Notre Dame University-Louaize
Faculty of Business Administration & Economics
Graduate Division

Ranking Commercial Banks in Lebanon: Application of Multiple Approaches

Submitted by: Chantal Ghasb Salem

Supervised by: Dr. Rim El Khoury

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of the Master of Business Administration (M.B.A.)

NDU-Lebanon
2015

Approval Certificate

Ranking Commercial Banks in Lebanon: Application of Multiple Approaches

BY

Chantal Ghasb Salem

GRADE: A

Approved by

Supervisor's Name and Signature: Dr. Rim El Khoury

Reader's Name and Signature: Dr. Charbel Bassil

Committee Chair Name and Signature: Dr. Roy Khoueiri

Date

DECLARATION

I hereby declare that this thesis is entirely my own work and that it has not been submitted as an exercise for a degree at any other University.

CHANTAL GHASB SALEM

ABSTRACT

Purpose – The thesis will try the measure the efficiency of Lebanese banks, to rank and rate them using multiple approaches and taking into consideration the effect of bank size. The main objective is to compare the efficiency score to the actual ranking to see if there is any discrepancy and to see if the performance of large banks is better than that of small banks and if the performance of listed banks is better than that of unlisted banks.

Design/methodology/approach – Only top ten Lebanese banks are included in this thesis due to scarcity of information. Data for the study cover the period from 2008 to 2012. For the analysis and ranking of banks' efficiency, two methods are used. The first one is the traditional approach based on the CAMELS framework. The second method is PROMETHEE. Furthermore, banks are divided into large and small banks and into listed and unlisted banks. In order to check if there is a statistical difference between the two groups of banks, a comparison between the means of big and small banks and between listed and unlisted banks will be tested using SPSS.

Findings – The main findings of this study prove that the banks scores based on traditional CAMELS approach are in conformance with those based on multi-criteria approach using PROMOTHEE methodology despite some differences in the results. Furthermore, the results confirm the hypothesis that there is a positive and significant statistical difference between listed and unlisted banks' performance while there is no difference between big and small size banks. The variables that affect the scores of listed and unlisted banks are the cost to income, the liquid assets over total assets, the loan loss reserve and the return on assets. Finally, the results show that the capital intelligence financial strength rating is not appropriate to rank Lebanese commercial banks.

Research limitations – The main limitation of the study is the availability of data that may be used as variables to rank banks. Furthermore the study covers the performance

of ten Lebanese banks over a period of 5 years which will not lead to an appropriate generalization of the findings of this research.

Practical implications – Since in Lebanon, commercial banks are the major lender of the government, their efficiency is a crucial issue. Therefore, evaluating banks' efficiency is important to depositors, owners, potential investors, managers, government, and regulators. Furthermore, the thesis will make recommendation whether there is a need to consolidate the operations of some of these banks to improve their efficiency.

Originality/value – The research is done to evaluate banks, to rate and rank them. Since Lebanese banks are only ranked based on their total assets, this thesis will fill the gap by providing two approaches to rate and rank banks. Furthermore, it will capture the strengths and weaknesses of banks and will find ways to improve them.

Keywords – Banks' Ranking, Rating, CAMELS, Efficiency, PROMETHEE, Lebanon

ACKNOWLEDGMENTS

Foremost, I would like to express my sincere gratitude to my supervisor Dr. Rim El Khoury for the continuous support of my thesis, for her patience, motivation, enthusiasm, and immense knowledge. I could not have imagined having a better supervisor thesis.

Besides Dr. Khoury, I would like to thank Dr. Charbel Bassil who assisted me with the thesis.

I would also like to thank my parents, my sister and my brother for all of their love and support in my entire life. I would specially thank my mom and my sister for taking care of my daughter Tala since I would not have finished this thesis without their support.

I would also like to thank my beloved husband, Talal. Thank you for supporting me for everything, and especially I can't thank you enough for encouraging me throughout this experience. Thank you for being my best friend and an amazing husband and father.

Last but not the least, I would like to thank my lovely daughter Tala for inspiring me and for being a source of unending joy and love for me.

Finally I thank my God for letting me through all the difficulties.

CONTENTS

LIST OF TABLES

Chapter 1

1 INTRODUCTION

1.1 Research Background

Banking is the key sector of the Lebanese economy. It has been playing a major role in boosting the economic development of Lebanon and ensuring the relative stability of the financial sector in a country located in an unstable region. In addition to the large presence in the Lebanese market, the Lebanese banks have expanded significantly in the Arab countries, Europe, Africa, Australia and many other countries (Hancock, 2013).

In general, banks have to be efficient; otherwise they will be an obstacle in the process of the development of the economy. Furthermore, adequate performance of banks is of crucial importance to consumers. In fact, banks need to be not only profitable, but also efficient. Therefore, it is important to conduct a study that measures banks' efficiency and ranks them. Ranking commercial banks can show how well these financial institutions are doing in providing their services. However, it is often very difficult to rank banks, especially that these entities are generally characterized by many indicators (Bikker, 2010).

In this thesis, a method based on a multiple criteria decision will be developed to rank Lebanese commercial banks, which will be compared to the traditional processes of ranking. The comparison provides a more realistic picture for a better comprehensive evaluation of banks' efficiency.

1.2 Significance of the Study

Since in Lebanon, commercial banks are the major lender of the government, their efficiency, ratings, and rankings are crucial issues. Therefore, evaluating banks' efficiency to rate and rank them is important to depositors, owners, potential investors, managers, government, and regulators. Furthermore, the thesis will compare the ranking based on more than one factor according to the CAMELS variables to that based on the size of assets. This thesis will capture the strengths and weaknesses of banks and will

find ways to improve them. Therefore, it will be of value to Lebanese banks and to those interested in investing in the Lebanese financial markets.

1.3 Research Problem and Objective

The thesis will try to assess the efficiency and the performance of Lebanese banks using multiple approaches and taking into consideration the effect of bank size. The main objective is to calculate a score and rank the Lebanese banks and to compare the results to the actual ranking to see if there is any discrepancy, and to check if the performance of large banks is better than that of small banks. The specific objectives are:

- To calculate banks' scores and to rank the Lebanese banks based on the traditional CAMELS and PROMETHEE Methodology.
- To check if the scores based on the previously stated methods are in conformance with each other.
- To ascertain if there is a significant difference in PROMETHEE scores between listed and unlisted banks and to find the factors that discriminate between them, if any.
- To determine if there is a significant difference in PROMETHEE scores between big and small size banks.
- To assess whether the actual ranking of banks based on their total assets is in conformance with their Capital Intelligence Financial Strength Rating given by Bankscope.

1.4 Outline of the Chapters

This chapter being the first chapter introduces the thesis and outlines the research significance, objectives and questions to be answered. The rest of the thesis is organized as follows.

Chapter two is devoted to the literature review. It will introduce the role of the banking sector in the economy generally and in the Lebanese economy specifically. An overview of the Lebanese banking sector with their strengths and their weaknesses will be presented to get insight on how this sector in Lebanon was able to become the major driving sector of the economy. The chapter will introduce as well different methods used to measure banks' efficiency and to rank banks, with a specific focus on the CAMELS framework and the PROMETHEE methodology that will be used as a basis for this research.

Chapter three will introduce the methodology used for the research. This methodology will be divided into two parts: the methodology for the traditional approach based on the CAMELS framework and the methodology for the PROMETHEE approach based on the PROMETHEE-GAIA software used to rank banks and to measure their efficiencies. It will also describe the data, sample size and selected variables and it will formulate the research questions, design, and hypotheses.

