scale free networks is zero.

In order to understand how the topology of the network of market participants affects the dynamical process of epidemics spreading, I will investigate whether or not the topology offers scale free network. Network theory to examine financial network relies on scale free networks (see e.g. Albert and Barabási, 2002). Scale free networks can be described simply as networks in which the distribution of the nodes' degree follows a power law distribution which means that the fraction $p(d)$ of vertices with degree d satisfies:

$$p(d) = \frac{d^{-\eta}}{\zeta(\eta, d_{min})}, \qquad d \geq d_{min} \quad \eta > 0 \tag{4.32}$$

where $\zeta(\eta, d_{min}) = \sum_{d=d_{min}}^{\infty} d^{-\eta}$ is known as the generalised Riemann Zeta Function. Figure 4.7 shows the graph of the fitting to a power law of the degree distributions, for 15 March 2007, 27 March 2007, and 15 June 2007 when disconnected components are the lowest. The functions used to generate graphs to estimate the parameters and the computation of the p–value were obtained through the methodology proposed in (Clauset et al., 2009).

On the full sample of 1476 days between 4 January 2007 and 28 December 2012 where there were 118 active participants, the estimated parameters were $\hat{\eta} = 2.22$ and $\hat{d}_{min} = 4.4$. The p–value obtained was 0.385, therefore, it can not be rejected that the degree distribution follows a power law distribution. Martinez-Jaramillo

et al. (2012) convey that fitting a power law distribution to a relatively small sample (less than 50 data points) can yield spurious good fitting even if the data is not distributed as a power law. Therefore, the results for the degree distribution in RRRM of Turkey are reliable given the daily samples consist of 118 data points.

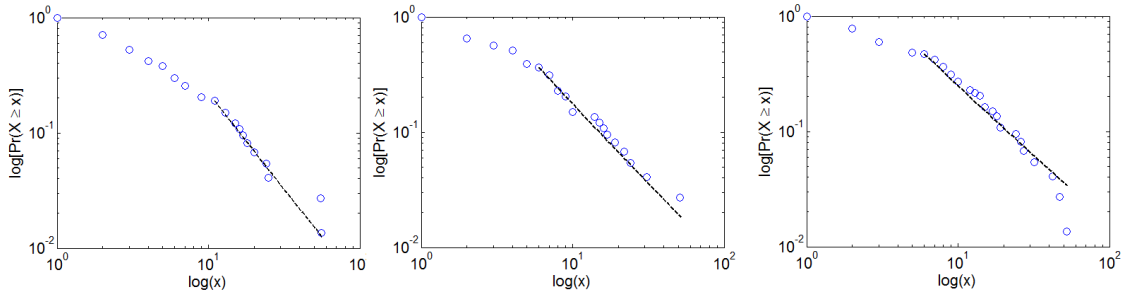


Figure 4.7: Test for the Power Law Distribution

Figure 4.8 summarizes the percentage of days in which the hypothesis that the sample can be fitted by a power law is not rejected. The figures are prepared according to a criteria if the p–value is less than 0.1. From Figure 4.8 one can infer that, there exists a scale free property for the network for the degree, almost higher than 80% out of sample period show power law distribution. Hence during the sample period, the RRRM is resilient to random collapses but frangible to coordinated/intentional collapses. This finding also suggests that the network structure is described by a scale free degree (the number of links of a vertex), indicating that a few participants trade with many counterparties while the majority trade with a few (Iori et al., 2008). These finding is also confirmed by the findings of centrality measures that will be elaborated in next sections.

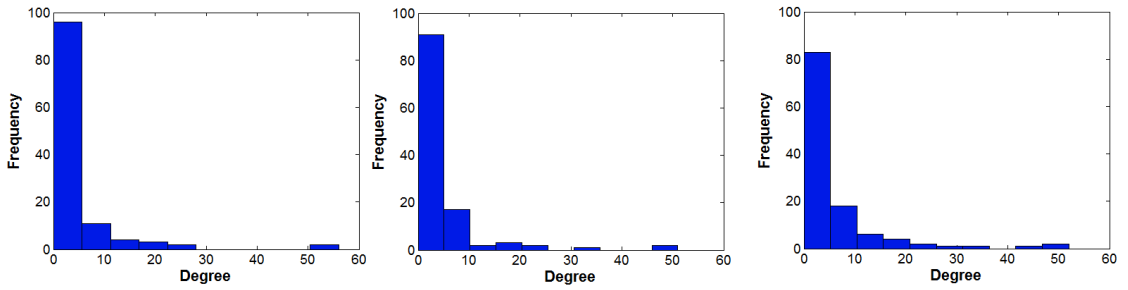


Figure 4.8: Percentage of Days Network Exhibited Power Law Distributions

4.3.3.6 Centrality Measures

One of the motivation of this study is to accurately spot the institutions whose payment and funding difficulties impact severely the others' ability to borrow and/or lend in the network. Centrality measures identify the central nodes in a network whose. In this section, centrality measures are computed for each operation day and institutions are ranked according to the centrality measures. These centrality measures include Degree Centrality, Strength Centrality, Closeness Centrality, Betweenness Centrality, Eigenvector Centrality, Entropy Eigenvector Centrality, Pagerank Centrality and Principal Component Centrality.

Table 4.3: Centrality Rankings–Summary

	Bank ID	Mean	Median	Min.	Max	Std.
Degree Centrality						
1^{st}	103	2.1	1.0	1.0	13.0	1.8
2^{nd}	100	3.3	3.0	1.0	13.0	2.4
3^{rd}	7	3.6	3.0	1.0	13.0	2.6
4^{th}	107	6.0	6.0	1.0	18.0	2.6
Strength Centrality						
1^{st}	103	1.7	1.0	1.0	29.0	1.3
2^{nd}	100	2.3	2.0	1.0	14.0	1.1
3^{rd}	7	4.1	3.0	1.0	31.0	2.9
4^{th}	117	5.2	5.0	1.0	21.0	2.1
Closeness Centrality						
1^{st}	103	2.8	2.0	1.0	16.0	1.6
2^{nd}	100	3.4	3.0	1.0	17.0	1.8
3^{rd}	117	4.1	4.0	1.0	15.0	1.8
4^{th}	7	4.8	5.0	1.0	19.0	2.2
Betweenness Centrality						
1^{st}	103	2.0	1.0	1.0	12.0	1.8
2^{nd}	7	3.5	3.0	1.0	14.0	2.1
3^{rd}	100	3.5	2.0	1.0	14.0	2.8
4^{th}	107	5.9	6.0	1.0	12.0	1.9
Eigenvector Centrality						
1^{st}	117	2.4	2.0	1.0	26.0	2.1
2^{nd}	103	5.8	5.0	1.0	23.0	3.9
3^{rd}	100	5.9	5.0	1.0	25.0	4.3
4^{th}	43	6.9	6.0	1.0	32.0	4.8
Entropy Eigenvector Centrality						
1^{st}	117	2.0	2.0	1.0	12.0	1.3
2^{nd}	100	2.6	2.0	1.0	37.0	2.1
3^{rd}	103	3.2	3.0	1.0	63.0	4.6
4^{th}	7	6.9	6.0	1.0	58.0	4.5
Page Rank Centrality						
1^{st}	103	4.1	2.0	1.0	47.0	6.5
2^{nd}	7	6.9	3.0	1.0	60.0	11.1
3^{rd}	107	8.0	6.0	1.0	42.0	7.1
4^{th}	100	8.5	3.0	1.0	47.0	12.2
Principal Component Centrality						
1^{st}	103	1.7	1.0	1.0	31.0	1.4
2^{nd}	100	2.4	2.0	1.0	20.0	1.2
3^{rd}	7	3.7	3.0	1.0	37.0	2.7
4^{th}	117	5.0	5.0	1.0	27.0	1.8

Note: The table reports the centrality measures pertaining to participants in RRRM over 1476 networks that was composed of 118 institutions, 48 of which are banks and the remaining are mutual and investment funds. The figures in this table should be read as follows: centrality measures are computed for each operation day. Institutions are ranked according to the centrality measures, the higher the measure the higher the degree of centrality. Then, descriptive statistics are computed based on these rankings.

Table 4.3 presents the descriptive statistics belonging to the rankings of participants in each operation day of RRRM. Among those participants 77 are below the average, on the other hand the first four participants who have the highest average degree have 45.9, 37.8, 33.4, and 21. Hence, there are few participants who dominate the market. According to their leading role in the network I present the first four in terms of their centrality in the network in Table 4.3. In a pooled panel where participants constitute the cross sectional units and time dimension is the sample period, the summary statistics for several centrality measures can mislead the central role the participants play in the network in certain point in time. For instance, the overly central role of a participant can be moderated by low centrality in the upcoming days. To pick up the days when a participant has high centrality, I first rank the participants in each day and provide the summary statistics for these ranking. The participants coded as 103, 100, 7, and 107 have the most number of in–degree and out–degree connections in the network. Hence, these institutions can be assessed as the central participants in the network. The centrality of these participants are so robust that, for instance, the participant coded as 103, ranked 13^{th} the least in the ranking during the sample period. The standard deviation figures also show that their centrality hardly changes.

Boss et al. (2004) argue that as far as banking regulation is concerned, the centrality analysis is useful for reforming traditional approaches to banking supervision. The systemic effect of individual shocks can be monitored with the information content of centrality measures. The issue of centrality has been left untouched by the traditional approaches which strongly emphasised the supervision of individual institutions. For the analysis of systemic risk, it is crucial to assess risk exposure at system level, because only then can the sources of systemic risk become predictable. The computation of several centrality measures helps to identify the critical nodes in the network, which can be read as the SIFIs in a financial market. The network topologies in the network of RRRM suggest that there are a few SIFIs in the market. The ranking of the higher centrality of few institutions in RRRM rarely changes

implying the need of close scrutiny.

The findings about the centrality of institutions are robust to different centrality definition. We consider the number of connections (Degree Centrality), the sum of institutions' interbank operations (assets and liabilities) (Strength Centrality), the sum of shortest distances between nodes to capture the possibility of contagion (Closeness Centrality), how strategically the nodes are located on the paths of many other nodes in the network (Betweenness Centrality), and centrality of nodes' neighbourhood (Eigenvector Centrality and Pagerank Centrality). The decision on the degree of centrality also considers the combination of all mentioned measures by Principal Component Centrality.

4.4 The Drivers of Connectivity

4.4.1 Hypothesis and Data

One of the controversial debates in academia and regulatory fora after the 2008 financial crisis is the interconnections in financial networks. Although interconnections carry the risk of contagion from the failure of SIFIs; it increases the effectiveness of the transmission of monetary policies, absorbs individual shocks, and ultimately contributes to well–functioning of the whole financial system. From regulatory perspective, the central issue is to cautiously monitor and regulate the interconnections in financial networks. This section considers both "negative" shocks that potentially reduce financial interconnections, and "positive" shocks that affect in the other way.

The centrality in complex networks suggest that the shocks originating from the central node(s) can transmit to the other nodes instantly and can have devastating impacts. Although the centrality measures provide important information about participants individually, system–wise interconnectedness can not be extracted from these measures. The interconnectedness in the system can be measured through connectivity computed as the ratio of the number of edges, l, to the number of possible maximum edges, $n(n-1)$.

This section examines the dynamic relationship between connectivity and several

international and domestic factors. I also take into account supply and demand factors in RRRM. Ahead of introducing the data used in the analysis, I categorize the variables and hypothesize their relationship with connectivity.

4.4.1.1 Hypothesis

Liquidity Supply : The CBRT has pursued conventional monetary policies to inflation targeting till the outbreak of the 2008 financial crisis. Just after the outbreak of the crisis, the CBRT has provided ample liquidity to the markets through several unconventional policies due to dried up liquidity in global financial markets. When advanced countries lowered the policy interest rates considerably and implemented several quantitative easing policies after the global financial crises, there appeared significant "push" and "pull" factors. The push factors triggered capital inflows to the emerging countries due to their relatively high interest rates. Relatively resilient stance of emerging market countries during and after the crisis has created the pull factors. Although many emerging market countries suffered from low level of international financial capital due to their unstable economy (Bosworth et al., 1999), the 2008 financial crisis has created a reverse condition which triggered huge amount of capital flow to these countries (Ahmed and Zlate, 2014; Brafu-Insaidoo and Biekpe, 2011). Ample liquidity has been a serious challenge for these countries due to its unintentional consequences on financial stability. The CBRT has pursued several unconventional policies leaving the inflation targeting as a mere policy goal in Turkey when amply liquidity became an issue. In the new framework, the CBRT has started to implement the "interest rate corridor" (as a cyclical tool) and the "reserve option mechanism" (as a structural tool) as new policy tools. Among them, interest rate corridor policy introduced a direct supply side control on interbank markets [48]. The CBRT currently provide liquidity at daily, weekly or monthly maturities. Since May–2010, weekly repo auctions that are performed as quantity auctions have been the main liquidity instrument with the one–week repo rate serving as the policy rate. The one–week repo rate lies between the overnight borrowing and lending rates of

[48]For the details of interest rate corridor please see Aysan et al. (2014).

the Central Bank. The one–week repo rate and overnight borrowing and lending rates are revised monthly in Monetary Policy Committee meetings. The CBRT's presence in RRRM assures that the repo interest rates in this market lie within the interest rate corridor set by the Central Bank.

Hypothesis-1 : When the markets are on amply supply condition, the institutions are more likely to transact in RRRM.

Liquidity Demand : When the market conditions are tranquil and regulators projects liquidity demand with a fair accuracy, the provision of liquidity is successfully absorbed by the demand from institutions. When there is a perceived liquidity problem in the markets, regulators face with difficulties in meeting the demands and the institutions that are in need of cash rush into interbank markets. In Turkey, weekly repo auctions that are regularly performed as quantity auctions have been the main liquidity instrument since May–2010. It will be consistent to think that several institutions may prefer having a liquidity cushion and avoid participating in RRRM after 2008 global crisis.

Hypothesis-2 : When the auctions are over/underbid, the institutions are more/less likely to transact in RRRM.

External Factors : Significant movements in the price of financial assets led to increased volatilities in the aftermath of the 2008 financial crisis. Shortly after the collapse of Lehman Brother's, as global risk aversion increased due to heightened volatility, the investors demanded higher compensation for risk. Given that entry barriers in emerging market countries are almost lifted, inter–linkages in global financial system might influence liquidity conditions in these countries. The rational would than suggest that external factors in international financial factors affect interconnections in RRRM [49].

Hypothesis-3 : When global market conditions deteriorate, the institutions are less likely to transact in RRRM.

Domestic Factors: Economic sentiment is generally influenced by real economic

[49]See the discussions in Caceres and Unsal (2013) who analyse how the global factors drive the financial indicators of emerging market economies.

activity. For instance, the relationship between negative sentiment and poor economic condition is confirmed for the UK and Germany in the early 1980s (Duch and Kellstedt, 2011). Duch and Kellstedt (2011) also argue that the negative economic sentiment after 2008 was not unexpected. It is assumed that strong domestic economic sentiment can be an indication of good credit conditions that would impact financial institutions' lending and borrowing behaviour (Caceres and Unsal, 2013). A positive sentiment would increase the risk appetite under the expectation that a well–functioning economy can be supported by well–functioning credit conditions. This chapter proxies domestic factors through the movements in stock exchange and credit default swap market. With deteriorating economic sentiment, financial institutions may choose to hoard liquidity when home country credit risk heightens. The stylised facts also confirm that capital inflow to national economies is inversely affected by sovereign credit risk. Once the sovereign credit risk rises, the capital tends to leave the country. The uncertainty as the natural outcome of high volatility also distracts lending and borrowing activities.

Hypothesis-4 : When economic sentiment and sovereign credibility go up, the institutions are highly likely to transact in RRRM.

4.4.1.2 Data

This section first computes a *connectivity* measure which can be represented as the ratio of the number of present links to the number of possible links. Then, the dynamic relationship between connectivity and its potential drivers is examined. Table 4.4 presents the variables, their definitions and the sources of data. The *BIST–100 index* which is the actively traded equity index of Turkey is used to proxy for the perceptions in domestic economic conditions. Daily prices of Turkish CDSs are used to examine the effect of sovereign credit risk as one of the fundamental driver[50]. The *5–year Turkish government CDS spreads* that shows the price of insurance of government bonds against a credit event for 5 years is employed for this purpose.