Chapter four will present the findings of this research. It will be divided into two parts; the first part will present the results and analysis of the traditional approach using the CAMELS framework and the second part will present the results and analysis of the PROMETHEE methodology. Furthermore, it will compare between listed and unlisted banks and between big and small size banks. It will conclude by comparing both methods and by comparing the ranking based on total assets versus Capital Intelligence Financial Strength rating.

Chapter five is the last chapter of the thesis; it is the concluding chapter that will summarize the findings and compare them with those of other studies, present the limitations of the study, provide any managerial implication and suggest some recommendations.

Chapter 2

2 LITTERATURE REVIEW

This chapter will serve as an introduction to banking and to banks' rating and measures of efficiency. The first part will start by defining banks' role in the economy. It will continue with a specific focus on the Lebanese banking sector, its role in the Lebanese economy and its historical overview. It will then introduce the largest ten banks, which will be studied in this thesis. The third part will explain the concept of efficiency and rating, and will review the main approaches and variables used for ranking banks and computing efficiency. Finally, the last part will examine the relevant empirical studies on the determinants of ratings and efficiency.

2.1 Role of the Banking Sector in the Economy

Banks play an important role in supporting the economic growth. They contribute to the economic development and the improvement in the society's living standards by providing various services to the rest of the economy (Bollard, 2011). In fact, commercial banks are of big importance. Savers are often unable to select the investment project that best matches their personal risk appetite and without pooling their money, they cannot take advantage of increasing returns to scale in investments (Stiglitz, 1998). Moreover, individual entrepreneurs or investors commonly lack sufficient capital to proceed with projects on their own. Therefore, banks provide an intermediation service that brings savers and investors together by helping private citizens save money, providing guard against uncertainty, and building credit, while enabling businesses to start up, expand, increase efficiency, and compete in local and international markets (Armenta, 2007).

There are many studies that focus on the importance of the financial system as a determinant of economic growth.

Greenwood and Jovanovic (1990) modeled the dynamic interactions between finance and growth and highlighted the two-way causality between them. Bencivenga and Smith (1991) showed that economic growth can be increased by eliminating liquidity risk. Banks, by eliminating liquidity risk, can increase investment in high return, thus accelerating growth. King and Levine (1993) used monetary indicators of the size and relative importance of banks. They found a positive relation between financial development indicators and GDP growth. Moreover, they found that better financial systems can stimulate economic growth as well as productivity growth by accelerating the rate of productivity enhancement and by channeling society's resources to promising productivity-enhancing activities.

Furthermore, a study conducted by Levine and Zervos (1998), shows that, even after controlling for many factors associated with growth, both stock market liquidity and banking development are both positively correlated with future rates of economic growth, capital accumulation, and productivity growth. Therefore, they concluded that there is a strong positive link between financial development and economic growth.

Moreover, Kenourgios and Samitas (2007) examined the long-run relationship between finance and economic growth for Poland and concluded that credit to the private sector has been one of the main driving forces of long-run growth.

Meslier-Crouzille et al. (2008) examined the link between financial and economic development at the regional level in the Philippines and highlighted the role of rural banks in regional economic activity. The results showed that for less developed country, and when the presence of rural banks is relatively important, an increase in their credit market share reinforces the economic development of the area.

Jokipii and Monnin (2013) concluded that banking sector stability is an important driver of GDP growth and that a stable banking sector reduces real output growth uncertainty.

Similarly, Mahajan and Verma (2014) examined the relation between the financial sector development in Indian economy and the long run economic growth. For this purpose, a financial development index has been formulated using principal component analysis. The variables have been used from the banking sector as well as from the stock market in order to capture most of the financial system. The period of the study was between years 1981 and 2011 and included the break during 1991 when Indian financial

system went through crucial financial reforms. The results showed long run causality between financial development and economic growth (Mahajan and Verma, 2014).

Furthermore, many recent literatures describe the effect of financial integration on economic growth. For example Guiso et al. (2004) aimed to quantify 'the growth dividend' in Europe due to financial integration, using both industry and firm-level data. The result suggested an empirical relationship between financial market development and growth across countries and sectors. The positive impact is explained by the fact that financial integration accelerates the development of backward financial markets and allows companies from these less developed countries to access finance to the same level as in the US (Guiso et al., 2004).

Finally, we can conclude that the banking sector improvement will affect the economic growth in a bi-directional causality. Therefore, banks play a major role in boosting the economic development. In the case of Lebanon that will be discussed further, the banking sector is an important player in the Lebanese economy, highlighting the significance of conducting a study that measures, rates, and ranks banks' efficiency.

2.2 The Lebanese Banking Sector

2.2.1 Historical Overview

Historically, the Lebanese banking sector is one of the oldest banking systems in the region; it had developed to become one of the most sophisticated systems in the area.

After the First World War and under the French mandate, foreign banks opened branches in Lebanon. Their main focus was financing Lebanese foreign trade, whereas local banks' focus was the domestic financing due to their limited capital. The foreign banks' main engagement was discounting short term bills of exchange, providing collateral loans and advances against goods, and dealing with foreign exchange trading. Instead, local banks mostly relied on the receipt of deposits offering higher deposit rates of interest. They also provided advances in the form of current accounts and discounting of local bills of exchange (BDL, n.d.).

The most important foreign banks were four French banks and one Italian bank and they are:

- Banque de Syrie et du Liban (the banking department, known as of 1963 as the Societe Nouvelle de Syrie et du Liban),
- Crédit Foncier D'Algérie et de Tunisie which was the most important investment bank (currently known as Fransabank),
- Banque Nationale pour le Commerce et l'Industrie (currently known as the Banque Nationale de Paris Intercontinentale),
- Companie Algérienne (currently known as the Banque Libano-Francaise)
- Banco di Roma.

Whereas the most important domestic commercial banks were:

- Banque Misr-Syrie-Liban (currently known as Banque Misr-Liban),
- Banque Tohmé (liquidated).

The banking system experienced a growth from the period starting with the independence of Lebanon in 1943 and till the establishment of the Banque du Liban (Lebanese central bank) in 1964 with the entry of 13 foreign banks and more than 40 Lebanese banks.

Before establishing the Banque du Liban (BDL), Lebanese banks were categorized by the Ministry of Finance into three groups: the approved banks whose guarantees were accepted by the Lebanese government, the non-approved banks whose guarantees were not accepted, and the discount houses. Since 1964, and by virtue of the Code of Money and Credit, the BDL issues a list of banks operating in Lebanon in January of every year (BDL, n.d.).

The banking sector had expanded in the late 1990s and many banks were listed on the Beirut Stock Exchange. In 1998, over 70 banks were operating in Lebanon with total assets of around $31 billion (Gale, 2012).

According to a study conducted by Peters, Raad and Sinkey in 2004, bank profitability and capital in Lebanon became quite strong after the civil war (since 1990) but not as strong as a control group of banks from five other Arab Gulf countries. They also mentioned that Lebanese banks had considerable room for improvement. On one hand, they recommended banks to make more loans, which will stimulate the economy and promote economic growth. On the other hand, they recommended the Banque du Liban to stop offering high returns on T-bills, which is providing a major discouragement for banks not to engage in lending to the private sector. They concluded that, if banks in emerging markets do not do their jobs, they restricted the ability of their countries to grow and their markets to develop more fully (Peters et al., 2004).

Figures 1 and 2 show the distribution of items from the balance sheet for banks in Lebanon for the years 1996 till 2012 and their relative ratios, respectively. As shown in Figure 1, total assets increased from 1996 till 2000 with a small decline in 2001. Then, they increased again to reach an amount of 1,750 Million LBP as of December 2012. The total credit increased as well from 1996 till 2010, remained stable in 2011, and then increased in 2012 to reach 750 Million LBP in 2012. Moreover, the capital and Tier 1 increased from 1996 till 2012 as shown in Figure 1. When looking at the ratios in Figure 2, we notice that the total capital ratio fluctuated in the years 2008 till 2012 from a minimum of 13.44% in 2010 to a maximum of 16.08% in 2008. The Tier 1 ratio has a minimum value of 24.11% in 2010 and a maximum value of 31.72% in 2008. The total credit over total assets is almost constant over the years 2008 to 2012 with an average of 44%. Same applies for the total credit over Tier 1 with an average of 158%. Finally, the total credit over capital ratio fluctuated from a minimum value of 264.92% in 2009 to a maximum value of 337.90% in 2010.

These figures give an approximate idea of how Lebanese banks had improved after the civil war.

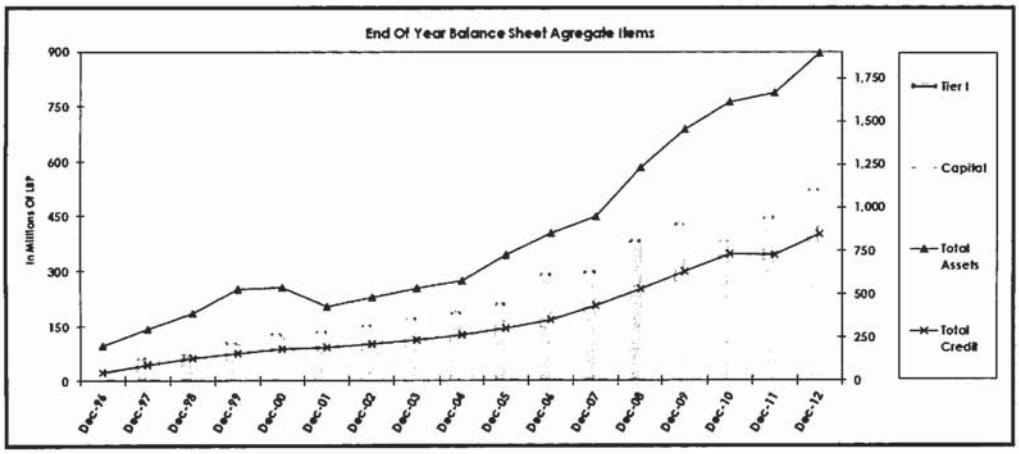


Figure 1: End of Year Balance Sheet Aggregate Items.
Source: BDL, 2012

End Of Year Ratios					
	Dec. 2008	Dec. 2009	Dec. 2010	Dec. 2011	Dec. 2012
Total Capital / Total Assets	16.08%	16.39%	13.44%	13.73%	14.22%
Tier I / Total Assets	31.72%	29.81%	24.11%	27.16%	27.91%
Total Credit / Total Assets	43.17%	43.43%	45.41%	43.63%	44.66%
Total Credit / Tier I	136.10%	145.68%	188.31%	160.61%	160.04%
Total Credit / Capital	268.55%	264.92%	337.90%	317.69%	314.11%

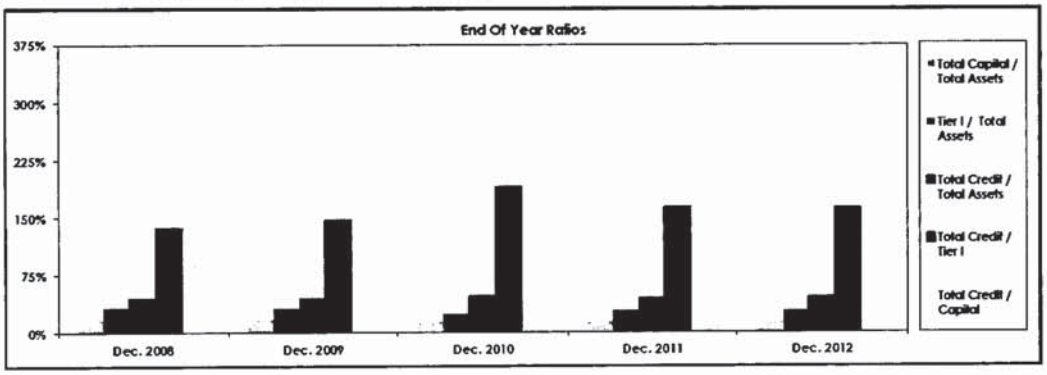


Figure 2: End of Year Ratios.
Source: BDL, 2012

2.2.2 Role of Lebanese Banks in the Lebanese Economy

Banking is the key sector in the Lebanese economy, accounting in 2010 for 35% of GDP growth (Ministry of Finance, 2013). Despite several periods of political instability, Lebanon's banking sector has proven its ability to advance by adapting to national, regional and international trends and requirements. It has played a major role in boosting the economic growth of Lebanon and ensuring the relative stability of the financial

sector. In fact, despite the domestic environment characterized by political instability and despite the ongoing financial crisis, the Lebanese banking sector has sustained a major growth in earnings. The major comparative advantages of this sector are the banking secrecy law, the relative stability of its currency and the strict policies set by the Central Bank that control entry into the banking industry, define the scope of banking activities and set regulations and codes of practice for banks (Association of Banks in Lebanon, 2013).

Moreover, the Central Bank and the private banks showed a notable capability to manage crises by achieving two major but paradoxical results as stated by the Lebanese Ex-Minister Dr. Charbel Nahas in one of his articles (Nahas, 2007). The first one is that the Lebanese banking sector was able to keep effective interaction with the growing amounts of money the Lebanese were able to gather. The second one is that, despite of all difficulties that faced Lebanon, the banking system financed all the needs of the Lebanese economy during the period of the war and the following period (Nahas, 2007).

According to the Association of Banks in Lebanon, Lebanon had experienced a strong economic growth between 2002 and 2012 with real output growing at an average rate of 5.1% (Association of Banks of Lebanon, 2013). It had experienced an exceptionally strong economic growth between 2007 and 2010 with real output growing at an average rate of 8.25%. The main reasons behind this growth were the post-war reconstruction spending following the July 2006 war; the fast rise in regional oil revenue, which generated abundant liquidity; and renewed confidence following the 2008 Doha agreement. These factors created a favorable business climate that was reinforced by a healthy banking sector that was viewed as safe haven in the midst of rising international uncertainty. The main comparative advantages for the banking sector were the high levels of liquidity that absorbed adverse shocks and its dependence on deposits instead of financial markets as in other countries.

Furthermore, according to the Association of Banks of Lebanon (2013), the banking sector contributes to 5.3% of the real GDP growth from 1998 to 2009 as shown in Figure 3.

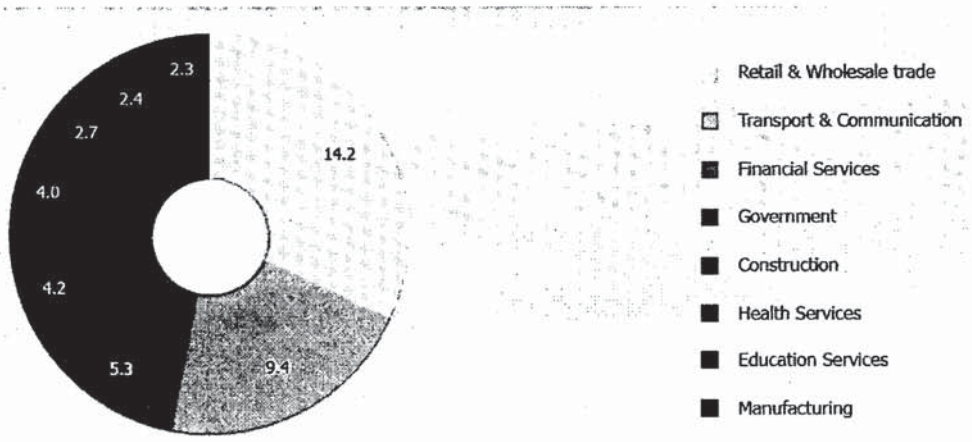


Figure 3: Contribution to Real GDP Growth, 1998-2009 (%).
Source: Association of Banks in Lebanon, 2013

Although the banking sector suffered during the civil war, it started rapidly to return to the position that it held before the war where it was considered the banking center of the region. Many foreign banks had been increasingly returning to Lebanon since, and the banks were considered as an example towards other economic sectors at the level of restructuring and the recovery of the economy. Lebanon's banking sector drew in most of the Arab capital from the Gulf, proving its capability to manage funds from any origin (Druart, 2010).