[50]The price that investors are willing to pay for the insurance of a given government bonds against a credit event is the CDS price that measures the sovereign credit risk

The reason for choosing this maturity is that 5–year CDSs are the most liquid part of sovereign CDS market.

Table 4.4: Variable Definitions and Data Sources

Variable	Definition	Model or Formula	Data Source
$LCON$	Connectivity	$\frac{l}{n(n-1)}$	Takasbank
$LEQU$	BIST–100 index		Bloomberg
$LCDS$	5 year Turkish Government CDS spread		Bloomberg
$LEMBI$	5 year Turkish Government EMBI spread		Bloomberg
$LPOL$	1–month TRLIBOR rate		CBRT & Bloomberg
$LVIX$	VIX index		Bloomberg
$LBIDCOV$	Bid to cover ratio in repo auctions		CBRT
$LVOL$	The time–varying conditional variance of CDS spreads	SWARCH	Bloomberg

Note: All the measures are in their logarithmic form. l represents the number of connections and n represents the number of nodes.

Sovereign spreads have exhibited a significant degree of volatility especially after the 2008 financial crisis. The volatility of CDS spreads are obtained from a SWARCH model. The global risk aversion has deteriorated tremendously and the financial markets across the world were surrounded by gloomy wait–and–see mood. The analyses track the global risk aversion over *VIX index* which is a ticker symbol of Chicago Board Options Exchange Market Volatility index that measures the volatility in US stock market [51]. The central bank policy is proxied by *1–month maturity Turkish lira interbank offer rate–TRLIBOR*, which is expected to demonstrate the effect of central bank policies more directly since the one month part of the Turkish lira yield curve is relatively more liquid compared to other short rates (see e.g. Kucukkocaoglu et al., 2013, for similar usage). The central banks have implemented decisive policies to counteract the effects associated with the crisis across the world. In Turkey, the CBRT has strategically used repo auctions as a direct policy tool to complement policy rates. In this study, the impact of supply and demand conditions in repo auctions is examined to show the degree of liquidity squeeze. Undoubtedly, liquidity condition is influential in driving connections in this market. The *bid/cover ratio* in repo auctions is computed to proxy for liquidity squeeze. All of the financial data is retrieved daily from Bloomberg data terminal. The results of repo auctions are from the CBRT. The auctions are at different maturities but

[51] See Longstaff et al. (2011) and Fender et al. (2012) who use VIX index with similar motivations.

with few exceptions are held daily.

As outlined in Baum and Wan (2010), CDSs as one of the liquid assets for credit risk have more accurate information about sovereign credit risk [52]. To estimate the volatility of CDS spreads, a SWARCH model is employed to proxy for uncertainties in Turkish financial markets. I construct a daily time series from daily CDS prices to proxy for volatility from the conditional variance of CDS spreads. The SWARCH model used for modelling CDS volatility is proposed by Hamilton and Susmel (1994). The model results yield conditional volatility for CDS time series which will proxy uncertainties in the country in the given period. What is common in most of the empirical studies is that the financial time series are used on their conditional mean in various financial models. However, financial time series carry certain stylised features such as volatility clustering that requires volatility modelling. In terms of uncertainty, the accurate computation of uncertainty can not be obtained by any measure of variability (Evans, 1991). For example, if individuals' information set is limited, e.g. about the likelihood of a failure in sovereign debt, the uncertainty in the CDS markets will be high even if the computed variability of the past CDS spreads is small. The reverse also holds true, if individuals are well informed about the risk a country will face, there will be little uncertainty despite large computed variation in CDS spread. Consequently, little can be learnt by simple variance or any other measure based on variability regarding uncertainty. Therefore, expectations and the volatility of economic variables must be defined conditionally based on some set of information.

In this section, time–varying conditional variance of CDS spreads is used as a measure of volatility in sovereign credit risk. The volatility series provide information about the degree of uncertainty. Recent empirical studies examining the effects of macroeconomic uncertainties tried to solve this problem by modelling relevant variables by various types of autoregressive conditional heteroskedasticity (ARCH) and generalised autoregressive conditional heteroskedasticity (GARCH) models (see

[52]Other financial instruments like bonds and equities are largely driven by liquidity and tax effects and may not solely display the actual credit risk.

e.g. Baum and Wan, 2010). Yet, Tas and Ertugrul (2013) argue that analysis of structural change in ARCH models is non–trivial. Hamilton and Susmel (1994) discuss some of the shortcomings of ARCH models one of which is that ARCH models do not allow for sudden, discrete changes. Considering the sample period that has several financial ups and downs, the SWARCH model that allows for regime switches in conditional volatility modelling best fits in this study. The basics of SWARCH model introduced in Hamilton and Susmel (1994) was inspired by Hamilton (1989) which theoretically laid down the regime–switching character of business cycles. SWARCH models capture more realistically the time series properties of dramatic economic events in which volatility depends on past news and the state of the economy (Hamilton and Susmel, 1994). Consider the following regime–switching model for conditional mean:

$$y_t = \mu_{s_t} + \tilde{y}_t \tag{4.33}$$

where μ_{s_t} denotes the parameter μ_1 when the process is in the regime represented by $s_t = 1$, while μ_{s_t} indicates μ_2 when $s_t = 2$, and so on. The variable $\tilde{y}_t$ was assumed to follow a zero–mean q^{th} order autoregression (AR):

$$\tilde{y}_t = \varphi_1 \tilde{y}_{t-1} + \varphi_2 \tilde{y}_{t-2} + ... + \varphi_q \tilde{y}_{t-q} + u_t \tag{4.34}$$

In SWARCH framework, the error process is described by the following equations:

$$\varepsilon_t = \sqrt{g_{s_t}} \tilde{u}_t \tag{4.35}$$

where $\tilde{\mu}_t$ is assumed to follow a standard ARCH process,

$$\tilde{u}_t = h_t \nu_t \tag{4.36}$$

with ν_t , a zero mean, unit variance i.i.d. sequence and

$$h_t^2 = a_0 + a_1 \tilde{u}_{t-1}^2 + a_2 \tilde{u}_{t-2}^2 + ... + a_q \tilde{u}_{t-q}^2 \tag{4.37}$$

The underlying $ARCH(q)$ variable $\tilde{u}_t$, is then multiplied by the constant $\sqrt{g_1}$ when the process is in the regime represented by $s_t = 1$, multiplied by $\sqrt{g_2}$ when $s_t = 2$, and so on. The factor for the first state g_1, is normalised at unity with $g_j \geq 1$ for $j : 2, 3, ..., K$. The idea is thus to model changes in regime as changes in the scale of the process. We can say that $\tilde{u}_t$ in Equation 4.35 follows state K, q^{th} order Markov-switching ARCH process, denoted as $SWARCH(K, q)$(Hamilton and Susmel, 1994). It is straightforward to see when $K = 1$, the model reduces to $ARCH(q)$ model. The volatility state is assumed to be the outcome of an unobserved first-order K^{th} state Markov process, which can be described by transition probabilities, $p_{ij} = Prob\{\ s_t = k|s_{t-1} = i\}$. Each probability figure p_{ij}, is the probability that state i is followed by state j. I assume that there are two volatility states in modelling CDS volatility: low volatility *state–1* and high volatility *state–2*. Hence, the transition probability matrix is simplified to:

$$P_{ij} = \begin{vmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{vmatrix} \text{where } \sum_{j=1}^{2} p_{ij} = 1.$$

Relying on this theoretical background, the SWARCH models are estimated as specified in Equation 4.38–4.39 in which the log level CDS spread data are used with daily frequency. The length of autoregressive process is determined by using the Akaike and Schwartz information criterion.

$$CDS = \beta_0 + \beta_1 CDS_{t-1} + \beta_2 CDS_{t-2} + \beta_3 CDS_{t-3} + ... + \beta_p CDS_{t-p} + \tilde{\mu}_t + \theta_1 \tilde{\mu}_{t-1} + \theta_2 \tilde{u}_{t-2} + \theta_3 \tilde{u}_{t-3} + ... + \theta_q \tilde{u}_{t-q} \tag{4.38}$$

$$h_t^2 = a_0 + a_1 + a_1 \tilde{u}_{t-1}^2 + a_2 \tilde{u}_{t-2}^2 + ... + a_q \tilde{u}_{t-q}^2 \tag{4.39}$$

4.4.2 The Estimators for Long–Run Relationship

This section examines the long–run relationship between connectivity, global and domestic risk aversion, domestic financial factors, and supply and demand conditions in RRRM for the period 2008-2012. The analyses begin with testing for co-integration between the connectivity measure and introduced time series, then continue with examining the long-run relationship by employing fully modified ordinary least squares (FMOLS) of Phillips and Hansen (1990), canonical cointegrating regression (CCR) of Park (1992), and dynamic ordinary least squares (DOLS) of Stock and Watson (1993) (for similar analysis see e.g. Narayan and Narayan, 2004; Wolde-Rufael, 2010).

The existence of cointegration implies that short term disturbances do not distort the long run equilibrium. In the literature, there are various approaches investigating the long–run equilibrium. Notable among these approaches include the tests of Engle and Granger (1987), Johansen (1991), and Johansen and Juselius (1990). The seminal test of Engle and Granger (1987) is based on an OLS estimate of Equation 4.40;

$$y_t = \mu + \beta^{'} x_t + \nu_{1t} = \theta^{'} z_t + \nu_{1t} \tag{4.40}$$

$$\Delta x_t = \nu_{2t} \tag{4.41}$$

where $t = 1, ..., T$ and $\theta = (\mu, \beta^{'})^{'}$, and $z_t = (1, x_t^{'})$. y_t and x_t represent 1 and n dimensional time series respectively. The test is based on the residuals of the regression model, stationary residuals imply cointegration. The parameter estimate of θ by ordinary least squares is reportedly inefficient but consistent. Pesaran and Pesaran (1997) indicated that the test of Engle and Granger (1987) is inefficient and can lead to contradictory results especially when there are more than two nonstationary series under consideration. Another drawback was indicated by Phillips and Hansen (1990) who prove that the test of Engle and Granger (1987) suffers from endogeneity of the nonstationary regressors and serially correlated error of the regression. FMOLS proposed by Phillips and Hansen (1990) employs a semi-parametric correction to eliminate the problems caused by the long–run correlation between the cointegrating equation and stochastic regressors' innovations. The method modifies least squares estimator to account for serial correlation and endogeneity and allows for both stationary and nonstationary time series in the same model. FMOLS modifies y_t to y_t^+ and then corrects for θ estimated by OLS. The estimator proposed by FMOLS is,

$$\hat{\theta}_{FMOLS} = \left(\sum_{t=1}^{T} z_t z_t^{'} \right) \left(\sum_{t=1}^{T} z_t y_t^+ - T\hat{J}^+ \right) \tag{4.42}$$

where $y_t^+ = y_t - \hat{\lambda}_{0x}\hat{\lambda}_{xx}^{-1}\Delta x_t$ is the correction term for endogeneity, $\hat{\lambda}_{0x}$ and $\hat{\lambda}_{xx}$ are the kernel estimates of long run covariances. $\hat{J}^+ = \hat{\Delta}_{0x} - \hat{\lambda}_{0x}\hat{\lambda}_{xx}^{-1}\hat{\Delta}_{xx}$ is the correction term for serial correlation, where $\hat{\Delta}_{0x}$ and $\hat{\Delta}_{xx}$ are the kernel estimates of one-sided covariances. The serial correlation correction term is employed to deal with the effects of covariances in the shocks of ν_{2t} that drive the nonstationary x_t and any serial correlation between the error term and past values of ν_{2t}. After transforming

the estimator that accounts for endogeneity and serial correlation, the error terms are tested for unit root as it is done in (Engle and Granger, 1987).

CCR which is proposed by Park (1992) employs stationary transformations of the regressors in least squares estimates to remove the long run dependence between the cointegrating equation and short term changes. The transformation process is realised through the introduction of contemporaneous covariance matrix, $\hat{\Omega}$. The kernel estimates of $\hat{\Delta}_{0x}$ and $\hat{\Delta}_{xx}$ FMOLS is slightly modified by the simple matrix operation of $\hat{\Omega}^{-1}\hat{\Delta}_{0x}$ and $\hat{\Omega}^{-1}\hat{\Delta}_{xx}$ to get the CCR estimator – $\hat{\theta}_{CCR}$. This slight transformation does not create significant differences in the estimated coefficients though.

The last approach adopted in this chapter is DOLS proposed by Stock and Watson (1993). This approach eliminates the feedback in the cointegrating equation in Engle and Granger (1987) through augmenting the equation with lead and lags of Δx_t so that the resulting equation's error term is orthogonal to the history of realisations of time series and their short term deviations (see Equation 4.43). The lead and lag orders (q, r) can be selected based on either Akaike or Schwarz criteria.

$$y_t = \mu + \beta' x_t + \sum_{j=-q}^{r} \lambda'_{j+q} \Delta x_{t+j} + \nu_{2t} \tag{4.43}$$

The tests of cointegration for FMOLS, CCR, and DOLS models are implemented by Park's added variable test (Park, 1992). The test is an added variable test, $H(p, q)$, which is computed by testing for the significance of spurious time trends in a cointegrating equation estimated by FMOLS, CCR, and DOLS. Suppose that the Equation 4.40 is estimated with the trend variables up to order of p. Then the Park's added variable test estimates the spurious regression model including $p + 1$ from to q spurious powers of trend as follows:

$$y_t = \mu + \beta' x_t + \sum_{s=0}^{p} t^s \gamma_s + \sum_{s=p+1}^{q} t^s \gamma_s + \nu_{1t} \tag{4.44}$$

and test the joint significance of the coefficients of $(\gamma_{p+1}, ..., \gamma_q)$. Under the null hypothesis of cointegration, the spurious trend coefficients should be insignificant, while under the alternative, the spurious trend terms mimic the remaining stochastic trend in the residual. Since the additional variables are simply deterministic regressors, a joint Wald test of significance to $(\gamma_{p+1}, ..., \gamma_q)$ is exercised under the hypothesis that the original specification of the cointegrating equation is correct. The resulting test statistic is asymptotically distributed over χ^2_{q-p}.

4.4.3 Results

4.4.3.1 Results for the Full Sample

Ahead of cointegration and regression analysis, the time series are tested whether they are integrated at an order higher than one, $I(1)$, or not. In the presence of $I(2)$ or higher variables, the results are not valid. To identify the integration properties of the time series, Ziwot–Andrews test that takes structural breaks into consideration and Augmented Dickey–Fuller (ADF) test are employed. Table 4.5 presents the test results which indicate that dominantly the series are integrated at an order of one, $I(1)$, but not $I(2)$.

Having established that none of the time series were $I(2)$ or higher, the next step is to estimate the cointegration relationship. When $LCON$ is the dependent variable, the χ^2_1 statistic for FMOLS(1-2), CCR(1-2), and DOLS (1-2) are 2.1×10^{-5}, 0.041, 0.053, 0.0068, 0.24, and 0.36 indicating that the F-statistics can not reject the null hypothesis of cointegration with no trend level. This suggests that there is a cointegrating relationship between $LCON$, $LEQU$, $LCDS/LEMBI$, $LPOL$, $LVIX$, $LBIDCOV$, $LVOL$, and DUM.