Moreover, banks play an important role in supporting the government deficit. As summarized in a research paper published by Dibeh in 2005, the effects of the war on the economy were important. In 1990, the GDP per capita was less than one third of the GDP per capita in 1974 before the beginning of the war. There was an enormous destruction of capital stock and a deterioration of the infrastructure of the economy. Lebanon suffered from the loss of human resources through emigration. All the institutions became weak. The post war Lebanese economy can divided into four stages:

- The first phase (from 1992 till 1998) was the period of reconstruction boom. However, the boom was unstable given the high government deficits. Though, there was an external capital inflow from Lebanese living outside Lebanon to

their family members. This inflow was deposited in the banks which make them play an important role in supporting the government deficits.

- The second phase (from 1998 till 2000) was the period of austerity measures taken by the government to lower the deficit. However, the plan did not work and the economic crisis increased due to the loss in the investors' confidence in the Lebanese economy. The investors lose their confidence in Lebanese economy; therefore banks financed again the government deficits and played an important role.
- The third phase (from 2000 till 2001) transformed the crisis from a cyclical one to a more structural one where Lebanon was threatened to lose most of the accomplishments of the postwar period. The economy was very close to deflation; however, banks again financed part of the government deficits.
- The last stage (from 2001 till 2005) was the beginning of a political crisis that started with an anti-Syrian national movement which led to the retreat of Syrian troops from the country in 2005 and a political instability. The continuous crisis was threatening the economy with a total collapse. The prime minister went for a foreign aid solution that was Paris II agreement. This agreement was supposed to bring US$3.1 billion from many contributors. Commercial banks declared their commitment to buy US$2 billion of Eurobonds at zero coupon rates as a contribution to the improvement of the fiscal crisis of Lebanon.

Therefore, in all of these stages, the banks were the most important support that financed and are still financing the government deficits (Dibeh, 2005).

Furthermore, Eltony (2003) indicated in his study that the monetization ratio, M2 to GDP, is higher in Lebanon than in the rest of both other developing countries and other diversified Arab economies which clearly demonstrates a deepened financial sector. He also indicated that the long-run mobilization ratio, M1 to M2, is very low in Lebanon which clearly indicates a well-developed banking sector and illustrates the depth of the financial sector in this country. However, the credit to private sector ratio in Lebanon is about half of the credit provided by the while banking system despite the near absence of the public sector, indicating the crowding out of the private sector by the public sector and the persistence of a large public debt financed by banks.

As mentioned by Finger and Hesse (2009), the Lebanese economy and financial system are characterized by a single link between government debt and the banking system. The ratio of government debt to GDP is among the highest in the world. According to their study, debt is mainly held by domestic commercial banks, which are funded mostly from deposits, including to a significant extent the non-resident deposits. They also showed that the ratio of total commercial bank assets to GDP is among the highest in emerging markets which lead to a conclusion that the banking system has grown very large (Finger and Hesse, 2009).

Additionally, according to a study conducted in 2007, Lebanon enjoys full capital account openness and is benefiting from massive transfers and capital inflows from abroad; as such it is unlikely that access to finance represents a major constraint to growth (Berthélemy et al., 2007)

Finally, since in Lebanon, commercial banks are the major lender of the government and since the growth of the Lebanese banking industry contributes to the development of the Lebanese economy, banks' efficiency is a crucial issue. Therefore, evaluating banks' efficiency is important to depositors, owners, potential investors, managers, government, and regulators. Section 2.3 of this thesis will discuss several ways to measure banks' efficiency including a multicriteria decision analysis that will provide a more realistic picture for a better evaluation of banks' efficiency.

2.2.3 Largest Ten Lebanese Banks

In order to assess and measure banks' efficiency, this thesis will include ten among the largest local banks in Lebanon. This section will briefly introduce them and they are: Bank Audi, BLOM Bank, Byblos Bank, Crédit Libanais, BankMed, FransaBank, SGBL, Bank of Beirut & Arab Countries, Bank of Beirut, and Banque Libano-Française.

2.2.3.1 Bank Audi sal - Audi Saradar Group

Bank Audi was founded in Lebanon in 1962. It is a regional Bank with a universal banking profile, covering commercial, retail, private and investment banking activities, in addition to "bancassurance". It merged with Banque Saradar sal in 2004. It is present in 13 countries and operates principally in Lebanon and the Middle East North Africa ("MENA") region and Turkey. Bank Audi has one of the largest branch network in Lebanon, with 80 branches covering the Greater Beirut area and other strategic regions in Lebanon, as well as a network of 75 branches in the MENA region (outside Lebanon) and 31 branches in Turkey. It has two principal subsidiaries in Lebanon, two principal subsidiaries and an asset management company in Europe and six principal subsidiaries in the MENA region in addition to a principal subsidiary in Turkey (Bank Audi, n.d.).

2.2.3.2 BLOM Bank

Founded in 1951, BLOM Bank is one of the oldest established banks in Lebanon. It has always been at the center of the country's banking system. It has been selected as the Best bank in Lebanon by many institutions. BLOM Bank's strategy is based on regional expansion to markets with strong fundamentals and on the diversification of its universal services that has placed it at the fore front of Arab banks in the region. As a result, BLOM Bank has the widest foreign presence among Lebanese Banks, and is currently present in the following 12 countries: Lebanon, Syria, Jordan, UAE, France, UK, Switzerland, Romania, Cyprus, Egypt, Qatar, and Saudi Arabia. It conducts its worldwide operations through a network of 213 banking and financial units, either directly or through its subsidiaries (BLOM, n.d.)

2.2.3.3 Byblos Bank

Bank Byblos was established in Jbeil Lebanon in 1950 under the name of "Societe Commerciale Agricole Byblos Bassil Freres & Co.". It has converted its name to Byblos Bank SAL in 1963. Byblos Bank is a leading financial institution focused on domestic and regional markets. It has an extensive branch network of more than 75 branches

covering most of the Lebanese areas. It has also expanded to several other countries including Armenia, Belgium, Cyprus, France, the United Arab Emirates, and others. It has established three subsidiaries which are Byblos Bank Africa (2003), Byblos Bank Syria (2005) and Byblos Bank Armenia (2007) (Byblos Bank, 2013).

2.2.3.4 Crédit Libanais

Credit Libanais was established in 1961, as a Lebanese joint stock company. The Bank's ownership is split between EFG Hermes CL Holding SAL controlling 63.74% of the share capital and CIH Bahrain International Holding SAL with a 25.20% stake .The remaining 11.06% is owned by over 1,000 individual shareholders, including mainly executives and employees of the Bank, each with less than 5%. It offers a full range of banking products and services channeled through an extensive network of 66 branches, an Islamic banking, a financial institution, a leasing and an insurance company subsidiaries in Lebanon, full-fledged branches in Limassol, Cyprus; Manama, Bahrain, Irbil and Baghdad, Iraq, and a Representative Office in Montreal, Canada as well as a banking subsidiary in Senegal, which paves the way for expansion in all eight states of the economic zone of West Africa (Credit Libanais, n.d.).

2.2.3.5 BankMed

BankMed was established in 1944, under Beirut CR 5261 - Banks List No 22. Its market share - measured by total assets - has grown over the years to comprise around 10% of the total of the Lebanese banking system in 2014. It has 51 branches spread all over Lebanon, and one in Cyprus. It offers a wide range of novel products and quality services to both individuals and corporations. BankMed's private bank in Switzerland, BankMed Suisse, is engaged in asset-management and advisory banking services, through its offices in Geneva. BankMed's regional presence was expanded to Turkey in 2007 with the addition of a subsidiary commercial bank, T-Bank, to the Group. In 2008 the SaudiMed Investment Company was launched in Riyadh which provides investment and corporate advisory services to a growing base of customers in the Kingdom and elsewhere in the Middle East (BankMed, n.d.).

2.2.3.6 Fransabank

Fransabank is one of the top leading Lebanese financial Group. It was founded in Lebanon in 1921 as a full branch of one of the major French banks, Crédit Foncier d'Algérie et de Tunisie (C.F.A.T.). It was registered as the first operating bank in Lebanon. Fransabank is among the first banks in Lebanon in terms of local branch network with more than 115 branches strategically spread all over the country. It has also expanded into many countries including France, Algeria, Syria, Cyprus, Libya, UAE and others. The bank provides a broad range of retail, commercial, corporate, investment and international banking services to its clients (Fransabank, n.d.).

2.2.3.7 SGBL

SGBL was founded in 1953 as a part of the international network of "Société Générale", one of the largest European financial services. It is present almost in all the Lebanese areas and ensures banking services through its network of 69 branches. It is also present in Jordan and Cyprus. SGBL is active in all banking business lines and supplies retail, corporate and private banking services (SGBL, 2012).

2.2.3.8 Bank of Beirut and the Arab countries

Bank of Beirut and the Arab Countries (BBAC) was established in 1956. The bank evolved to become one of the Lebanese largest banking institutions. In 2000, as part of an assertion to the bank's innovative approach, Bank of Beirut and the Arab Countries shortens its name in a rebranding push, to become BBAC. It provides a full range of banking and financial solutions to individuals and corporations through an extensive network of forty-nine ATMs and thirty-eight branches comprising thirty-five domestic branches, three international branches, one in Cyprus - Limassol and two in Iraq - Erbil and Baghdad, in addition to a representative office in UAE - Abu Dhabi (BBAC, n.d.).

2.2.3.9 Bank of Beirut

Bank of Beirut was established in 1963, under the name of "Realty Business Bank S.A.L", and it adopted its current name in 1970. In 1998, it witnessed a historic expansion thanks to the acquisition of "Mebco Bank s.a.l." and "Transorient Bank s.a.l." It diversified its products by establishing an advanced insurance, consulting and brokerage company "Beirut Broker Company s.a.r.l". The Bank operates in Lebanon through its network of more than 55 branches. Bank of Beirut extended its commercial banking services to a number of countries through different subsidiaries; regulated by the Financial Services Authority ("FSA") for the wholly owned Bank of Beirut (U.K.) Ltd and the Germany branch in Frankfurt; regulated by the Central Bank of Cyprus for the Limassol branch; and regulated by the Central Bank of Oman for the 3 branches in Muscat, Ghubra and Sohar. Bank of Beirut also boasts its representative office in the United Arab Emirates (Dubai) to service the Gulf region (Bank of Beirut, n.d.).

2.2.3.10 Banque Libano-Française

Banque Libano-Française (BLF) is one of the leading banks in Lebanon. It was established as a joint stock company (Société Anonyme Libanaise, SAL) in 1967. While it had historically been a commercial bank, the Bank has diversified its activities and is currently providing banking services in five principal areas: commercial banking, retail banking, investment banking, private banking and correspondent banking. BLF manages a network of more than 35 branches in addition to an international expansion in many countries such as Paris, Cyprus, and Abu Dhabi (BLF, n.d.).

Table 1 shows the ranking of these ten banks in terms of total assets as of the end of year 2012.

Table 1. Ranking of Lebanese Banks in Terms of Total Assets.

Rank	Bank	Total Assets in USD Million (end of 2012)
1	Bank Audi	31,304
2	BLOM Bank	25,051
3	Byblos Bank	17,015
4	Fransabank	15,750
5	BankMed	12,507
6	Bank of Beirut	11,557
7	SGBL	11,228
8	Banque Libano-Française	10,487
9	Crédit Libanais	7,947
10	BBAC	4,888

2.3 Banks' Efficiency, Ratings, and Rankings

2.3.1 Banks' Efficiency

Due to increasing competition for financial services, technological innovation, and banking consolidation, banks are focusing more on controlling their costs and on providing their services and products efficiently. Bank's efficiency is the measure of the bank's ability to turn resources into revenue. In other words, efficiency is related to the ability to produce a result with minimum effort or resources. Efficiency is an important factor in remaining competitive, since efficient banks have substantial cost and competitive advantages over those with average or below average efficiency. Wheelock and Wilson (1995) mentioned in his article that efficiency measures are indicators of success, by which the performance of individual banks can be evaluated.

In fact, banks will be more successful in maintaining their businesses if they operate efficiently. Berger and Humphrey (1992) found that during the 1980s, high-cost banks experienced higher rates of failure than more efficient banks. Similarly in a study of

bank failures during the 1920s, Wheelock and Wilson (1995) found that the less technically efficient a bank was, the greater its likelihood of failure.

However, measuring bank's efficiency is difficult because there is no satisfactory definition of bank output. Neither the number of accounts nor total assets, total loans, nor total deposits provides a good index of the output. Although many analysts used accounting data such as profit margins, costs and income as measures of bank efficiency, the usefulness of such data is undermined by substantial structural and accounting differences across countries, among individual banks and over time.

2.3.2 Definition of Banks' Rating

A bank's rating is a rating given based on the safety and soundness of the bank. In the US, the Federal Deposit Insurance Corporation (FDIC) developed formulas to rate banks on a scale of 1 to 5 in order to classify their overall condition. The first two Ratings (1 and 2) designate a sound bank, whereas Ratings of 3 and 4 designate a bank with severe problems. A rating of 5 is assigned to banks that have a high probability of failing within the next 12 months (Collier et al., 2003). The formulas upon which the rating is based are typically built on CAMELS: capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk.

First, capital adequacy ratios are a measure of the bank's capital expressed as a percentage of its risk weighted credit exposures. An international standard which recommends minimum capital adequacy ratios has been developed to ensure that banks can absorb a reasonable level of losses before becoming insolvent (Matthews, 1996).

Second, asset quality rating is a review or evaluation assessing the credit risk associated with a particular asset. Third, earnings represent the ability to provide adequate capital through retained earnings. Fourth, liquidity is the capability of management to properly identify, measure, monitor, and control the institution's liquidity position. Fifth, the sensitivity to Market Risk is the ability of management to identify, measure, monitor, and control exposure to market risk. Sixth, the Management component of the CAMELS rating reflects the governance capability of the board of directors and management in their respective roles to identify, measure, monitor, and control the risks

of an institution's activities and to ensure the soundness and the efficient operation of the financial institution and its compliance with applicable laws and regulations (Hinkel, 2010)

Thus, the CAMELS rating is a guiding rating system that was developed in the U.S to classify the general condition of a bank. The financial statements of banks are analyzed along with an on-site examinations made by an elected party in order to assign ratings. Ratings results are restricted to top management in order to prevent a possible bank run on an institution which receives a CAMELS rating downgrade (Collier et al., 2003).