Since our results support the existence of cointegration, I estimate the long-run

Table 4.5: Unit Root Test Results

Variable	Zivot–Andrews				ADF	
	At level		At 1^{st} difference		At level	At 1^{st} difference
	T statistics	Time break	T statistics	Time break		
$LCON$	-6.43*	24 June 2011	-	-	- 4.88*	-
$LEQU$	-3.24	9 June 2009	-13.15*	6 March 2009	-0.96	-29.26*
$LCDS$	-2.06	15 May 2009	-13.26*	6 March 2009	0.70	-25.79*
$LEMBI$	-1.67	4 July 2011	-13.83*	9 February 2011	0.90	-28.59*
$LPOL$	-2.17	10 December 2010	10.35*	19 October 2009	-2.44	-24.23*
$LVIX$	-3.35	11 July 2011	-15.20*	6 March 2009	-2.23	-20.28*
$LBIDCOV$	-4.62	5 August 2011	-16.98	15 October 2010	-3.06	-26.66*
$LVOL$	-8.42*	15 June 2011	-	-	-7.62*	-

Note: * and ** represent significance at 1% and 5% levels. $LCON$, $LEQU$, $LCDS$, $LEMBI$, $LPOL$, $LVIX$, $LBIDCOV$, and $LVOL$ are computed connectivity measure, BIST–100 equity index, 5–year CDS spread, emerging market bond index–Turkey, 1–month TRLIBOR rate, VIX index, bid/cover ratio in repo transactions held by the Central Bank, and CDS volatility respectively. For Zivot-Andrews structural break unit root test, 4 optimal lag is selected. The reported statistics belong to including trend and intercept for both Zivot-Andrews Structural Break and Augmented Dickey–Fuller tests. The stationary levels do not change either for trend only or no-trend and no-intercept.

coefficients. Table–4.6 shows a positive and a statistically significant relationship between BIST–100 index and connectivity. A 1% rise in equity index raises connectivity around 0.6% percent. The coefficients are estimated at 1% significance level in different models, indicating a robust and positive relationship as expected. As hypothesised, the domestic economic sentiment positively drives the connections in RRRM. This can be explained with the fact that institutions engage in busy lending activity that rides up the connectivity. In a reverse condition where the sentiment indicates a gloomy environment, the institutions would probably lock in liquidity.

In addition to BIST–100 index, global risk aversion, bid/cover ratio in repo auctions, the volatility of 5–year CDS spreads and the structural break dummy impact the connectivity statistically significantly and in line with expectations. A loosely significant coefficient belongs to bid/cover ratio which is estimated at 10% percent level in some models and insignificant in the remaining. These findings suggest that, global risk aversion distracts fund flows in the market, just in line with the explanations belonging to BIST–100 index. I explain this with diminished liquidity which happens during perceived high risk environment. An increasing bid/cover ratio indicates that participants' demand in RRRM could be met at decreasing level. Hence, when the participants' demand are not met by the CBRT, then the participants who are in need of cash knock the other participants' door. An interesting finding

is the relationship between volatility of CDS spreads and connectivity. The findings suggest that the volatility of CDS spreads positively drive the connectivity. That is, when perceived uncertainty of sovereign credit risk heightens, then the illiquid participants are conducive to borrow more from the other participants. On the other hand after the structural break date of 24 June 2011, the connections gets lower, indicating that the intervention led by the CBRT is influential enough to cover the liquidity needs of the participants. Since CBRT use repo market actively, the participants meet their needs with the CBRT's funds instead of the other participants'. The parameter estimates of 5–year CDS spreads and 1–month TRLIBOR rates are positive but statistically insignificant. To note, the insignificant parameter estimate of 1–month TRLIBOR rates should be read as plausible since the increase in TRLIBOR rates do instantly impact bank rates without changing the lending/borrowing behaviour of participants in RRRM.

This section alternatively uses emerging market bond index – Turkey instead of 5–year CDS spreads since CDSs and bond markets are expected to reflect the same information on credit risk (Arce et al., 2013). Theoretically, the difference between the bond yield and CDS spreads, namely the CDS–bond basis, is zero but actually may deviate related to various factors,e.g. counterparty risk, market illiquidity, funding constraints (Akdogan and Chadwick, 2013; Arce et al., 2013). The CDS-bond basis especially widens especially during crisis times when the information about sovereign credit risk gets blurred [53]. Discarding the possibility that CDS spreads may diverge from bonds yields which might measure the sovereign credit risk more accurately, I also employ emerging market bond index – Turkey to proxy for sovereign credit risk in the estimations. Table–4.6 reports the results that takes emerging market bond index–Turkey. The results are almost unchanged implying that these two time series inherit similar information content associated with sovereign credit risk.

To complement the results obtained from the estimations to explore the long–

[53]See Arce et al. (2013), for instance, who explore the extent to which CDS spreads and bond yields reflect the same information on sovereign credit risk.

Table 4.6: Long Run Relationship–Full Sample

Dependent Variable: *LCON*						
Variable	FMOLS(1)	CCR(1)	DOLS(1)	FMOLS(2)	CCR(2)	DOLS(2)
LEQU	0.649293***	0.61929***	0.591264***	0.595405***	0.582328***	0.589217***
	(0.177695)	(0.180541)	(0.171672)	(0.147368)	(0.15006)	(0.16162)
LCDS	0.100274	0.098184	0.037941			
	(0.155743)	(0.157584)	(0.147756)			
LEMBI				0.062961	0.064917	0.034303
				(0.120269)	(0.123109)	(0.132652)
LPOL	0.057589	0.048984	0.049878	0.050987	0.045842	0.030868
	(0.087162)	(0.087557)	(0.080224)	(0.073254)	(0.074182)	(0.079777)
LVIX	-0.168989**	-0.199585***	-0.156221**	-0.177284**	-0.194615**	-0.149821**
	(0.072185)	(0.07568)	(0.071511)	(0.06214)	(0.065334)	(0.07304)
LBIDCOV	0.037118	0.034156	0.05501*	0.04026*	0.038147*	0.066313*
	(0.029784)	(0.03231)	(0.030759)	(0.026775)	(0.029074)	(0.032753)
LVOL	36.24226***	55.34883***	23.61656	22.3896	31.83259	18.89195
	(13.93671)	(18.0225)	(19.37418)	(12.25358)	(15.69549)	(19.96081)
DUM	-0.173333**	-0.18673**	-0.118314*	-0.143167*	-0.150236*	-0.103362*
	(2.50073)	(2.54581)	(2.428122)	(2.066581)	(2.11097)	(2.278934)
C	-11.50069***	-11.08631***	-10.5321***	-10.66992***	-10.49047***	-10.48212***
	(2.50073)	(2.54581)	(2.428122)	(2.066581)	(2.11097)	(2.278934)
TREND	0.0000007	0.0000361	-0.0000703	-0.0000288	-0.0000121	-0.0000936
	(0.000153)	(0.000157)	(0.000144)	(0.000142)	(0.000146)	(0.000156)
Number of obs.	934	934	866	934	934	866
Adjusted R-squared	2.08E-05	0.053184	0.238355	0.436053	0.432265	0.490301
S.E. of regression	0.9964	0.8176	0.6254	0.211609	0.212319	0.200087
Park's added variables cointegration tests						
Chi-square	2.08E-05	0.053184	0.238355	0.041221	0.006863	0.35807
Prob.	0.9964	0.8176	0.6254	0.8391	0.934	0.5496

Note: ***, **, and * represent significance at 1%, 5% and 10% levels. Standard errors are reported in parentheses. Dependent variable *CON* is the connectivity measure, and *LEQU*, *LCDS*, *LEMBI*, *LPOL*, *LVIX*, *BIDCOV*, and *LVOL* are BIST–100 equity index, 5–year CDS spread, emerging market bond index–Turkey, 1–month TRLIBOR rate, VIX index, bid/cover ratio in repo transactions held by the Central Bank, and CDS volatility respectively. *DUM* is the dummy variable that takes 1 after 24 June 2011 that refers to the structural break date of *CON*, and 0 otherwise. Park's cointegration test is based on $H0$ of cointegration against the alternative of no cointegration (Park, 1992). The long–run variances of FMOLS, CCR and DOLS are computed using a nonparametric method with the Bartlett kernel and a real-valued bandwidth chosen by Newey–West fixed bandwidth selection method. The lead and lag orders (q, r) of DOLS are selected according to Akaike information criteria.

run relationship, I carry out Granger non–causality test developed by Toda and Yamamoto (1995) which is valid regardless of whether a series is $I(0)$, $I(1)$ or $I(2)$, non-cointegrated or cointegrated of any arbitrary order (Wolde-Rufael, 2010; Zapata and Rambaldi, 1996). To apply the Granger non–causality test of Toda and Yamamoto (1995), for VAR(2), I estimate the following system equations:

$$\begin{bmatrix} LCON_t \\ LEQU_t \\ LCDS_t \\ LPOL_t \\ LVIX_t \\ LBIDCOV_t \\ LVOL_t \\ DUM_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} LCON_{t-1} \\ LEQU_{t-1} \\ LCDS_{t-1} \\ LPOL_{t-1} \\ LVIX_{t-1} \\ LBIDCOV_{t-1} \\ LVOL_{t-1} \\ DUM_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} LCON_{t-2} \\ LEQU_{t-2} \\ LCDS_{t-2} \\ LPOL_{t-2} \\ LVIX_{t-2} \\ LBIDCOV_{t-2} \\ LVOL_{t-2} \\ DUM_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \\ \varepsilon_6 \\ \varepsilon_7 \\ \varepsilon_8 \end{bmatrix} \quad (4.45)$$

In Equation 4.45, A_0, A_1, A_2 are 8 by 8 matrices of coefficients with A_0 being the

8 by 1 identity matrix and ε_s are the disturbance terms with zero mean and constant variance. From Equation 4.45, e.g. I can test the hypothesis that $LEQU$ does not Granger cause $LCON$, in the following hypothesis: $H_0 = a_{12}^1 = a_{12}^2 = 0$ where a_{12}^1 and a_{12}^2 are the coefficients of the $LEQU$ in the first equation of the system presented in Equation 4.45. Several other hypothesis that $LCDS/LPOL/LVIX/LBIDCOV/LVOL/DUM$ does not Granger cause $LCON$ can be constructed similarly.

Table 4.7: Choice Criteria for Selecting the Order of the VAR Model

Lag (k)	FPE	AIC	SIC	HQ
0	7.23E-17	-14.46221	-14.38674	-14.43241
1	7.06E-26	-35.20947	**-34.53021***	**-34.94128***
2	**5.81e-26***	**-35.40451***	-34.12147	-34.89793
3	6.24E-26	-35.33431	-33.44749	-34.58933
4	6.62E-26	-35.27578	-32.78517	-34.29241
5	6.22E-26	-35.34081	-32.24642	-34.11904
6	6.96E-26	-35.23194	-31.53376	-33.77178
7	8.18E-26	-35.07557	-30.77361	-33.37701
8	9.66E-26	-34.91462	-30.00888	-32.97767
9	1.08E-25	-34.8148	-29.30527	-32.63945
10	1.21E-25	-34.70759	-28.59428	-32.29385
11	1.40E-25	-34.57522	-27.85812	-31.92309
12	1.57E-25	-34.47059	-27.14971	-31.58006
13	1.62E-25	-34.46179	-26.53712	-31.33287
14	1.84E-25	-34.35274	-25.82429	-30.98543
15	2.15E-25	-34.22033	-25.0881	-30.61462
16	2.48E-25	-34.10456	-24.36854	-30.26046
17	2.79E-25	-34.01741	-23.6776	-29.93491
18	2.96E-25	-33.99498	-23.05139	-29.67409
19	3.53E-25	-33.85922	-22.31185	-29.29994
20	3.87E-25	-33.81263	-21.66147	-29.01495
21	4.39E-25	-33.73617	-20.98123	-28.7001
22	4.41E-25	-33.78906	-20.43034	-28.5146
23	4.63E-25	-33.80396	-19.84146	-28.2911
24	4.75E-25	-33.84925	-19.28296	-28.098
25	5.41E-25	-33.79732	-18.62725	-27.80767

Note: FPE: Final prediction error AIC: Akaike information criterion SIC: Schwarz information criterion HQ: Hannan-Quinn information criterion.

Ahead of testing for causality, I determine the optimal lag, k. Granger non–causality test can vary to the selection of different lag length. If the chosen lag length is less than the appropriate lag length, the omission of relevant lags can cause bias. Nonetheless, when the lag length is selected unnecessarily long the parameter estimates become inefficient due to more than required parameters (Wolde-Rufael, 2010; Clarke and Mirza, 2006). Since this chapter employs the time series on daily frequency, the persistence is expected to be high. Hence on selecting the optimal

lag length, I decide the lag length out of 25 lags, a long observance interval, in order to observe potential optimal long lag. The decision is based on Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn information criterion (HQ). As can be seen from Table 4.7, it can be reasonably accepted that there were no serious deviations between four different information criteria, which imply that the optimal lag is either one or two, $k = 1$, $k = 2$. To be on the safe side, I select the lag order as two based on FPE and AIC, $k = 2$.

Table 4.8: Granger Non–Causality Test Results

Null Hypothesis	Mwald χ^2	ρ-value	Sum of lagged independent coefficients
$LCDS \not\rightarrow LCON$	5.128	0.077*	$\sum$of lagged $LCDS$ coefficients = 0.067
$LCON \not\rightarrow LCDS$	2.648	0.2661	$\sum$of lagged $LCDS$ coefficients = -0.007
$LEQU \not\rightarrow LCON$	15.323	0.0005***	$\sum$of lagged $LEQU$ coefficients = 0.281
$LCON \not\rightarrow LEQU$	3.514	0.1725	$\sum$of lagged $LEQU$ coefficients = -0.000
$LPOL \not\rightarrow LCON$	0.904	0.6365	$\sum$of lagged $LPOL$ coefficients = -0.012
$LCON \not\rightarrow LPOL$	1.056	0.5899	$\sum$of lagged $LPOL$ coefficients = 0.002
$LVIX \not\rightarrow LCON$	5.735	0.0568*	$\sum$of lagged $LVIX$ coefficients = -0.089
$LCON \not\rightarrow LVIX$	0.455	0.7967	$\sum$of lagged $LVIX$ coefficients =-0.009
$LBIDCOV \not\rightarrow LCON$	7.163	0.0278**	$\sum$of lagged $LBIDCOV$ coefficients = 0.023
$LCON \not\rightarrow LBIDCOV$	7.767	0.0206**	$\sum$of lagged $LBIDCOV$ coefficients = 0.061
$DUM \not\rightarrow LCON$	7.552	0.0229**	$\sum$of lagged DUM coefficients = -0.074
$LCON \not\rightarrow DUM$	0.320	0.8523	$\sum$of lagged DUM coefficients = -0.002
$LVOL \not\rightarrow LCON$	6.310	0.0426**	$\sum$of lagged $LVOL$ coefficients = 4.74
$LCON \not\rightarrow LVOL$	14.601	0.0007***	$\sum$of lagged $LVOL$ coefficients = 0.001

Note: ***, **, and * represent significance at 1%, 5% and 10% levels. $\not\rightarrow$ denotes the rejection of the null hypothesis of no causality.

Results of the tests of non–causality are presented in Table 4.8. As can be seen from this table, there is a positive and significant uni–directional causality running from sovereign credit risk to connectivity, $LCDS \rightarrow LCON$. This implies that connectivity is dependent on connectivity where an increase in sovereign credit risk may lead to increase the fund flows in RRRM. This finding contradicts with the findings of long–run relationship. But the low significance level (10%) reconciles with the findings. The remaining causal relationships are totally in agreements with the findings of long–run relationship. There is a positive and significant uni–directional causality running from BIST–100 index to connectivity, $LEQU \rightarrow LCON$. The rise in equity index spurs the connectivity. The 1–month TRLIBOR is found to be disassociated with connectivity bi–directionally, $LPOL \not\rightarrow LCON$ and $LCON \not\rightarrow LPOL$.

The uni–directional causality running from global risk aversion to connectivity is accepted at conventional levels, $LVIX \rightarrow LCON$. Interestingly, the causality relationship between bid/cover ratio and connectivity is bi–directional. Hence not only bid/cover ratio leads to connectivity but also led by the connectivity itself. This is quite reasonable, since both relation is interrelated, i.e. the bid for CBRT money will lead to connectivity but on the other hand the connectivity would also lead the bid for CBRT money, $LBIDCOV \rightarrow LCON$ and $LCON \rightarrow LBIDCOV$. A uni–directional causality exists between the dummy, the days after the structural break date, and the connectivity, $DUM \rightarrow LCON$. A bi–directional causality exists between the volatility of 5–year CDS spreads and connectivity, $LVOL \rightarrow LCON$ and $LCON \rightarrow LVOL$. This has severe implications for the policy designers in the country. The causality running from volatility through to connectivity is important for the policymakers who are in charge of the supervision of financial markets. But the high volume of fund transfers in RRRM leads to the increased uncertainty in the sovereign credit risk, implying that the high fund demand through RRRM is read as a cause of uncertainty component related to sovereign credit risk.