2.3.3 Rating Agencies

A credit rating agency is an independent company that evaluates the financial condition of issuers of debt instruments and then assigns a rating that reflects its assessment of the issuer's ability to make the debt payments. Potential investors, customers, employees and business partners rely upon the data and objective analysis of credit rating agencies in determining the overall strength and stability of a company (Ellis et al., 2012). Credit rating agencies play an important role in financial markets by reducing the informative asymmetry about the creditworthiness of companies or countries between lenders and investors, on one side, and issuers, on the other side. The role of these agencies has expanded and has received an additional boost from Basel II which incorporates the ratings into the rules for setting weights for credit risk.

The most reputable credit rating agencies are Standard & Poor's (S&P), Moody's, and Fitch Group. S&P and Moody's are based in the US, while Fitch is dual-headquartered in New York City and London, and is controlled by the France-based FIMALAC (Financière Marc de Lacharrière) (White, 2010). In 2011, these agencies accounted approximately for a combined market share of 95%, 40% held by S&P, 40% by Moody's and 15% by Fitch (Chemrat, 2014).

Each of the rating agencies has its own way to assess institutions. For example, Standard and Poor's provides a rate for institutions by capturing the forward-looking probability

of the occurrence of default. It does not assess the expected time of default or the recovery values. On the other hand, Moody's and Fitch's ratings focus on the expected loss which is a function of both probability of default and the expected recovery rate. However, they are reminded to be forward-looking and to be alert to possible discontinuities between past track records and future trends (Khoury, 2008).

2.3.4 Methods for Ranking and Measuring Efficiency

Ranking methods and measuring banks' efficiency in developing countries such as Lebanon where rating agencies do not assess all banks can be based on different criteria. Banks' efficiency can be measured by four ways, the traditional methods based on balance sheet analysis, the CAMELS framework, the parametric methods and the non-parametric methods. Therefore, this section will present a short review of the various methods used to measure productivity and efficiency with a special focus on the methodology used in this study.

2.3.4.1 Traditional Method- Balance Sheet Analysis

The most common way of measuring financial performance of banks and their efficiency is through the calculation of financial ratios and their comparison with benchmarks or with time. Traditionally, financial indicators were and are still an important analytical instrument used to evaluate the performance of banks (Orlitzky et al., 2003). Since the banks' owners and potential customers are still using them to compare and evaluate banks, banks need to pay particular attention to the value of the traditional indicators if they want to create a positive image and to be perceived positively by general public.

However, the number of financial indicators applied can be really big, and interpretation of results is more difficult. Moreover, a single indicator provides too little information whether or not a given value is correct. Below is a list of financial indicators and ratios that are used to measure the performance of commercial banks.

2.3.4.1.1 Return on Equity (ROE)

The ROE is the net profit divided by the total equity. It is an important indicator of a bank's profitability and of the bank's growth potential. It is the rate of return to shareholders, in other terms, it is the percentage return on each $ of equity invested in the bank. In order to analyze the bank's performance in details, and to identify the weak points, ROE can be decomposed into its components ratios, mainly ROA that measures operational profitability and equity multiplier that measures the financial leverage or solvency risk (Chorafas, 2004).

2.3.4.1.2 Return on Assets (ROA)

The ROA is the net profit divided by the total assets. It specifies the net income generated for each $ of assets. The ROA shows the ability of management to acquire deposits at a logical cost and invest them in beneficial investments. The higher the ROA, the better is the profitability of the bank (Chorafas, 2004).

2.3.4.1.3 Net Interest Margin

Net interest margin (NIM) is a measure of the difference between the interest income generated by banks or other financial institutions and the amount of interest paid out to their lenders (for example, deposits), relative to the amount of their interest-earning assets. It is similar to the gross margin of non-financial companies. The interest income is what the financial institution earns on loans in a time period and the interest expense is the interest paid on borrowed funds. The difference between the two is expressed as a percentage of the average amount of the assets on which income is earned in that time period (Chorafas, 2004).

2.3.4.1.4 Spread

The spread represents the difference between the average yield a financial institution receives from loans and other interest-accruing activities and the average rate it pays on

deposits and borrowings. The net interest rate spread is a key determinant of a financial institution's profitability (Chorafas, 2004).

2.3.4.1.5 Basel II Capital Requirements

Basel II is an international business standard that requires financial institutions to maintain enough cash reserves to cover risks incurred by operations. The Basel accords are a series of recommendations on banking laws and regulations issued by the Basel Committee on Banking Supervision. The name for the accords is derived from Basel, Switzerland, where the committee maintains the accords meetings (Chorafas, 2004).

Basel II consists of three main areas called the three pillars. The first one deals with the minimum capital requirements that financial institutions should maintain to protect depositors and promote the stability and efficiency of the financial system. The second one suggests a framework for regulators to deal with non-quantifiable forms of risk. The third one promotes for market discipline. The focus of this accord is to strengthen international banking requirements as well as to supervise and enforce these requirements (Chorafas, 2004).

Two types of capital are measured by the Basel, the Tier I and Tier II capital requirements that attempt to measure the financial strength of a bank.

- Tier I Capital Ratio

The Tier I Capital Ratio is used to assess the capital adequacy of banks. It is calculated as the ratio of a bank's Tier I capital to its total risk weighted assets. The Tier I capital is the core measure of a bank's financial strength that is composed of core capital which consists primarily of common stock and retained earnings (Chorafas, 2004). The risk-weighted assets are the total of all assets held by the bank weighted by the credit risk according to a formula determined by the Regulator.

According to Forbes 2011, the tier I capital ratio has been monitored closely by financial institutions over the recent years due to strict requirements norms that the Basel committee are prescribing (Trefis, 2015).

- Tier II Capital Ratio

Tier II capital is calculated as the ratio of a bank's Tier II capital to its total risk weighted assets. Tier II Capital includes several constituents of the bank's capital (Coker, 2010):

1. Undisclosed Reserves or reserves that occur when a bank has made a profit that does not appear in the banks' retained earnings.
2. Revaluation Reserves or reserves created when a bank revalues an asset and the increase in value is recognized.
3. General Provisions that are created when a bank provides provisions for a loss that may occur in the future.
4. Hybrid Instruments or financial instruments that have some characteristics of both debt and stockholders' equity.
5. Subordinated Term Debt or a debt that ranks lower in liquidation preference than the bank's depositors.

Tier two capital provides a lower level of protection for depositors and other creditors than tier I capital. It comes into play in absorbing losses after tier one capital has been lost by the bank.

2.3.4.1.6 Efficiency ratio

The bank efficiency ratio is a quick and easy measure of a bank's ability to turn its resources into revenue. It is equal to the non-interest expense divided by the income (net interest income and noninterest income). The efficiency ratio measures how effectively a bank is operating and how profitable it is (Chorafas, 2004).

2.3.4.1.7 Cost to Income Ratio (C/I)

C/I ratio the total cost divided by the total income. It specifies the income generated for each $ of cost. In other words, it shows how expensive it is for the bank to produce a unit of output. The lower the C/I ratio, the better is the performance of the bank (Chorafas, 2004).

2.3.4.1.8 Deposits

Deposits are defined as money placed into a banking institution for safekeeping. They include savings accounts, checking accounts, money market accounts, time deposits and others. The account holder has the right to withdraw any deposited funds based on the terms and conditions of the account. The deposit is considered as a liability owed by the bank to depositors (Sohaimi , 2013). Al-Taani and Al-Slehat (2014) concluded in their article that there exist a positive relationship between bank deposits and profitability. Therefore banks with high deposits have a better performance than banks with low deposits.

2.3.4.1.9 Bank Credit

Bank Credit is the amount of credit available to a company or individual from the banking system. In other terms, it is the amount of funds financial institutions are willing to provide to an individual or organization. The credit depends on both the borrower's capacity to repay and the overall amount of credit available in the banking system.

According to Olagunju et al. (2011), Nigerian banks' profitability is inversely proportional to the level of bank credit since banks with higher credit are exposed to great risk of illiquidity.

2.3.4.1.10 Total Assets

Total Assets are what a bank holds, including loans, reserves, investment securities, and physical assets. The largest asset category of most banks is loans, which generates interest revenue (Chorafas, 2004). A critical asset category used to maintain the safety of deposits is reserves (vault cash and Federal Reserve deposits). Total asset is considered as an important variable to measure banks' efficiency since it is used as a common way to rank banks. For example, the banker provides the ranking of 150 worldwide banks in

2012 based on total assets (Banker, 2013). The financial advisor provides as well the ranking of 529 banks in 2013 based on total assets (Financial Advisor, 2014).

2.3.4.1.11 Shareholders' Equity

Shareholders' Equity is firm's total assets minus its total liabilities. It comes from two main sources. The first is the money that was originally invested in the company. The second comes from the retained earnings which the company is able to accumulate over time through its operations (Chorafas, 2004).

2.3.4.1.12 Net Loans to total asset ratio (NLTA)

It measures the percentage of assets that is tied up in loans. The higher the ratio, the less liquid the bank is. This ratio indicates the liquidity performance of a bank.

2.3.4.1.13 Net loans to deposit and borrowing (NLDST)

This ratio measures the percentage of the total deposits locked into non-liquid assets. A high figure denotes lower liquidity. This ratio indicates as well the liquidity performance of a bank (Kumbirai and Webb, 2010).

The traditional methods for evaluating banks do not take into account other than one criterion; moreover, when multiple criteria such as profits, liquidity, asset quality, risk level, management strategies and others are considered simultaneously, the process of measuring the financial performance of banks will be very complicated. For this purpose, several statistical methods that include regression form or production function form are often used. The following sections will briefly defined the different multi-criteria methods used for measuring banks' performance.

2.3.4.2 CAMELS Framework

The Uniform Financial Institutions Rating System proposed the CAMELS rating, a rating system used by regulators for assessing financial institutions on a constant basis in order to identify the institutions that require a special supervisory attention. CAMELS rating was introduced in 1979 and had at the time five components (Cole and Gunther, 1998):

- C-Capital adequacy
- A-Asset quality
- M-Management
- E-Earnings
- L-Liquidity

A sixth component was introduced in 1996, which is S or Sensitivity to market risk (Barr et al., 2002)

The CAMELS framework reviews various aspects of a bank based on different criteria in order to ensure healthy conditions for a bank's status. The obtained rating ranges from 1 to 5 with 1 being the best rating and 5 being the worst one (Coker, 2010).

In a research study conducted by Yue (1992), it was shown that "financial ratios are often used to measure the overall soundness of a bank and the quality of bank management. Thus, bank regulators may use financial ratios to help evaluate a bank's performance as part of CAMEL rating system." (p.31).

Barker and Holdsworth (1993) found evidence that CAMEL ratings are useful in predicting banks failure. Similarly, Cole and Gunther (1998) found that CAMEL ratings contain useful information. Moreover, Barr et al. (2002) states that "CAMEL rating has become a concise and indispensable tool for examiners and regulators" (p.19).

The CAMELS rating has been used by many studies. For example, Said and Saucier (2003) used CAMEL rating methodology to evaluate Japanese Banks. Furthermore,

Hays, Stephen and Arthur (2009) analyze the efficiency of banks in the United States using data from year-end 2006-2008 employing the CAMELS framework in order to differentiate between low efficiency and high efficiency banks.

Buerger (2011) highlighted in his article the importance of the CAMELS rating by mentioning that there is no single number more important to a bank than its CAMELS rating and that all bank directors should have a firm understanding of the meaning of CAMELS ratings and the profound impact these ratings have on the bank.

From the above studies and from many other studies that were not mentioned in this thesis, we can make an overall conclusion that CAMELS rating is a useful tool in the supervisory monitoring of bank conditions.

2.3.4.3 Parametric Methods

The parametric approach estimates the optimal production or cost function of banks through a regression. Then, the efficiency of a certain bank is calculated by comparing its production or cost level to that optimal level. Therefore, this method is based on a regression model with certain confidence level and deviations and requires explicit assumptions about the function that converts inputs into outputs and about the distribution of the error terms (Ngo, 2012).

As described in a research paper by Kablan (2007), the parametric approach consists of an econometric estimate of the best practice frontier. The econometric method can be deterministic. In this case, every deviation from the frontier is attributed to inefficiency. It can also be stochastic and it is possible to separate random errors from the production unit inefficiency. The stochastic frontier method has two principal advantages compared to the non-parametric method. First, it allows separating random error from the production unit inefficiency and takes into account the existence of exogenous shocks. At this purpose, the error term is divided into two components: an inefficiency component and a random one (which is composed of the error measurement and the

exogenous shocks). Second, the stochastic frontier analysis is less sensitive to absurd values (Kablan, 2007).

However, the debate on which approach suits better the problem of analyzing the efficiency of the banking sector is still open and has been the subject of many applied works.

2.3.4.4 Non-Parametric Methods

The nonparametric methods involve solving linear programs, in which an objective function envelops the observed data; then efficiency scores are derived by measuring how far an observation is positioned from the "envelope" or frontier.

The nonparametric methods include Data Envelopment Analysis, I-distance method, Analytic Hierarchy Process, and PROMETHEE Gaia method. PROMETHEE Gaia will be more detailed in the next section since it is the multi criteria method chosen in this thesis to evaluate banks' efficiency and to rank Lebanese banks.

2.3.4.4.1 Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is one of the main non-parametric operational research methods. It is a mathematical programming technique used for the construction of relatively efficient production frontiers and the measurement of efficiency relative to the constructed frontier. It has recently become a leading method for measuring and comparing performance of different entities, especially banks.

DEA method was introduced by Charnes, Cooper and Rhodes (1978). Starting in 1957 with Debreu and Farell's concept of productivity that defines the efficiency measure as a ratio of a single input to a single output, the authors applied the method in a multidimensional situation, with more than one input and more than one output (Kuosmanen, 2001). Efficiency can be defined in economy as Weighted Sum of Outputs divided by Weighted Sum of Inputs. While inputs refer to resources, such as labor, raw

materials and capital, outputs are items produced from the inputs as a result of the process performed within each entity.

As summarized by Mihailovic et al. (2009), DEA measures the efficiency of the decision-making units (DMUs) by comparing their performance with an efficient entity. DMU can refer to any entity that is to be evaluated in terms of its ability to convert inputs into outputs. DEA identifies reference points that define the efficiency frontier (relatively efficient DMUs) and evaluates the inefficiency of other interior points (relatively inefficient DMUs). As a consequence, efficiency score for a specific DMU is not defined by an absolute standard, but it is defined relative to the other DMUs in the specific data set under consideration. All inefficient units are enveloped by production frontier, consisted of efficient DMUs, and for each of them there is an efficient unit lying on the efficiency frontier. This feature differentiates DEA from the parametric approaches, which require a pre-specified functional form of the production or cost (Mihailovic et al., 2009).

Efficiency can be calculated as either input oriented technical efficiency (minimizing inputs) or output oriented technical efficiency (maximizing outputs). While input-oriented technical efficiency shows how much company's inputs should be decreased to be efficient leaving outputs unchanged, output-oriented technical efficiency presents how much company's productivity should be increased using the same values of inputs. Furthermore, various assumptions related to the economy of scale can be made such as constant return to scale effects, variable scale effects, and non-increasing scale effects.