In addition to the Granger non-causality test, I compute the forecast–error variance decompositions that show how much of the variance of a particular variable can be explained by a shocks in other variables in the same system of simultaneous equations known as the vector autoregressive model (VAR). Wolde-Rufael (2010) argues that the non–causality test indicates causality within the sample period, but not beyond. He recommends decomposing the forecast–error variance of time series into proportions attributed to shocks in all variables in the system including itself using the procedure proposed by Pesaran and Shin (1998) to capture the relative strength of the causality between the series beyond the sample period. In this procedure, shocks to a variable can affect both changes in itself (i.e., "own effects") and lead to changes in other variables, as well. The decomposition can identify the relative importance of the effects of the various different series on any particular single series.

The error forecast decomposition results are reported in Table 4.9. The results clearly suggest that most of the volatility in connectivity is due to its "own" shocks. Among all the variables, BIST–100 index has the highest impact on the volatility of connectivity at the determined horizons. The accountability of BIST–100 index on the forecast error of connectivity is varying from almost zero in short horizon to 4.23% in longer horizon. Followed by the equity index, the global risk perception and bid/cover ratio has the highest impact. Although the significantly estimated long–run effect of the dummy variable and the volatility of 5–year CDS spreads, their forecast-error variance explain negligible forecast-error variance of connectivity.

Table 4.9: Forecast Error Decomposition Results

Period	S. E.	*LCON*	*LEQU*	*LCDS*	*LPOL*	*LVIX*	*LBIDCOV*	*LVOL*	*DUM*
2	0.194618	98.75971	0.000339	0.390141	0.047301	0.040249	0.569028	0.190522	0.002705
5	0.205423	97.23695	0.392119	0.475826	0.052715	0.58433	0.909558	0.290897	0.05761
10	0.209213	94.18205	1.777322	0.486981	0.051554	1.831482	1.143744	0.291913	0.234957
15	0.212339	91.43958	3.113096	0.519607	0.060499	2.956969	1.192867	0.319113	0.39827
20	0.215024	89.17204	4.227777	0.546248	0.094038	3.895618	1.197735	0.343099	0.523446

The results belonging to impulse responses of connectivity to one standard deviation innovations are plotted in Figure 4.9. The initial impact of 5–year CDS spreads on connectivity is positive and significant which is consistent with the long–run relationship between 5–year CDS spreads and connectivity, as uncovered by cointegration estimations. As the figure shows, however, the initial impact of shocks belonging to CDS spreads vanishes immediately, indicating a rapid adjustment mechanism, which implies the sovereign credit related risks are not taken as a serious concern among participants. CDS spreads of the country hover around low levels compared to its country peers that also confirms that sovereign credit risk may not pose a significant threat (Keller et al., 2007). Similar results are obtained for the initial and second horizon impacts of 1–month TRLIBOR on connectivity. The response of connectivity to 1–month TRLIBOR is negative but dies off immediately. Although a similar pattern can be observed for the response of connectivity to bid/cover ratio and volatility of 5–year CDS spreads, the impacts are not short lived as the case in 5–year CDS spreads and 1–month TRLIBOR. The impacts of own shocks have the highest potency as found in forecast–error variance decomposition results but

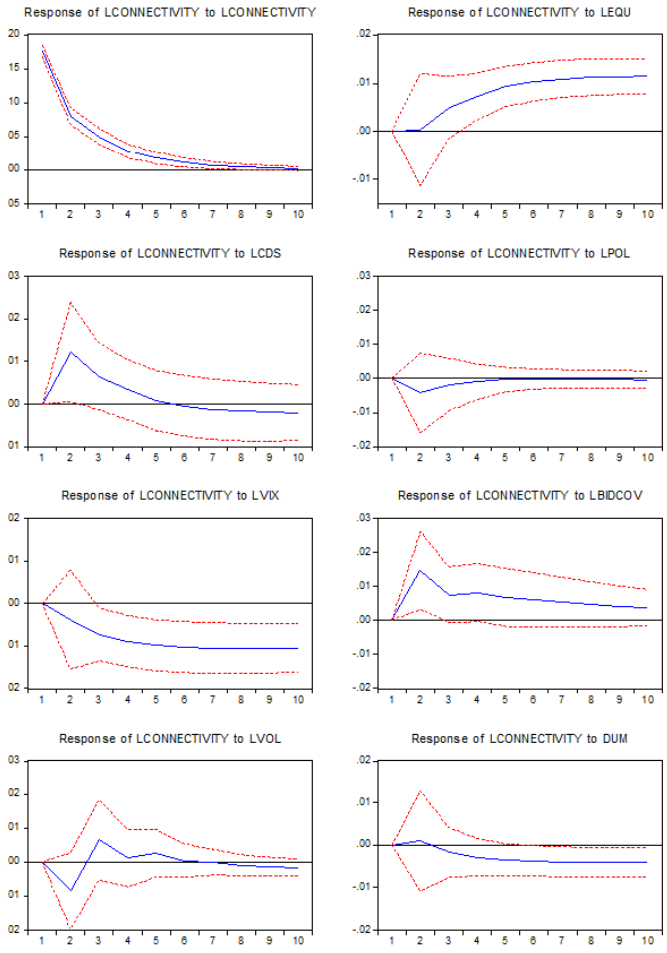


Figure 4.9: Impulse Repsonse Results

the trend is toward zero. The highest impacts are coming from BIST–100 index through to connectivity. This implies that positive shocks boost the connectivity at a steady increasing momentum. This finding is in line with the cointegration estimation results and forecast–error variance decompositions results. Similarly, the shocks from VIX index drive connectivity with negative sign and at an increasing momentum.

4.4.3.2 Results for Before and After CBRT Interventions

This section discusses the impact of the CBRT's interventions in RRRM that can be arguably intensified by the establishment of the Interbank Repo and Reverse Repo Market. After the establishment of the new interbank market, the CBRT found an active area to intervene in the RRRM. Although the establishment of the

Interbank Repo and Reverse Repo Market dates back to 7 January 2011, we take 24 June 2011 as the policy intervention date. This is due to potential lagged effects of interventions and the structural break date of connectivity measures found earlier.

The sample is split into two categories as before and after intervention to observe the changing impacts of the parameters on connectivity. Since the models are estimated with the same estimators and the estimation strategy is quite the same, this section devotes the discussions solely over the regression results. Overall results can be the indications of active intervention policy of the CBRT. The active policy management of central bank proves to be effective in Turkish case. The establishment of new repo market provides unique policy tool to the CBRT to manage market liquidity in RRRM.

Table 4.10: Long Run Relationship–Before and After Central Bank Intervention

Dependent Variable: $LCON$						
	Before Intervention			After Intervention		
Variable	FMOLS(1)	CCR(1)	DOLS(1)	FMOLS(2)	CCR(2)	DOLS(2)
$LEQU$	0.748537***	0.703959***	0.78105***	0.073203	0.128154	-0.045636
	(0.18152)	(0.188254)	(0.198514)	(0.416277)	(0.416432)	(0.438837)
$LCDS$	0.294967	0.269658	0.365452	-0.155203	-0.053321	0.002331
	(0.199906)	(0.20646)	(0.214901)	(0.198218)	(0.193073)	(0.189191)
$LPOL$	0.063823	0.047533	0.015394	-0.352231*	-0.530562**	-0.314276*
	(0.091107)	(0.091246)	(0.087779)	(0.215496)	(0.21992)	(0.167218)
$LVIX$	-0.294963***	-0.328222***	-0.27576***	0.242992**	0.361907***	-0.121474**
	(0.097956)	(0.100186)	(0.099556)	(0.106977)	(0.112437)	(0.083998)
$LBIDCOV$	0.003019	0.006988	0.027751	0.129876**	0.184299***	0.116256***
	(0.031487)	(0.033875)	(0.033728)	(0.054231)	(0.055674)	(0.04173)
$LVOL$	44.05764***	68.00941***	12.84276	-271.5756***	-356.6169***	-12.47472
	(15.08694)	(19.39295)	(22.26922)	(25.5294)	(29.38046)	(15.68886)
C	-13.18755***	-12.46737***	-13.85718***	-4.019881	-5.106109	-2.864468
	(2.772495)	(2.879931)	(3.036407)	(5.256342)	(5.242359)	(5.529235)
Number of obs.	665	665	616	270	270	280
Adjusted R-squared	4.54E-01	0.43086	0.513455	-0.851703	-1.665193	0.264496
S.E. of regression	0.236392	0.241305	0.222114	0.205315	0.24632	0.13215

Note: ***, **, and * represent significance at 1%, 5% and 10% levels. Standard errors are reported in parentheses. Dependent variable CON is the connectivity measure, and $LEQU$, $LCDS$, $LEMBI$, $LPOL$, $LVIX$, $BIDCOV$, and $LVOL$ are BIST–100 equity index, 5–year CDS spread, emerging market bond index–Turkey, 1–month TRLIBOR rate, VIX index, bid/cover ratio in repo transactions held by the Central Bank, and CDS volatility respectively. Sub–periods are decided on DUM, the dummy variable that takes 1 after 24 June 2011 that refers to the structural break date of CON, and 0 otherwise. The long–run variances of FMOLS, CCR and DOLS are computed using a nonparametric method with the Bartlett kernel and a real-valued bandwidth chosen by Newey–West fixed bandwidth selection method. The lead and lag orders (q, r) of DOLS are selected according to Akaike information criteria.

The estimation results for before and after intervention is presented in Table 4.10. The regression results indicate clear influence of the CBRT's intervention on connectivity in RRRM. The parameter estimates of 1–month TRLIBOR, $LPOL$, and bid/cover ratio, $LBIDCOV$, turn out to be statistically significant. The results

suggest that the policy rate negatively impacts the connectivity after the inauguration of the new repo market, and repo auctions significantly impact the connectivity in RRRM. Interestingly, the estimates of global risk aversion and $LVIX$, before and after intervention, are both significant but with different signs. The results suggest that the increasing global risk perceptions reduced the connections before intervention period, yet, the adverse impact of global risk perception is wiped out with increasing funding coming through the CBRT. The increasing global risk perception is, therefore, mitigated by the CBRT's interventions. Another interesting finding is that the impact of perceived uncertainty in country credit risk instigated higher connections between the institutions before intervention, yet the impact of uncertainty turns out to be negative after intervention. This can be the possible impact of Eurozone crisis and its impact on countries which drained liquidity in the markets after intervention.

4.5 Summary and Conclusion

It has been increasingly recognised that interactions in financial networks can be regarded as complex networks where the connections among financial agents playing the role of buyers and sellers may congest the risk on some agents called SIFIs. The 2008 financial crisis has revealed that SIFIs can create contagious effect in the system and do have cross–border impacts. Therefore, it is vitally important to identify SIFIs and take necessary measures to curb systemic failures in the system.

The 2008 financial crisis demonstrated that proper and well–established resolution regime for SIFIs is an urgent need. To set the standards of a proper and well–established resolution regime for SIFIs, considerable effort is shown to advice policymakers worldwide. In terms of SIFI–related issues, to find out possible ways to resolve failing SIFIs quickly without destabilising global financial system and causing minimum harm to taxpayers is the main goal. Recently under the auspices of several international regulatory fora, policymakers and authorities encourage policy actions that contain local–SIFIs as an important step in dealing with SIFIs, since

the issue of complex networks poses a threat in emerging market countries as well. Therefore, initiatives to solve the crisis–related problems on international regulatory fora, involved emerging market countries. In terms of financial stability, the complex networks in interbank markets have been one of the hot topics in banking literature after the 2008 financial crisis which was firstly covered in the novel studies of Freixas et al. (2000) and Allen and Gale (2000). Since then, increasing number of studies focused on network topology in interbank markets. ECB (2010) underscores the importance of the links and connections of the financial system and reiterated the benefits of network theory in this regard.

This chapter examined RRRM of Turkey from a complex network perspective. The study first discussed the topology of the market over 1476 days and examined the potential drivers of connectivity in this market between 4 January 2007 and 28 December 2012. Turkey is an interesting case, since after the 2001 crisis of the country, many national regulatory authorities disregarded complex networks, yet it was noticed that one of the main culprits of the crisis was the complex networks in the local interbank market. Motivated from the scarcity of research in the field and an urgent need for more regulatory measures in Turkish banking system, this chapter has investigated the complex networks in RRRM. The results of the analysis provided important insights on the understanding of financial linkages in the local interbank market in light of country's past experiences.

This chapter explored the interconnections among participants in RRRM by applying several measures derived from graph theory and uncovered a number of microstructure characteristics. The novel data compromises a network which was composed of a total of 1476 days that was participated by 118 institutions, 48 of which are banks and the remaining are mutual and investment funds, and nearly one million financial transactions.

The findings revealed that there occurred a structural change when the CBRT has directly involved in the market. The network shows scale free properties, that is vulnerable to epidemics during financial mayhem. Yet, the recovery process of

the network can be rapid compared to random networks that should be received as a good signal by the policymakers. Money flows directly from the lender to the borrower without intermediaries which is direct result of low clustering coefficient. This finding also compatible with the findings of centrality measures which suggests that the dominant institutions in the market remain the same who directly fund the others in the system. The increasing reciprocity of the network reflects the presence of relationship funding, i.e. participants transact with their peers bilaterally. During 2008 when the financial crisis was in effect and 2011 when the Eurozone crisis was at its peak, the GSCC and Completeness Index show significant decrease. Bearing in mind that decreasing completeness with rising connections increase the risk of contagion, the possibility of contagion is investigated. The results showed that this does not pose significant threat to the system, since the network at these episodes also experience low links and low volume of transactions.

The benefits of network theory in relation to financial stability is certainly to supervise the SIFIs in the system effectively. This chapter revealed that the SIFIs in the market is few but remain unchanged. The findings are robust to different centrality definitions. Hence, the problems with these institutions can easily transmit to the others yet the containment is relatively straightforward due to their unchanged status.

Since financial connections in a network amplify depending on a number of factors like financial and macroeconomic shocks, asset price volatility, liquidity conditions; the long– and short–run effects of several variables on connectivity in RRRM is estimated. This chapter investigated the potential drivers of connectivity based on the connectivity measure computed as the ratio of active links to the number of possible links in an operation day. BIST–100 index, 5–year CDS spreads, volatility of 5–year CDS spreads obtained by a SWARCH model, VIX index, 1–month TRLIBOR rates, bid/cover ratios in repo auctions of CBRT are employed as the potential drivers in the analysis. The results supported the existence of cointegration among the mentioned variables. The regression estimates for the long–run relationship revealed

that domestic economic sentiment proxied by BIST–100 index positively drives the connections in RRRM. In addition to BIST–100 index, VIX index which shows the degree of global risk aversion, bid/cover ratio in repo auctions, the volatility of 5–year CDS spreads and the structural break dummy impact the connectivity statistically significantly and in line with expectations. The findings suggested that, global risk aversion distracts fund flows in the market, whereas the rise in BIST–100 index boost the connectivity. The reason for this can be that during perceived high risk environment both in domestic and global financial markets, the money demand changes which is the stylised facts of this literature. Interestingly, when the participants' demand are not met by the CBRT auctions then the participants who are in need of cash contact to other participants. Another interesting finding suggested that when perceived uncertainty of sovereign credit risk heightens, then the illiquid participants are conducive to borrow more from the other participants. All these results suggested that the connectivity in RRRM is more exposed to developments in international markets rather than domestic markets. Therefore, the CBRT should pay close attention to developments in international markets to manage interconnections in this market.

Researches in the area of financial network analysis focus on modelling the interlinking exposures between market participants. Most of the studies employ simulation exercises to detect important shock transmission mechanisms in the system. Simulation exercises' contribution to this literature have been revealing the parts of the systems which are not considered vulnerable to given adverse scenarios but could still be affected due to their close connections with other participants. Hence, the notion of "cascaded failures" is key in this literature. The trades in a network, however, may be collateralised and may not lead to cascaded failures. Ther can be still concerns about the interconnections since the liquidity drainage due to payment failures can yield harmful effects. The 2001 crisis of Turkey has well proven that a problem directly related to a bank can cause system–wide damages, although the connections in the system is collateralised by government debts. One of the main

contributions of this chapter has been the investigation of the association between connectivity and several other financial and macroeconomic factors in a collateralised debt market. The findings of the chapter shed light on the importance of macroprudential measures which assess the financial sector in its entirety. Policymakers should consider interconnectedness as endogenous to different segments of economy and financial system in their regulatory practices.

The findings have several policy recommendations for policymakers in the country. The results confirm that there are a few SIFIs in RRRM. The close monitoring of these institutions is of critical importance in terms of domestic financial stability. Once considered that the 2001 crisis was triggered by the collapse of a small but systemically relevant bank, the monitoring of interconnections requires further consideration. It should be taken as a positive result that policymakers are now aware of the critical role of interconnections in financial networks. It is found that central bankers are successful in mitigating the factors that could exacerbate the degree of connectivity in RRRM. This chapter showed that the use of network theory has wide applicability to financial networks that was overlooked beforehand. Distress in financial networks can effectively be predicted by the use of network theory.

5 Conclusions, Policy Implications and Future Researches

5.1 Summary of Findings

In the early stages of the 2008 financial crisis, as developed markets were caught by recession, eyes turned to emerging market countries. Although the figures have proven that emerging market economies have outperformed the developed countries to some extent, this does not mean that emerging markets are an utopia. The banking system of these economies is still immature and vulnerable to volatilities in their economies.

As Bolton (2002) argues, banking has been the research area mostly in developed economies, and still, we know relatively less about banking in emerging market countries. This thesis aimed at contributing to literature by investigating Turkish banking system which has shown considerable change in the last decade after the 2001 national crisis. The importance of Turkish economy comes from its growing economy, its geographical proximity to Europe and Asia, and its candidacy to European Union membership that still needs further improvements. Based on these three pillars, it would not be inconsistent if it was argued that the developments in Turkish economy have direct and indirect impacts on the economic relations between the country and peripheral countries. Since the financial system of Turkey is dominated by the banking system, the overall performance of the national economy depends mostly on the banking system. This thesis examined all the sub–sectors of Turkish banking system; namely development banks, Islamic banks, and commercial banks.

The first empirical chapter examined development banking in Turkey with a retrospective outlook. Due to the nature of the role of state in countries, development banks have played a leading role in supporting development since their establishment back in the 19^{th} century. Despite the liberalisation process of the 1980s and 1990s,

development banks have continued to be influential in financing development. In the Turkish case, the performance of development banking in supporting development has varied over time. Yet, we still do not know the role of development banking in the promotion of industrialisation and/or alleviation of regional imbalances.

This chapter found that development loans were primarily distributed to the periphery of the capital city, indicating the significance of proximity on development lending as spatial concentration theory suggests. Having pointed out that the distant provinces of the country are either less developed or highly industrialised, the findings suggest that development banks neither supported industrialisation nor helped alleviation of regional imbalances. The results further revealed that political connection of municipalities to the central government has been influential. The results also suggest that electoral cycle did not significantly affect development banking activities.

The first empirical chapter studied regional commercial loans with the same motivation in development loans. The results demonstrated that, whilst spatial dimension works for regional commercial loan allocation, political connection did not have significant effect. The empirical results also do not demonstrate a concrete relationship between electoral cycle and commercial lending. Differing results of political connection on two distinct banking schemes clearly pointed out how the interactions within politics can shape business in development banks.

The second empirical chapter examined Islamic banking with a comparison to conventional banking in Turkey. This chapter mainly tried to find out whether Islamic banks generate higher returns using their brand names, so–called rent–seeking *Shariah* arbitrage. Once disentangling self–selection bias with several propensity score matching techniques, the results demonstrated that Islamic banks are more profitable than their conventional counterparts.

The results in this chapter showed that the reason for higher profitability is not their asset quality, since the ratio of non–performing loans in total asset portfolio is higher in Islamic banks. The results confirmed the recent findings which suggest

that Islamic banks tend to choose risky loans for high profits the end result of which could be high default rates. This chapter also tested whether higher profitability of Islamic banks was an outcome of the legislative changes in the last decade. The legislative changes that removed certain barriers on Islamic banks could result in higher profitability. By adopting synthetic control methods, this chapter found that the profitability among Islamic banks showed significant deterioration after the legislative changes. These results provide evidence that the legislative changes provided further discipline to Islamic banks in the country.

To support the findings of higher profitability, this chapter examined the market structure in Turkish banking under Islamic banking versus conventional banking duality. The results of Panzar–Rosse models to investigate market competition showed that the market structure in Islamic banking is toward higher degree of monopolistic power especially after the implementation of legislative changes. Then, this chapter concluded that this might further trigger persistent profitability of Islamic banks unless more entries are encouraged.

The third empirical chapter investigated Repo and Reverse Repo Market of Turkey which is a venue for complex bilateral transactions. The market is one of the main platforms in the country where especially commercial banks resort to for their short–term funding needs. The 2008 financial crisis has revealed the vitality of identifying systemically important financial institutions to curb systemic failures in the system. Motivated from the fact that systemically important financial institutions are not solely associated with developed countries but also with emerging market economies, this chapter explored the interconnections in an emerging economy by employing a novel data collected from Repo and Reverse Repo Market.

This chapter first presented the network topologies of the market to better understand the network structure in the market. This chapter then computed several centrality measures to identify the systemically important financial institutions in the market. The results showed that a number of institutions had been persistently in the higher rankings which can be read as these institutions' systemic relevance in

the market. The analysis proposed that network theory can be effectively employed for monitoring the institutions with regards to their systemic relevance. Finally, this chapter examined the long–run relationship between connectivity and several domestic and external factors that are potential drivers of connectivity in the market. The findings suggested that mainly external factors drive the movements in connectivity. The impact of domestic factors is mixed, whereas supply and demand conditions in repo auctions does not statistically affect the connectivity. Once the sample period is split into two sub–samples based on central bank's intervention, the results suggested that the central bank has been successful in alleviating the impact of heightened global risk aversion in the market.

5.2 Policy Implications

The results of these thesis offer several lessons to policymakers both in developed and emerging market countries. In the aftermath of the 2008 crisis, the role of development banks as the tool–kits to lessen the impact of the crisis has been rekindled. The results obtained in the first empirical chapter have several implications for emerging market countries. Although financial liberalisation has reduced the share of development banks in banking business, their importance continues with new tasks. Since the 2008 financial crisis, development banks have been considered to be influential in alleviating adverse social and economic effects of the crisis. The use of development banks for industrial diversification and deepening as well as for social objectives such as the alleviation of poverty and regional imbalances requires a more cautious design of the policies regarding development banking. Although the Turkish experience of development banking needs to be supported by other country experiences, the evidence from Turkey suggests that the impacts of political connection and geographical bias on development lending should be cautiously taken into consideration by policymakers. This consideration becomes more important for emerging market countries where development banking is widely employed for industrialisation.

The findings of second empirical chapter is of vital importance especially since the growth potential of Islamic banks is significant worldwide. There is an active controversy in banking literature to what extent Islamic banks are akin to conventional banks. The academic debate swings between religious commitments or rational preferences, whether or not religious doctrines prevent Islamic banks from providing interest rate embedded financial products and services. Since Islamic banks are accepted to remove interest rate components from their products and services, the differentiated products and services can create huge profit opportunities for Islamic banks in demand–driven Islamic bank market. This phenomenon popularised as *Shariah* arbitrage can be conducive to welfare losses, increasing market power and high inefficiency. The findings of the second empirical chapter provide convincing evidence that *Shariah* arbitrage exists in Turkish banking system. Since there is an increasing interest toward Islamic banking, the findings point out the need for prudential regulations for Islamic banks in the country. To protect wealth transfers from customers to Islamic banks, policymakers should be more vigilant on the actual practices of Islamic banks. As a practical solution to persistent profits in Islamic banking, entry barriers to the sector can be removed. Moreover, the findings which indicate that Turkish Islamic banks have low quality asset portfolio confirm the need for better risk management. The disciplining impact of legislative changes can improve proper risk management in Islamic banks which is deemed to be one of the drawbacks in current Islamic banking practices (see e.g. Akkizidis and Khandelwal, 2008).

The findings of last empirical chapter have several policy implications for emerging and developed countries. Still on–going crisis followed by the collapse of Lehman Brothers is a clear evidence that there is no "silver bullet" when the issue comes to managing contagion risk. Shortly after the incidence, even the best and brightest examples in financial system were left exposed to significant risk stemming from cross–border effects. The contagious effects of the failure of Lehman Brothers have disseminated so rapidly that governments across the world scrambled to combat

the adverse externalities created by the uncertainties in financial markets. Unlike experiences from past global crises, the recent crisis has enabled cross–border co-operation, along with standalone country efforts. The joint initiatives call not only advanced countries but also emerging market countries to cooperation, since it is well accepted that addressing systemic risk at domestic level is still of interest to a wider group of countries. The necessity for more proper monitoring in local interbank markets is an issue of global financial stability since complex networks in local interbank markets can precipitate local banking crisis which can easily spill–over to global markets.

Once considered that Repo and Reverse Repo Market is among the crucial means for the central bank to influence financial markets in Turkey, the findings provide clear policy recommendations for policymakers. The main evidence in this chapter suggests that there are a number of systemically important financial institutions in the market. This finding should motivate policymakers in the country to be more cautious about these institutions' activities. The findings in this chapter also provide evidence that the connectivity in an emerging market economy is vulnerable to external shocks. This finding raises the importance of macroprudential policies that consider measures in the entire form. Even if local authorities are capable of managing domestic risks, they can not escape from the adverse effects of international developments. This chapter also has a more macro lesson regarding the applicability of network theory. Network theory introduces new tools for regulators without discriminating in favour of any country type. Besides their availability as an early warning system, network measures can be used to investigate the aspects of institutions' behaviour in complex networks. Why, when and how institutions transact in complex networks can be observed effectively thanks to network theory.

5.3 Future Researches

This thesis has improved our knowledge about Turkish banking system by examining its three sub–sectors. However, the findings of this thesis encourage potential

directions for future research. Regarding the first empirical chapter, the unavailability of adequate evidence can be overcome by other countries' development banking experiences. Further evidence would enable us to judge development banks from various perspectives.

The theme of the second empirical chapter is also open for further research. In this study, the presence of *Shariah* arbitrage is investigated from banks perspective. The same topic can be investigated from customers perspective as well. For instance, Islamic bank depositors' relation with their banks could provide valuable insights about the presence of *Shariah* arbitrage. If these depositors have weak disciplining power due to their religious commitments, this could imply the existence of *Shariah* arbitrage. The findings can also contribute to the active depositor disciplining literature. Moreover, the impact of regulatory changes could be more informative with new evidences from other country cases.

Finally, the third empirical chapter motivates new research in the literature. The findings about the drivers of connectivity in Turkish markets can be enriched with further evidence from other emerging market countries. The findings from different countries can create new collaboration opportunities for these countries. This study has focused on the system–wise connectivity but has not uncovered the institutions' individual relevance in a financial network. Under different scenarios, the impact of external shocks; e.g. crisis, financial distress etc., on the degree of institutions' interconnectedness can be examined. The findings of such research can show to what extent the extreme events impact individual bank interconnectedness. Moreover, it will be worthwhile to investigate the balance sheet determinants of institutions' propensity to connect in a financial network. Interconnectedness can be considered helpful since the liquidity created by the financial institutions help them to solve liquidity constraints themselves without resorting to central banks' funds. The proliferation of interconnectedness however can be alarming if any failure instigates further failures.

References

Abadie, A., Diamond, A., and Hainmueller, J. (2010). Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program. *Journal of the American Statistical Association*, 105(490):493–505.

Abadie, A. and Gardeazabal, J. (2003). The Economic Costs of Conflict: A Case Study of the Basque Country. *American Economic Review*, 93(1):113–132.

Abdul-Majid, M., Saal, D. S., and Battisti, G. (2010). Efficiency in Islamic and Conventional Banking: An International Comparison. *Journal of Productivity Analysis*, 34(1):25–43.

Abedifar, P., Molyneux, P., and Tarazi, A. (2013). Risk in Islamic Banking. *Review of Finance*, 17(6):2035–2096.

Adrian, T. and Shin, H. S. (2009). The Shadow Banking System: Implications for Financial Regulation. *Financial Stability Review*, (13):1–10.

Agénor, P. R. and Aizenman, J. (2005). Financial Sector Inefficiencies and the Debt Laffer Curve. *International Journal of Finance & Economics*, 10(1):1–13.

Aghion, P., Hémous, D., and Kharroubi, E. (2014). Cyclical Fiscal Policy, Credit Constraints, and Industry Growth. *Journal of Monetary Economics*, 62(C):41–58.

Ahmed, S. and Zlate, A. (2014). Capital Flows to Emerging Market Economies: A Brave New World? *Journal of International Money and Finance*.

Aizenman, J., Binici, M., and Hutchison, M. (2013). Credit Ratings and the Pricing of Sovereign Debt During the Euro Crisis. *Oxford Review of Economic Policy*, 29(3):582–609.

Akalın, G. and Erkişi, K. (2007). Türkiye'de Seçim Ekonomisi Uygulamalarının Geleneksel Oportünist Seçim Çevrimleri Açısından Değerlendirilmesi. *Sosyal Bilimler Dergisi*, 3(5):89–116.

Akdogan, K. and Chadwick, M. G. (2013). Nonlinearities in CDS-Bond Basis. *Emerging Markets Finance and Trade*, 49(3):6–19.

Akkizidis, I. S. and Khandelwal, S. K. (2008). *Financial Risk Management for Islamic Banking and Finance*. Palgrave Macmillan.

Akyurek, C. (2006). The Turkish Crisis of 2001: A Classic? *Emerging Markets Finance and Trade*, 42(1):5–32.

Akyuz, Y. and Boratav, K. (2002). The Making Of The Turkish Financial Crisis. Technical report.

Al-Muharrami, S., Matthews, K., and Khabari, Y. (2006). Market Structure and Competitive Conditions in the Arab GCC Banking System. Cardiff Economics Working Papers E2006/8, Cardiff University, Cardiff Business School, Economics Section.

Albert, R. and Barabási, A. L. (2002). Statistical Mechanics of Complex Networks. *Reviews of Modern Physics*, 74(1):47–97.

Alessandrini, P., Croci, M., and Zazzaro, A. (2005). The Geography of Banking Power: Role of Function Distance. *Banca Nazionale del Lavoro Quarterly Review*, 58(235):129–167.

Allen, F. and Carletti, E. (2013). New Theories to Underpin Financial Reform. *Journal of Financial Stability*, 9(2):242–249.

Allen, F., Carletti, E., and Gale, D. (2009). Interbank Market Liquidity and Central Bank Intervention . *Journal of Monetary Economics*, 56(5):639–652.

Allen, F. and Gale, D. (2000). Financial Contagion. *Journal of Political Economy*, 108(1):1–33.

Allen, F. and Giovannetti, G. (2011). The Effects of the Financial Crisis on Sub-Saharan Africa. *Review of Development Finance*, 1(1):1–27.

Allen, L., Gottesman, A., Saunders, A., and Tang, Y. (2012). The Role of Banks in Dividend Policy. *Financial Management*, 41(3):591–613.

Altug, S., Filiztekin, A., and Pamuk, S. (2008). Sources of Long-term Economic Gowth for Turkey, 1880-2005. *European Review of Economic History*, 12(3):393–430.

Amemiya, T. and MaCurdy, T. E. (1986). Instrumental-Variable Estimation of an Error-Components Model. *Econometrica*, 54(4):869–880.

Amsden, A. (1989). *Asias Next Giant: South Korea and Late Industrialization.* Oxford University Press.

Angelini, P., Maresca, G., and Russo, D. (1996). Systemic Risk in the Netting System. *Journal of Banking & Finance*, 20(5):853–868.

Arce, O., Mayordomo, S., and Pena, J. I. (2013). Credit-Risk Valuation in the Sovereign CDS and Bonds Markets: Evidence from the Euro Area Crisis. *Journal of International Money and Finance*, 35(C):124–145.

Arellano, M. and Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies*, 58(2):277–97.

Arellano, M. and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-components Models. *Journal of Econometrics*, 68(1):29–51.

Armendariz de Aghion, B. (1999). Development Banking. *Journal of Development Economics*, 58(1):83–100.

Athanasoglou, P. P., Brissimis, S. N., and Delis, M. D. (2008). Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability. *Journal of International Financial Markets, Institutions and Money*, 18(2):121–136.

Atiyas, I. and Ersel, H. (1996). The Impact of Financial Reform: The Turkish Experience. In Caprio, G., Atiyas, I., and Hanson, J. A., editors, *Financial*

Reform: Theory and Experience, pages 103–139. Cambridge University Press, Cambridge.

Aysan, A., Disli, M., and Ozturk, H. (2013a). Integration of the Participation Banking Legislations to the Banking Law and its Influence on Competition. *Afro-Eurasian Studies*, 2(1-2):91–110.

Aysan, A. F. and Ceyhan, S. P. (2008). What Determines the Banking Sector Performance in Globalized Financial Markets? The Case of Turkey. *Physica A: Statistical Mechanics and its Applications*, 387(7):1593–1602.

Aysan, A. F., Disli, M., and Schoors, K. (2013b). Bank Competition and Outreach: Evidence from Turkey. *Emerging Markets Finance and Trade*, 49:7–30.

Aysan, A. F., Dolgun, M. H., and Turhan, M. I. (2013c). Assessment of the Participation Banks and Their Role in Financial Inclusion in Turkey. *Emerging Markets Finance and Trade*, 49(S5):99–111.

Aysan, A. F., Fendoglu, S., and Kilinc, M. (2014). Macroprudential Policies as Buffer Against Volatile Cross-Border Capital Flows. Working Papers 2014-04, Central Bank of the Republic of Turkey.

Aysan, A. F., Karakaya, M. M., and Uyanik, M. (2011). Panel Stochastic Frontier Analysis of Profitability and Efficiency of Turkish Banking Sector in the Post Crisis Era. *Journal of Business Economics and Management*, 12(4):629–654.

Bae, K. H., Karolyi, G. A., and Stulz, R. M. (2003). A New Approach to Measuring Financial Contagion. *Review of Financial Studies*, 16(3):717–763.

Bandyopadhyay, R. (1978). Operational Research in Development Banking in India. *European Journal of Operational Research*, 2(1):8–25.

Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *The Quarterly Journal of Economics*, 106(2):407–443.

Barth, J. R., Caprio, G. J., and Levine, R. (2004). Bank Regulation and Supervision: What Works Best? *Journal of Financial Intermediation*, 13(2):205–248.

Barthélemy, M., Barrat, A., Pastor-Satorras, R., and Vespignani, A. (2005). Dynamical Patterns of Epidemic Outbreaks in Complex Heterogeneous Networks. *Journal of Theoretical Biology*, 235(2):275–288.

Bartolini, D. and Fiorillo, F. (2011). Cooperation among Local Councils for the Provision of Public Goods. *Rivista Italiana degli Economisti*, 16(1):85–108.

Basu, S. (1966). *Theory and Practice of Development Banking: A Study in the Asian Context*. Asia Publishing House.

BAT (2008). *50. Yilinda Turkiye Bankalar Birligi ve Turkiye'de Bankacilik Sistemi"1958-2007"*. Banks Association of Turkey, Istanbul, Turkey.

Baum, C. (2001). Residual Diagnostics for Cross-section Time Series Regression Models. *Stata Journal*, 1(1):101–104.

Baum, C. and Wan, C. (2010). Macroeconomic Uncertainty and Credit Default Swap Spreads. *Applied Financial Economics*, 20(15):1163–1171.

Baum, C. F., Caglayan, M., and Talavera, O. (2010). Parliamentary election cycles and the Turkish banking sector. *Journal of Banking & Finance*, 34(11):2709–2719.

Beck, T., Demirgüç-Kunt, A., and Merrouche, O. (2013). Islamic vs. Conventional Banking: Business Model, Efficiency and Stability. *Journal of Banking & Finance*, 37(2):433–447.

Beck, T., Levine, R., and Loayza, N. (2000). Finance and the Sources of Growth. *Journal of Financial Economics*, 58(1-2):261–300.

Becker, S. O. and Ichino, A. (2002). Estimation of Average Treatment Effects Based on Propensity Scores. *Stata Journal*, 2(4):358–377.

Bencivenga, V. R. and Smith, B. D. (1991). Financial Intermediation and Endogenous Growth. *Review of Economic Studies*, 58(2):195–209.

Bennaceur, S. and Goaied, M. (2008). The Determinant of Commercial Bank Interest Margin and Profitability: Evidence from Tunisia. *Frontiers in Finance and Economics*, 5(1):106–130.

Berger, A., Klapper, L., and Turk-Ariss, R. (2009). Bank Competition and Financial Stability. *Journal of Financial Services Research*, 35(2):99–118.

Berger, A. N. (1995). The Profit-Structure Relationship in Banking–Tests of Market-Power and Efficient-Structure Hypotheses. *Journal of Money, Credit and Banking*, 27(2):404–31.

Berger, A. N., Bonime, S. D., Covitz, D. M., and Hancock, D. (2000). Why are Bank Profits So Persistent? The Roles of Product Market Competition, Informational Opacity, and Regional Macroeconomic Shocks. *Journal of Banking & Finance*, 24(7):1203–1235.

Berger, A. N., Hanweck, G. A., and Humphrey, D. B. (1987). Competitive Viability in Banking : Scale, Scope, and Product Mix Economies. *Journal of Monetary Economics*, 20(3):501–520.

Berger, A. N., Miller, N. H., Petersen, M. A., Rajan, R. G., and Stein, J. C. (2005). Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks. *Journal of Financial Economics*, 76(2):237–269.

Bhagwati, J. N. (1982). Directly Unproductive, Profit-Seeking Activities. *Journal of Political Economy*, 90(5):988–1002.

Bikker, J. A. and Haaf, K. (2002). Competition, concentration and their relationship: An empirical analysis of the banking industry. *Journal of Banking & Finance*, 26(11):2191–2214.

Bikker, J. A., Shaffer, S., and Spierdijk, L. (2012). Assessing Competition with the Panzar-Rosse Model: The Role of Scale, Costs, and Equilibrium. *The Review of Economics and Statistics*, 94(4):1025–1044.

Black, D. and Henderson, V. (1999). Spatial Evolution of Population and Industry in the United States. *The American Economic Review*, 89(2):321–327.

Blundell, R. and Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics*, 87(1):115–143.

Blundell-Wignall, A. and Atkinson, P. (2009). Origins of the Financial Crisis and Requirements for Reform. *Journal of Asian Economics*, 20(5):536–548.

Bolton, P. (2002). Banking in Emerging Markets. *Journal of Financial Intermediation*, 11(4):362–365.

Bonacich, P. (1972). Factoring and Weighting Approaches to Status Scores and Clique Identification. *Journal of Mathematical Sociology*, 2(1):113–120.

Boskey, S. (1961). *Problems and Practices of Development Banks*. The John Hopkins Press, published for The International Bank for Reconstruction and Development.

Boss, M., Elsinger, H., Summer, M., and Thurner, S. (2004). Network Topology of the Interbank Market. *Quantitative Finance*, 4(6):677–684.

Bosworth, B. P., Collins, S. M., and Reinhart, C. M. (1999). Capital Flows to Developing Economies: Implications for Saving and Investment. *Brookings Papers on Economic Activity*, 1999(1):143–180.

Brafu-Insaidoo, W. and Biekpe, N. (2011). International Capital Flows and Investment Volatility in Selected Sub-Saharan African Countries. *Review of Development Finance*, 1(3):223–228.

Bresnahan, T. F. (1982). The Oligopoly Solution Concept is Identified. *Economics Letters*, 10(1-2):87–92.

Brevoort, K. P. and Wolken, J. D. (2008). Does Distance Matter in Banking? Technical report.

Brown, C. O. and Dinc, I. S. (2005). The Politics of Bank Failures: Evidence from Emerging Markets. *The Quarterly Journal of Economics*, 120(4):1413–1444.

Bruck, N. (2002). *The Role of Development Banks in the Twenty First Century*, volume 3 of *Principles and Practices of Development Banking*. Association of Development Financing Institutions in Asia and the Pacific/Institute of Development Finance (ADFIAP/IDF), Manila.

Brunnermeier, M. K. and Pedersen, L. H. (2009). Market Liquidity and Funding Liquidity. *Review of Financial Studies*, 22(6):2201–2238.

Caballero, R. J. (2010). Macroeconomics After the Crisis: Time to Deal with the Pretense-of-Knowledge Syndrome. *Journal of Economic Perspectives*, 24(4):85–102.

Caceres, C. and Unsal, D. F. (2013). Sovereign Spreads and Contagion Risks in Asia. *Asian Economic Journal*, 27(3):219–243.

Cajueiro, D. O. and Tabak, B. M. (2008). The Role of Banks in the Brazilian Interbank Market: Does Bank Type Matter? *Physica A: Statistical Mechanics and its Applications*, 387(27):6825–6836.

Caliendo, M. and Kopeinig, S. (2008). Some Practical Guidance For The Implementation Of Propensity Score Matching. *Journal of Economic Surveys*, 22(1):31–72.

Cameron, R. (1972). *Banking and Economic Development: Some Lessons of History*. Oxford University Press.

Cameron, R. E. (1953). The Crédit Mobilier and the Economic Development of Europe. *Journal of Political Economy*, 61(6):461–488.

Canuto, O. and Ghosh, S. (2013). Dealing with the Challenges of Macro Financial Linkages in Emerging Markets. *World Bank - Economic Premise*, (129):1–8.

Caprio, G. and Martinez-Peria, M. S. (2002). Avoiding Disaster: Policies to Reduce the Risk of Banking Crises. In *Monetary Policy and Exchange Rate Regimes: Options for the Middle East*, pages 193–230. Cairo: Egyptian Centre for Economic Studies.

Carbó, S., Humphrey, D., Maudos, J., and Molyneux, P. (2009). Cross-Country Comparisons of Competition and Pricing Power in European Banking. *Journal of International Money and Finance*, 28(1):115–134.

Carvalho, D. (2010). The Real Effects of Government-Owned Banks: Evidence from an Emerging Market. Technical report, Marshal Business School, University of Southern California, Los Angeles.

Casu, B. and Girardone, C. (2009). Competition Issues in European Banking. *Journal of Financial Regulation and Compliance*, 17(2):119–133.

Catte, P., Cova, P., Pagano, P., and Visco, I. (2011). The Role of Macroeconomic Policies in the Global Crisis. *Journal of Policy Modeling*, 33(6):787–803.

Celebioglu, F. and Dallerba, S. (2010). Spatial Disparities Across the Regions of Turkey: An Exploratory Spatial Data Analysis. *The Annals of Regional Science*, 45(2):379–400.

Celik, G. (2013). Türkiye Bankalararası Ödeme Sisteminin Ağ Teorisi Yöntemiyle İncelenmesi . Expertise thesis, The Central Bank of Turkey.

Cetorelli, N. and Gambera, M. (2001). Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry Data. *The Journal of Finance*, 56(2):617–648.

Chakravarty, S. R. and Pal, R. (2013). Financial Inclusion in India: An Axiomatic Approach. *Journal of Policy Modeling*, 35(5):813–837.

Chong, B. S. and Liu, M.-H. (2009). Islamic Banking: Interest-free or Interest-based? *Pacific-Basin Finance Journal*, 17(1):125–144.

Claessens, S., Dell'Ariccia, G., Igan, D., and Laeven, L. (2010). Cross-Country Experiences and Policy Implications from the Global Financial Crisis. *Economic Policy*, 25:267–293.

Claessens, S., Feijen, E., and Laeven, L. (2008). Political Connections and Preferential Access to Finance: The Role of Campaign Contributions. *Journal of Financial Economics*, 88(3):554–580.

Clarke, J. A. and Mirza, S. (2006). A Comparison of Some Common Methods for Detecting Granger Noncausality. *Journal of Statistical Computation and Simulation*, 76(3):207–231.

Clauset, A., Shalizi, C. R., and Newman, M. E. J. (2009). Power-Law Distributions in Empirical Data. *SIAM Review*, 51(4):661–703.

Cocco, J. F., Gomes, F. J., and Martins, N. C. (2009). Lending Relationships in the Interbank Market. *Journal of Financial Intermediation*, 18(1):24–48.

Coccorese, P. (2009). Market Power in Local Banking Monopolies. *Journal of Banking & Finance*, 33(7):1196–1210.

Cole, S. (2009a). Financial Development, Bank Ownership, and Growth: Or, Does Quantity Imply Quality? *The Review of Economics and Statistics*, 91(1):33–51.

Cole, S. (2009b). Fixing Market Failures or Fixing Elections? Agricultural Credit in India. *American Economic Journal: Applied Economics*, 1(1):219–250.

Collender, R. N. and Shaffer, S. (2003). Local Bank Office Ownership, Deposit Control, Market Structure, and Economic Growth. *Journal of Banking & Finance*, 27(1):27–57.

Coskun, Y. (2012). Repo and Reverse Repo Regulations in Turkey: Emergence of Regulations After 1982 Banking Crisis and Policy Suggestions in the Light of Financial Failure Lessons. *Business and Economics Research Journal*, 3(1):90.

Cowen, T., Glazer, A., and McMillan, H. (1994). Rent Seeking Can Promote The Provision of Public Goods. *Economics & Politics*, 6(2):131–145.

Dallas, L. L. (2012). Short-Termism, The Financial Crisis, and Corporate Governance. *Journal of Corporation Law*, 37(2):265–364.

Dang, Y. and Li, W. (2011). Comparative Analysis on Weighted Network Structure of Air Passenger Flow of China and US. *Journal of Transportation Systems Engineering and Information Technology*, 11(3):156–162.

Dasgupta, A. (2004). Financial Contagion Through Capital Connections: A Model of the Origin and Spread of Banking Panics. *Journal of the European Economic Association*, 2(6):1015–1048.

De Jonghe, O. and Vennet, R. V. (2008). Competition versus Efficiency: What Drives Franchise Values in European Banking? *Journal of Banking & Finance*, 32(9):1820–1835.

Degryse, H. and Nguyen, G. (2007). Interbank Exposures: An Empirical Examination of Contagion Risk in the Belgian Banking System. *International Journal of Central Banking*, 3(2):123–171.

Degryse, H. and Ongena, S. (2005). Distance, Lending Relationships, and Competition. *Journal of Finance*, 60(1):231–266.

Demirgüç-Kunt, A. and Detragiache, E. (1998). The Determinants of Banking Crises in Developing and Developed Countries. *IMF Staff Papers*, 45(1):81–109.

Demsetz, H. (1973). Industry Structure, Market Rivalry, and Public Policy. *Journal of Law and Economics*, 16(1):1–9.

Denizer, C. (1997). The Effects of Financial Liberalization and New Bank Entry on Market Structure and Competition in Turkey. Policy Research Working Paper Series 1839, The World Bank.

Diamond, W. (1957). *Development Banks*. World Bank Research Publications. Johns Hopkins Press.

Dinc, I. S. (2005). Politicians and Banks: Political Influences on Government-owned Banks in Emerging Markets. *Journal of Financial Economics*, 77(2):453–479.

Disli, M., Schoors, K., and Meir, J. (2013). Political Connections and Depositor Discipline. *Journal of Financial Stability*, 9(4):804–819.

Dorogovtsev, S. N., Mendes, J. F. F., and Samukhin, A. N. (2001). Giant Strongly Connected Component of Directed Networks. *Physical Review Letters*, 64:025101R.

Dow, S. C. (1987). The Treatment of Money in Regional Economics. *Journal of Regional Science*, 27(1):13–24.

Drukker, D. M. (2003). Testing For Serial Correlation in Linear Panel-data Models. *Stata Journal*, 3(2):168–177.

Duch, R. M. and Kellstedt, P. M. (2011). The Heterogeneity of Consumer Sentiment in an Increasingly Homogenous Global Economy. *Electoral Studies*, 30(3):399 – 405. Special Symposium on the Politics of Economic Crisis.

Dumontaux, N. and Pop, A. (2013). Understanding the Market Reaction to Shockwaves: Evidence from the Failure of Lehman Brothers. *Journal of Financial Stability*, 9(3):269–286.

Dungey, M., Fry, R., Gonzalez-Hermosillo, B., and Martin, V. (2006). Contagion in International Bond Markets During the Russian and the LTCM Crises. *Journal of Financial Stability*, 2(1):1–27.

Duttagupta, R. and Cashin, P. (2011). Anatomy of Banking Crises in Developing and Emerging Market Countries. *Journal of International Money and Finance*, 30(2):354–376.

Duygun, M., Sena, V., and Shaban, M. (2014). Trademarking Status and Economic Efficiency among Commercial Banks: Some Evidence for the UK. *Journal of Banking & Finance*.

Ebrahim, M. S. and Safadi, A. (1995). Behavioral Norms in the Islamic Doctrine of Economics: A Comment. *Journal of Economic Behavior & Organization*, 27(1):151–157.

ECB (2010). Recent Advances in Modelling Systemic Risk Using Network Analysis. Technical report, European Central Bank.

El-Gamal, M. (2006). *Islamic finance: Law, Economics and Practice*. Cambridge Universtiy Press: New York.

El-Gamal, M. A. (2007). Mutuality as an Antidote to Rent-Seeking Shariah Arbitrage in Islamic Finance. *Thunderbird International Business Review*, 49(2):187–202.

Elnahass, M., Izzeldin, M., and Abdelsalam, O. (2013). Loan Loss Provisions, Bank Valuations and Discretion: A Comparative Study Between Conventional and Islamic Banks. *Journal of Economic Behavior & Organization*.

Engle, R. F. and Granger, C. W. J. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, 55(2):251–276.

Eren, O. (2007). Measuring the Union-Nonunion Wage Gap Using Propensity Score Matching. *Industrial Relations: A Journal of Economy and Society*, 46(4):766–780.

Ergec, E. H. and Arslan, B. G. (2013). Impact of Interest Rates on Islamic and Conventional Banks: The Case of Turkey. *Applied Economics*, 45(17):2381–2388.

Ernst & Young (December 2012). Growing Beyond: DNA of Successful Transformation. Ernst & Young.

Essers, D. (2013). Developing Country Vulnerability in Light of the Global Financial Crisis: Shock Therapy? *Review of Development Finance*, 3(2):61 – 83.

Evans, M. (1991). Discovering the Link Between Inflation Rates and Inflation Uncertainty. *Journal of Money, Credit and Banking*, 23(2):169–184.

Farrell, J. and Klemperer, P. (2007). Coordination and Lock-in: Competition with Switching Costs and Network Effects. *Handbook of Industrial Organization*, 3:1967–2072.

Fatum, R. and Hutchison, M. M. (2010). Evaluating Foreign Exchange Market Intervention: Self-Selection, Counterfactuals and Average Treatment Effects. *Journal of International Money and Finance*, 29(3):570–584.

Fender, I., Hayo, B., and Neuenkirch, M. (2012). Daily Pricing of Emerging Market Sovereign CDS Before and During the Global Financial Crisis. *Journal of Banking & Finance*, 36(10):2786–2794.

Fisher, F. M. (1985). The Social Costs of Monopoly and Regulation: Posner Reconsidered. *Journal of Political Economy*, 93(2):410–416.

Forbes, K. J. and Rigobon, R. (2002). No Contagion, Only Interdependence: Measuring Stock Market Comovements. *Journal of Finance*, 57(5):2223–2261.

Francis, B. B., Hasan, I., and Sun, X. (2009). Political Connections and the Process of Going Public: Evidence from China. *Journal of International Money and Finance*, 28(4):696–719.

Freixas, X., Parigi, B. M., and Rochet, J.-C. (2000). Systemic Risk, Interbank Relations, and Liquidity Provision by the Central Bank. *Journal of Money, Credit and Banking*, 32(3):611–638.

Freixas, X. and Rochet, J. (2008). *Microeconomics of Banking*. Mit Press.

FSB (2012). Extending the G-SIFI Framework to Domestic Systemically Important Banks. Progress Report to G-20 Ministers and Governors, Financial Stability Board.

Gai, P., Haldane, A., and Kapadia, S. (2011). Complexity, Concentration and Contagion. *Journal of Monetary Economics*, 58(5):453–470.

García-Herrero, A., Gavilá, S., and Santabárbara, D. (2009). What Explains the Low Profitability of Chinese banks? *Journal of Banking & Finance*, 33(11):2080–2092.

Garlaschelli, D. and Loffredo, M. I. (2004). Patterns of Link Reciprocity in Directed Networks. *Physical Review Letters*, 93:268701–268704.

Garner, J. M. (2013). A Critical Perspective on the Principles of Islamic Finance Focusing on Sharia Compliance and Arbitrage. *Leeds Journal of Law & Criminology*, 1(1):69–90.

Gelos, R. G. and Roldos, J. (2004). Consolidation and Market Structure in Emerging Market Banking Systems. *Emerging Markets Review*, 5(1):39–59.

Georg, C. P. (2013). The Effect of the Interbank Network Structure on Contagion and Common Shocks . *Journal of Banking & Finance*, 37(7):2216 – 2228.

George Assaf, A., Matousek, R., and Tsionas, E. G. (2013). Turkish Bank Efficiency: Bayesian Estimation with Undesirable Outputs. *Journal of Banking & Finance*, 37(2):506–517.

Gerlach, S. and Smets, F. (1995). Contagious Speculative Attacks. *European Journal of Political Economy*, 11(1):45–63.

Gerschenkron, A. (1962). *Economic Backwardness in Historical Perspective, A Book of Essays*. Harvard Universtiy Press: Cambridge, MA.

Gezici, F. and Hewings, G. J. D. (2007). Spatial Analysis of Regional Inequalities in Turkey. *European Planning Studies*, 15(3):383–403.

Gischer, H. and Stiele, M. (2009). Competition Tests with a Non-Structural Model: the Panzar-Rosse Method Applied to Germany's Savings Banks. *German Economic Review*, 10:50–70.

Goddard, J. and Wilson, J. O. (2009). Competition in Banking: A Disequilibrium Approach. *Journal of Banking & Finance*, 33(12):2282 – 2292.

Goldsmith, R. W. (1969). *Financial Structure and Development*. Yale Universtiy Press: New Heaven, CT.

Goldstein, I. and Pauzner, A. (2005). Demand Deposit Contracts and the Probability of Bank Runs. *The Journal of Finance*, 60(3):1293–1327.

Greenwood, J. and Jovanovic, B. (1990). Financial Development, Growth, and the Distribution of Income. *Journal of Political Economy*, 98(5):1076–1107.

Gropp, R., Duca, M. L., and Vesala, J. (2009). Cross-Border Bank Contagion in Europe. *International Journal of Central Banking*, 5(1):97–139.

Gunalp, B. and Celik, T. (2006). Competition in the Turkish Banking Industry. *Applied Economics*, 38(11):1335–1342.

Gup, B. (2004). *Too Big to Fail: Policies and Practices in Government Bailouts*. ABC–Clio E–book. Praeger.

Gupta, S., Clements, B., Bhattacharya, R., and Chakravarti, S. (2004). Fiscal Consequences of Armed Conflict and Terrorism in Low and Middle Income Countries. *European Journal of Political Economy*, 20(2):403–421.

Hamilton, J. and Susmel, R. (1994). Autoregressive Conditional Heteroskedasticity and Changes in Regime. *Journal of Econometrics*, 64(1-2):307–333.

Hamilton, J. D. (1989). A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle. *Econometrica*, 57(2):357–84.

Hansen, L. P. (1982). Large Sample Properties of Generalized Method of Moments Estimators. *Econometrica*, 50(4):1029–1054.

Hardy, L. (2012). The Evolution of Participation Banking in Turkey. *Online Journal on Southwest Asia and Islamic Civilization*, Winter 2012.

Harrigan, F. J. and McGregor, P. G. (1987). Interregional Arbitrage And The Supply Of Loanable Funds: A Model Of Intermediate Financial Capital Mobility. *Journal of Regional Science*, 27(3):357–367.

Hasan, M. and Dridi, J. (2011). The Effects of The Global Crisis on Islamic and Conventional Banks: A Comparative Study. *Journal of International Commerce, Economics and Policy*, 2(02):163–200.

Hausman, J. A. and Taylor, W. E. (1981). Panel Data and Unobservable Individual Effects. *Econometrica*, 49(6):1377–1398.

Heper, M. (1989). *Local Government in Turkey: Governing Greater Istanbul*. Routledge, London, UK.

Hermann, F. (2010). Development Banks in the Financial Liberalization Era: The Case of BNDES in Brazil. *Cepal Review*, 100:189–203.

Huizinga, H. and Laeven, L. (2009). Accounting Discretion of Banks During a Financial Crisis. CEPR Discussion Papers 7381, C.E.P.R. Discussion Papers.

Hutchinson, R. W. and McKillop, D. G. (1990). Regional Financial Sector Models: An Application to the Northern Ireland Financial Sector . *Regional Studies*, 24(5):421–431.

Iannotta, G., Nocera, G., and Sironi, A. (2007). Ownership Structure, Risk and Performance in the European Banking Industry. *Journal of Banking & Finance*, 31(7):2127–2149.

Iatridis, G. (2012). Terrorist Attacks and Company Financial Numbers: Evidence on Earnings Management and Value Relevance from Madrid, London and Istanbul. *Research in International Business and Finance*, 26(2):204–220.

Imakubo, K. and Soejima, Y. (2010). The Transaction Network in Japanfs Interbank Money Markets. *Monetary and Economic Studies*, 28:107–150.

Imbens, G. W. (2003). Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review. NBER Technical Working Papers 0294, National Bureau of Economic Research, Inc.

IMF (2006). *World Economic Outlook, April 2007: Spillovers and Cycles in the Global Economy*. World Economic Outlook. Internatinoal Monetary Fund.

Inanoglu, H. and El-Gamal, M. A. (2005). Inefficiency and Heterogeneity in Turkish Banking: 1990-2000. *Journal of Applied Econometrics*, 20(5):641–664.

Iori, G., De Masi, G., Precup, O. V., Gabbi, G., and Caldarelli, G. (2008). A Network Analysis of the Italian Overnight Money Market. *Journal of Economic Dynamics and Control*, 32(1):259–278.

Iqbal, M. (2001). Islamic and Conventional Banking in the Nineties: A Comparative Study. *Islamic Economic Studies*, 8(2):1–27.

Ishi, K., Fujita, K., and Stone, M. R. (2011). Should Unconventional Balance Sheet Policies be Added to the Central Bank Toolkit? A Review of the Experience So Far. IMF Working Papers 11/145, International Monetary Fund.

Isik, I. and Hassan, M. K. (2002). Technical, Scale and Allocative Efficiencies of Turkish Banking Industry. *Journal of Banking & Finance*, 26(4):719–766.

Isik, I. and Hassan, M. K. (2003a). Efficiency, Ownership and Market Structure, Corporate Control and Governance in the Turkish Banking Industry. *Journal of Business Finance & Accounting*, 30(9-10):1363–1421.

Isik, I. and Hassan, M. K. (2003b). Financial Deregulation and Total Factor Productivity Change: An Empirical Study of Turkish Commercial Banks. *Journal of Banking & Finance*, 27(8):1455–1485.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica*, 59(6):1551–1580.

Johansen, S. and Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration–With Applications to the Demand for Money. *Oxford Bulletin of Economics and Statistics*, 52(2):169–210.

Jorion, P. (2000). Risk Management Lessons from Long–Term Capital Management. *European Financial Management*, 6(3):277–300.

Kares, A., Schoors, K., and Lanine, G. (2008). Liquidity Matters: Evidence from the Russian Interbank Market. BOFIT Discussion Papers 19/2008, Bank of Finland, Institute for Economies in Transition.

Kazgan, G. (1994). *Tanzimattan XX Yuzyila Turkiye Ekonomisi*. Altin Kitaplar, Istanbul, Turkey.

Keller, C., Kunzel, P., and Souto, M. (2007). Measuring Sovereign Risk in Turkey. IMF Working Papers 07/233, International Monetary Fund.

Khan, F. (2010). How 'Islamic' is Islamic Banking? *Journal of Economic Behavior & Organization*, 76(3):805–820.

Khan, M. S. (1986). Islamic Interest-Free Banking: A Theoretical Analysis. *Staff Papers - International Monetary Fund*, 33(1):1–27.

Khan, M. S. and Mirakhor, A. (1990). Islamic Banking: Experiences in the Islamic Republic of Iran and in Pakistan. *Economic Development and Cultural Change*, 38(2):353–375.

Khwaja, A. I. and Mian, A. (2005). Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market. *The Quarterly Journal of Economics*, 120(4):1371–1411.

Kia, A. and Darrat, A. F. (2007). Modeling Money Demand Under the Profit-Sharing Banking Scheme: Some Evidence on Policy Invariance and Long-Run Stability. *Global Finance Journal*, 18(1):104–123.

King, R. G. and Levine, R. (1993). Finance, Entrepreneurship and Growth: Theory and Evidence. *Journal of Monetary Economics*, 32(3):513–542.

Klagge, B. and Martin, R. (2005). Decentralized versus Centralized Financial Systems: Is There A Case for Local Capital Markets? *Journal of Economic Geography*, 5(4):387–421.

Kormendi, R. C. and Meguire, P. G. (1985). Macroeconomic Determinants of Growth: Cross-Country Evidence. *Journal of Monetary Economics*, 16(2):141–163.

Krause, A. and Giansante, S. (2012). Interbank Lending and the Spread of Bank Failures: A Network Model of Systemic Risk. *Journal of Economic Behavior & Organization*, 83(3):583–608.

Krueger, A. O. (1974). The Political Economy of the Rent-Seeking Society. *The American Economic Review*, 64(3):291–303.

Krueger, A. O. and Tuncer, B. (1982). Growth of Factor Productivity in Turkish Manufacturing Industries. *Journal of Development Economics*, 11(3):307–325.

Kucukkocaoglu, G., Unalmis, D., and Unalmis, I. (2013). How Do Banks' Stock Returns Respond to Monetary Policy Committee Announcements in Turkey? Evidence from Traditional versus New Monetary Policy Episodes. *Economic Modelling*, 35(C):536–545.

Kuran, T. (1983). Behavioral Norms in the Islamic Doctrine of Economics : A Critique. *Journal of Economic Behavior & Organization*, 4(4):353–379.

Kuran, T. (1993). The Economic Impact of Islamic Fundamentalism. In Marty, M. and Appleby, R., editors, *Fundamentalisms and the State: Remaking Polities, Economies, and Militance*. University of Chicago Press, Chicago.

Kuran, T. (2004). *Islam and Mammon: The Economic Predicaments of Islamism*. Princeton University Press.

Kuzubas, T. U., Omercikolu, I., and Saltoglu, B. (2014). Network Centrality Measures and Systemic Risk: An Application to the Turkish Financial Crisis. *Physica A: Statistical Mechanics and its Applications*, 405:203–215.

La Porta, R., Lopez-De-Silanes, F., and Shleifer, A. (2002). Government Ownership of Banks. *The Journal of Finance*, 57(1):265–301.

La Porta, R., Lopez-De-Silanes, F., and Zamarripa, G. (2003). Related Lending. *The Quarterly Journal of Economics*, 118(1):231–268.

Laeven, L. (2001). Insider Lending and Bank Ownership: The Case of Russia. *Journal of Comparative Economics*, 29(2):207–229.

Lago-Fernández, L., Huerta, R., Corbacho, F., and Sigenza, J. (2000). Fast Response and Temporal Coherent Oscillations in Small–World Networks. *Physical Review Letters*, 84(12):2758–2761.

Lau, L. J. (1982). On Identifying the Degree of Competitiveness from Industry Price and Output Data. *Economics Letters*, 10(1-2):93–99.

Lee, C. C. and Hsieh, M. F. (2014). Bank Reforms, Foreign Ownership, and Financial Stability. *Journal of International Money and Finance*, 40(C):204–224.

Lee, S. H. (2013). Systemic Liquidity Shortages and Interbank Network Structures. *Journal of Financial Stability*, 9(1):1–12.

Lenzu, S. and Tedeschi, G. (2012). Systemic Risk on Different Interbank Network Topologies. *Physica A: Statistical Mechanics and its Applications*, 391(18):4331 – 4341.

Leuvensteijn, M. V., Bikker, J., van Rixtel, A., and Sorensen, C. K. (2011). A New Approach to Measuring Competition in the Loan Markets of the Euro Area. *Applied Economics*, 43(23):3155–3167.

Levine, R. (1991). Stock Markets, Growth, and Tax Policy. *Journal of Finance*, 46(4):1445–1465.

Levine, R., Loayza, N., and Beck, T. (2000). Financial Intermediation and Growth: Causality and Causes. *Journal of Monetary Economics*, 46(1):31–77.

Levine, R. and Zervos, S. (1998). Stock Markets, Banks, and Economic Growth. *American Economic Review*, 88(3):537–58.

Li, M. (2013). Using the Propensity Score Method to Estimate Causal Effects: A Review and Practical Guide. *Organizational Research Methods*, 16(2):188–226.

Li, S., He, J., and Zhuang, Y. (2010). A Network Model of the Interbank Market. *Physica A: Statistical Mechanics and its Applications*, 389(24):5587–5593.

Longstaff, F. A., Pan, J., Pedersen, L. H., and Singleton, K. J. (2011). How Sovereign Is Sovereign Credit Risk? *American Economic Journal: Macroeconomics*, 3(2):75–103.

Markose, S., Giansante, S., and Shaghaghi, A. R. (2012). "Too Interconnected to Fail" Financial Network of US CDS Market: Topological Fragility and Systemic Risk. *Journal of Economic Behavior & Organization*, 83(3):627–646.

Martin, R. and Minns, R. (1995). Undermining the Financial Basis of Regions: The Spatial Structure and Implications of the UK Pension Fund System. *Regional Studies*, 29(2):125–144.

Martinez-Jaramillo, S., Alexandrova-Kabadjova, B., Bravo-Benitez, B., and Solorzano-Margain, J. P. (2012). An Empirical Study of the Mexican Banking System's Network and its Implications for Systemic Risk. Working Papers 2012-07, Banco de México.

Martinez Peria, M. S. (2001). Do Depositors Punish Banks for Bad Behavior? Market Discipline, Deposit Insurance, and Banking Crises. *Journal of Finance*, 56(3):1029–1051.

Maudos, J. and de Guevara, J. F. (2007). The Cost of Market Power in Banking: Social Welfare Loss vs. Cost Inefficiency. *Journal of Banking & Finance*, 31(7):2103–2125.

McKinnon, R. (1973). *Money and Capital in Economic Development*. Washington, DC: Brookings Institution.

Memmel, C. and Sachs, A. (2013). Contagion in the Interbank Market and Its Determinants. *Journal of Financial Stability*, 9(1):46–54.

Micco, A. and Panizza, U. (2006). Bank Ownership and Lending Behavior. *Economics Letters*, 93(2):248–254.

Micco, A., Panizza, U., and Yanez, M. (2007a). Bank Ownership and Performance. Does Politics Matter? *Journal of Banking & Finance*, 31(1):219–241.

Micco, A., Panizza, U., and Yanez, M. (2007b). Bank Ownership and Performance. Does Politics Matter? *Journal of Banking & Finance*, 31(1):219–241.

Michelle, N.C.and Wheelock, D. (1997). Why Does Bank Performance Vary Across States? *Review*, (3):27–40.

Modigliani, F. and Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, 48(3):261–297.

Moore, C. L. and Hill, J. M. (1982). Interregional Arbitrage and the Supply of Loanable Funds. *Journal of Regional Science*, 22(4):499–512.

Mundlak, Y. (1978). On the Pooling of Time Series and Cross Section Data. *Econometrica*, 46(1):69–85.

Narayan, S. and Narayan, P. K. (2004). Determinants of Demand for Fiji's Exports: An Empirical Investigation. *The Developing Economies*, 42(1):95–112.

Nier, E., Yang, J., Yorulmazer, T., and Alentorn, A. (2007). Network Models and Financial Stability. *Journal of Economic Dynamics and Control*, 31(6):2033–2060.

Nordhaus, W. D. (1975). The Political Business Cycle. *The Review of Economic Studies*, 42(2):pp. 169–190.

Nurkse, R. (1966). *Problems of Capital Formation in Underdeveloped Countries*. Oxford University Press.

Odedokun, M. O. (1996). International Evidence on the Effects of Directed Credit Programmes on Efficiency of Resource Allocation in Developing Countries: The Case of Development Bank Lendings. *Journal of Development Economics*, 48(2):449–460.

Onder, Z. and Ozyildirim, S. (2011). Political Connection, Bank Credits and Growth: Evidence from Turkey. *The World Economy*, 34(6):1042–1065.

Onis, Z. and Guven, A. B. (2011). Global Crisis, National Responses: The Political Economy of Turkish Exceptionalism. *New Political Economy*, 16(5):585–608.

Opsahl, T., Agneessens, F., and Skvoretz, J. (2010). Node Centrality in Weighted Networks: Generalizing Degree and Shortest Paths. *Social Networks*, 32(3):245–251.

Ozyildirim, S. and Onder, Z. (2008). Banking Activities and Local Output Growth: Does Distance from Centre Matter? *Regional Studies*, 42(2):229–244.

Öztürk, H., Gültekin-Karakaş, D., and Hisarciklilar, M. (2010). The Role Of Development Banking In Promoting Industrialization In Turkey. *Region et Developpement*, 32:153–178.

Padin, J. A. (2003). Puerto Rico in the Post War: Liberalized Development Banking and the Fall of the Fifth Tiger . *World Development*, 31(2):281–301.

Page, L., Brin, S., Motwani, R., and Winograd, T. (1999). The PageRank Citation Ranking: Bringing Order to the Web. Technical Report 1999-66, Stanford InfoLab.

Panzar, J. and Rosse, J. (1977). *Chamberlin Versus Robinson: An Empirical Test for Monopoly Rents*. Studies in industry economics research paper. Workshop on Applied Microeconomics, Industrial Organization, and Regulation, Department of Economics, Stanford Univ.

Panzar, J. C. and Rosse, J. N. (1987). Testing For Monopoly Equilibrium. *The Journal of Industrial Economics*, 35(4):pp. 443–456.

Park, A. and Sehrt, K. (2001). Tests of Financial Intermediation and Banking Reform in China. *Journal of Comparative Economics*, 29(4):608–644.

Park, J. Y. (1992). Canonical Cointegrating Regressions. *Econometrica*, 60(1):119–143.

Pazarbasioglu, C., Laeven, L., Nedelescu, O. M., Claessens, S., Valencia, F., Dobler, M., and Seal, K. (2011). Crisis Management and Resolution: Early Lessons from the Financial Crisis. IMF Staff Discussion Notes 11/05, International Monetary Fund.

Pesaran, H. H. and Shin, Y. (1998). Generalized Impulse Response Analysis in Linear Multivariate Models. *Economics Letters*, 58(1):17–29.

Pesaran, M. H. and Pesaran, B. (1997). *Microfit 4.0*. New York: Oxford University Press.

Petersen, M. A. and Rajan, R. G. (2002). Does Distance Still Matter? The Information Revolution in Small Business Lending. *Journal of Finance*, 57(6):2533–2570.

Phillips, P. C. B. and Hansen, B. E. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *Review of Economic Studies*, 57(1):99–125.

Porteous, D. (1995). *The Geography of Finance: Spatial Dimensions of Intermediary Behavior*. Avebury Ashgate, Aldershot.

Posner, R. A. (1975). The Social Costs of Monopoly and Regulation. *Journal of Political Economy*, 83(4):807–27.

Presley, J. R. (2012). *Directory of Islamic Financial Institutions* , volume 29. Routledge.

Raina, L., Bakker, M., and Bank, W. (2003). *Non-Bank Financial Institutions and Capital Markets in Turkey*. A World Bank Country Study. World Bank.

Rajan, R. and Zingales, L. (2003). Saving Capitalism from the Capitalists.

Rappaport, A. (2005). The Economics of Short-Term Performance Obsession. *Financial Analyst Journal*, 61(3):65–79.

Reinhart, C. M. and Kaminsky, G. L. (1999). The Twin Crises: The Causes of Banking and Balance-of-payments Problems. *American Economic Review*, 89(3):473–500.

Rigobon, R. (2003). On the Measurement of the International Propagation of Shocks: Is the Transmission Stable? *Journal of International Economics*, 61(2):261–283.

Roberts, R. B. and Fishkind, H. (1979). The Role of Monetary Forces in Regional Economic Activity: An Econometric Simulation. *Journal of Regional Science*, 19(1):15–28.

Roodman, D. (2009a). A Note on the Theme of Too Many Instruments. *Oxford Bulletin of Economics and Statistics*, 71(1):135–158.

Roodman, D. (2009b). How to Do xtabond2: An Introduction to Difference and System GMM in Stata. *Stata Journal*, 9(1):86–136.

Rordam, K. B. and Bech, M. L. (2008). The Topology of Danish Interbank Money Flows. FRU Working Papers 2009/01, University of Copenhagen. Department of Economics. Finance Research Unit.

Rosenbaum, P. R. and Rubin, D. B. (1985). Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score. *The American Statistician*, 39(1):33–38.

Rosenstein-Rodan, P. N. (1943). Problems of Industrialisation of Eastern and South-Eastern Europe. *The Economic Journal*, 53(210/211):202–211.

Rostow, W. W. (1956). The Take-Off Into Self-Sustained Growth. *The Economic Journal*, 66(261):25–48.

Rowley, C. K., Tollison, R. D., and Tullock, G. (1988). *The Political Economy of Rent Seeking*. Kluwer Academic.

Saint-Paul, G. (1992). Technological Choice, Financial Markets and Economic Development. *European Economic Review*, 36(4):763–781.

Saltoglu, B. (2013). Turkish Banking Sector Current Status and the Future Challenges. *Atlantic Economic Journal*, 41(1):75–86.

Saltoglu, B. and Yenilmez, T. (2010). Analyzing Systemic Risk with Financial Networks An Application During a Financial Crash. MPRA Paper 26684, University Library of Munich, Germany.

Samad, A. (1999). Comparative Efficiency of the Islamic Bank vis-à-vis Conventional Banks in Malaysia. *IIUM Journal of Economics and Management*, 7(1):1–27.

Sanderson, F. H. (1958). The Five-Year Experience of the European Coal and Steel Community. *International Organization*, 12(02):193–200.

Sapienza, P. (2004). The Effects of Government Ownership on Bank Lending. *Journal of Financial Economics*, 72(2):357–384.

Saunders, A. and Sascha, S. (2011). The Costs of Being Private: Evidence from the Loan Market. *Review of Financial Studies*, 24(12):4091–4122.

Schaeck, K., Čihák, M., and Wolfe, S. (2009). Are Competitive Banking Systems More Stable? *Journal of Money, Credit and Banking*, 41(4):711–734.

Shaban, M., Duygun, M., Anwar, M., and Akbar, B. (2014). Diversification and Banks' Willingness to Lend to Small Businesses: Evidence from Islamic and Conventional Banks in Indonesia. *Journal of Economic Behavior & Organization*.

Shaw, E. (1973). *Financial Deepening in Economic Development*. New York: Oxford University Press.

Shleifer, A. and Vishny, R. (2002). *The Grabbing Hand: Government Pathologies and Their Cures*. Harvard University Press.

Siddiqi, M. (1981). *Rationale of Islamic Banking*. Research series in English. International Centre for Research in Islamic Economics King Abdulaziz University.

Simpson, W. and Buckland, J. (2009). Examining Evidence of Financial and Credit Exclusion in Canada from 1999 to 2005 . *The Journal of Socio-Economics*, 38(6):966–976.

Sohrab Behdad, F. and Nomani, F. (2006). *Islam and the Everyday World: Public Policy Dilemmas*. Routledge Political Economy of the Middle East and North Afr. Routledge.

Solís, L. and Maudos, J. (2008). The Social Costs of Bank Market Power: Evidence from Mexico. *Journal of Comparative Economics*, 36(3):467–488.

Soramaki, K., Bech, M. L., Arnold, J., Glass, R. J., and Beyeler, W. E. (2007). The Topology of Interbank Payment Flows. *Physica A: Statistical Mechanics and its Applications*, 379(1):317 – 333.

Srairi, S. A. (2010). Cost and Profit Efficiency of Conventional and Islamic Banks in GCC Countries. *Journal of Productivity Analysis*, 34(1):45–62.

Stalling, B. and Studart, R. (2006). *Finance for Development: Latin America in Comparative Perspective*. The Brookings Institution.

Stein, J. C. (2002). Information Production and Capital Allocation: Decentralized versus Hierarchical Firms. *The Journal of Finance*, 57(5):1891–1921.

Stiglitz, J. (1993). *The Role of the State in Financial Markets*. Chung-hua Series of Lectures by Invited Eminent Economists. Institute of Economics, Academia Sinica.

Stock, J. H. and Watson, M. W. (1993). A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems. *Econometrica*, 61(4):783–820.

Strogatz, S. H. (2001). Exploring Complex Networks. *Nature*, 410:268–276.

Syed-Ali, S. (2006). Financial Distress and Bank Failure: Lessons from Ihlas Finans Turkey. *Islamic Economic Studies*, 14(1-2):1–51.

Tabacco, G. A. (2013). A New Way to Assess Banking Competition. *Economics Letters*, 121(2):167 – 169.

Tas, B. K. O. and Ertugrul, H. M. (2013). Effect of Inflation Targeting on Inflation Uncertainty: A SWARCH Analysis. *Australian Economic Review*, 46(4):444–459.

Toda, H. Y. and Yamamoto, T. (1995). Statistical Inference in Vector Autoregressions with Possibly Integrated Processes. *Journal of Econometrics*, 66(1-2):225–250.

Turk-Ariss, R. (2009). Competitive Behavior in Middle East and North Africa Banking Systems. *The Quarterly Review of Economics and Finance*, 49(2):693–710.

Turk Ariss, R. (2010). On the Implications of Market Power in Banking: Evidence from Developing Countries. *Journal of Banking & Finance*, 34(4):765–775.

Upper, C. (2011). Simulation Methods to Assess the Danger of Contagion in Interbank Markets. *Journal of Financial Stability*, 7(3):111–125.

Valverdie, S. C., Humphrey, D., and Fernandez, F. R. (2003). Deregulation, bank competition and regional growth. *Regional Studies*, 37(3):227–237.

Čihàk, M. and Hesse, H. (2010). Islamic Banks and Financial Stability: An Empirical Analysis. *Journal of Financial Services Research*, 38(2):95–113.

Wade, R. (1990). *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*. Princeton Paperbacks. Princeton University Press.

Warde, I. (2010). *Islamic Finance in the Global Economy* . Edinburgh University Press, Edinburgh, 2nd edition.

Weill, L. (2011). Do Islamic Banks Have Greater Market Power. *Comparative Economic Studies*, 53(2):291–306.

Werner, R. A. (2014). Enhanced Debt Management: Solving the Eurozone Crisis by Linking Debt Management with Fiscal and Monetary Policy. *Journal of International Money and Finance*.

Williamson, S. D. (1987). Financial Intermediation, Business Failures, and Real Business Cycles. *Journal of Political Economy*, 95(6):1196–1216.

Wolde-Rufael, Y. (2010). Bounds Test Approach to Cointegration and Causality between Nuclear Energy Consumption and Economic Growth in India. *Energy Policy*, 38(1):52–58.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge.

World Bank (2008). *Lessons From World Bank Research On Financial Crises*. The World Bank.

World Bank (2012). *Global Financial Development Report 2013 : Rethinking the Role of the State in Finance*. Number 11848 in World Bank Publications. The World Bank.

Yeldan, E. (2006). Neoliberal Global Remedies: From Speculative-Led Growth to IMF-Led Crisis in Turkey. *Review of Radical Political Economics*, 38(2):193–213.

Yeyati, E. L., Micco, A., and Panizza, U. (2004). Should the Government Be in the Banking Business? The Role of State-Owned and Development Banks. Research Department Publications 4379, Inter-American Development Bank, Research Department.

Yousef, T. (2004). The Murabaha Syndrome in Islamic Finance: Laws, Institutions and Politics. In Henry, C. and Wilson, R., editors, *Politics of Islamic Finance*. Edinburgh University Press, Edinburgh.

Yuan, Y. (2006). The State of Competition of the Chinese Banking Industry. *Journal of Asian Economics*, 17(3):519–534.

Zaim, O. (1995). The Effect of Financial Liberalization on the Efficiency of Turkish Commercial Banks. *Applied Financial Economics*, 5(4):257–264.

Zapata, H. O. and Rambaldi, A. N. (1996). Monte Carlo Evidence On Cointegration And Causation. Staff Papers 31690, Louisiana State University, Department of Agricultural Economics and Agribusiness.

Zhao, T., Casu, B., and Ferrari, A. (2010). The Impact of Regulatory Reforms on Cost Structure, Ownership and Competition in Indian Banking. *Journal of Banking & Finance*, 34(1):246–254.