According to Mihailovic et al., (2009), the advantages of the DEA method over the traditional efficiency measurement approaches are described as follows:

- DEA provides a single unambiguous measure of performance,
- DEA can handle multiple inputs and outputs, in different measurement units,
- DEA is focused on DMUs best practice, and
- DEA results can be used in determining the forthcoming actions in managing the observed DMU.

Thus, DEA can offer recommendations by calculating a virtual DMU efficiency for each DMU under evaluation.

2.3.4.4.2 I-distance method

The I-distance method is a multivariate statistical method for ranking entities. It allows the use of several criteria to give one single index which can be considered as a rank.

In the I-distance ranking process, rank is determined as the distance from referent DMU, defined at the beginning of the analysis, usually a virtual one with average, minimal or maximal values for all the variables. The I-distance methodology can be used in order to rank the banks according to their performance, expressed through different indicators (Mihailovic et al., 2009).

For a selected set of variables (X_1 to X_n), the I-distance method is an iterative method that can be calculated through the following steps:

- First, calculating the value of the discriminate effect of the variable X_1 (the most significant variable which offers the biggest amount of information on the entities to be ranked)
- Second, adding the value of the discriminate effect of X_2 which is not covered by X_1
- Third, adding the value of the discriminate effect of X_3 which is not covered by X_1 and X_2
- Finally, repeating the procedure for all variables (Mihailovic et al., 2009).

In the I-distance method, it is necessary to have one entity fixed as a reference in the observing set in order to rank the entities. Thus, the ranking of entities is based on the calculated distance from the referent entity.

The I-distance method has many advantages, mainly its possibility to implement a large number of variables that are of various units of measure. Therefore, it can be used to perform an efficiency measurement and to compare entities using several variables. Moreover, this method does not place any weighting factor on variables and is based on

dissimilar assumptions about the distribution of the inefficiency term (Jeremic et al., 2012).

2.3.4.4.3 Analytic Hierarchy Process (AHP)

Analytic Hierarchy Process (AHP) is one of the most exploited decision making methods in which the decision (the selection of given alternatives and their ranking) is based on several attributes used as criteria. Complex decision problem solving which uses this method is based on the decomposition into a hierarchy structure which consists of the elements such as: the goal, the criteria (sub-criteria) and the alternatives (Hunjak and Jakovčević, 2001).

According to Hunjak and Jakovčević (2001), the AHP method can be divided into four steps (as shown in Figure 4):

- The first step is to develop the hierarchy model of the decision problem in a way that the goal is located at the top of the model, with criteria and sub-criteria on lower levels and finally alternatives at the bottom of the model.
- The second step is to compare all possible pairs of elements on each hierarchy structure level. The decision maker's preferences are expressed by verbally describing intensities and the corresponding numeric values on 1-3-5-7-9 scale.
- The third step is to calculate the weights of the elements of the hierarchy structure (criteria, sub-criteria and alternatives) on the basis of the pairwise comparisons.
- The last step is to carry out the sensitivity.

The main advantage of the AHP method is related to the pairwise comparisons technique which provides extra precision to AHP based weights. Another advantage of AHP is the consistency control mechanism which prevents inconsistencies among experts' judgments (Kayaa and Kahraman, 2011).

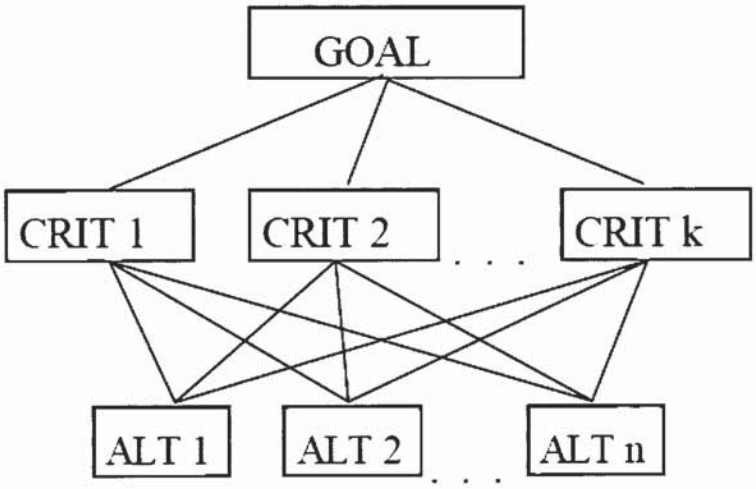


Figure 4: Basic AHP model with goal, criteria and alternatives.
Source: Hunjak and Jakovčević, 2001

2.3.4.4.4 PROMETHEE Gaia Method

The decision problems whether they are economical, industrial, or financial are usually multicriteria. If someone wants to buy a car, he cannot make his decision based on the price only (financial criterion); but other criteria should be taken into account such as comfort, quality, performances.... Moreover, each person reacts in a different way. The selection of a car depends on each individual's personal taste. Therefore, everyone allocates a different set of weights to the criteria.

Ranking of different options subject to a multi-criteria evaluation is a difficult problem since there is no alternative which is the best one on each and every criterion. In the car example, a better quality implies a higher price. Therefore compromise solute.

Figure 5 shows the phases of decision making which are (Corrente, 2013):

- Identifying and defining problems.
- Determining collection of criteria for alternative evaluation (Cj).
- Determining collection of alternative solutions (Ai).
- Determining alternative evaluation and, finally, alternative selection

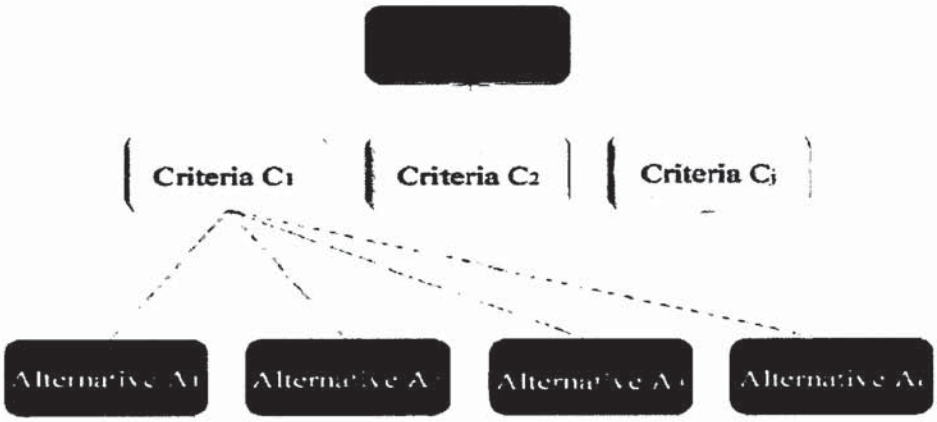


Figure 5: Phases of Decision Making.

Source: Corrente, 2013

The Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) represents one of the most efficient methods for treating multi-criteria problems. This method will be used in this thesis in order to evaluate banks' efficiency.

PROMETHEE I and II ranking methods were generated in 1982 by Professor Jean-Pierre Brans. The PROMETHEE method reduces the number of incomparability among some pairs of alternatives. The decision maker has to provide inter-criteria parameters and intra-criterion parameters. If we consider G the family of criteria consisting of n criterion (G_1 to G_n), then Inter-criteria parameters represent the importance of criterion Gj ($\forall j \in G$) inside the family of criteria G. Intra-criterion parameters consist of one preference function Pj(dj) related to each criterion Gj ($\forall j \in G$). The preference functions are shown in figure 6.

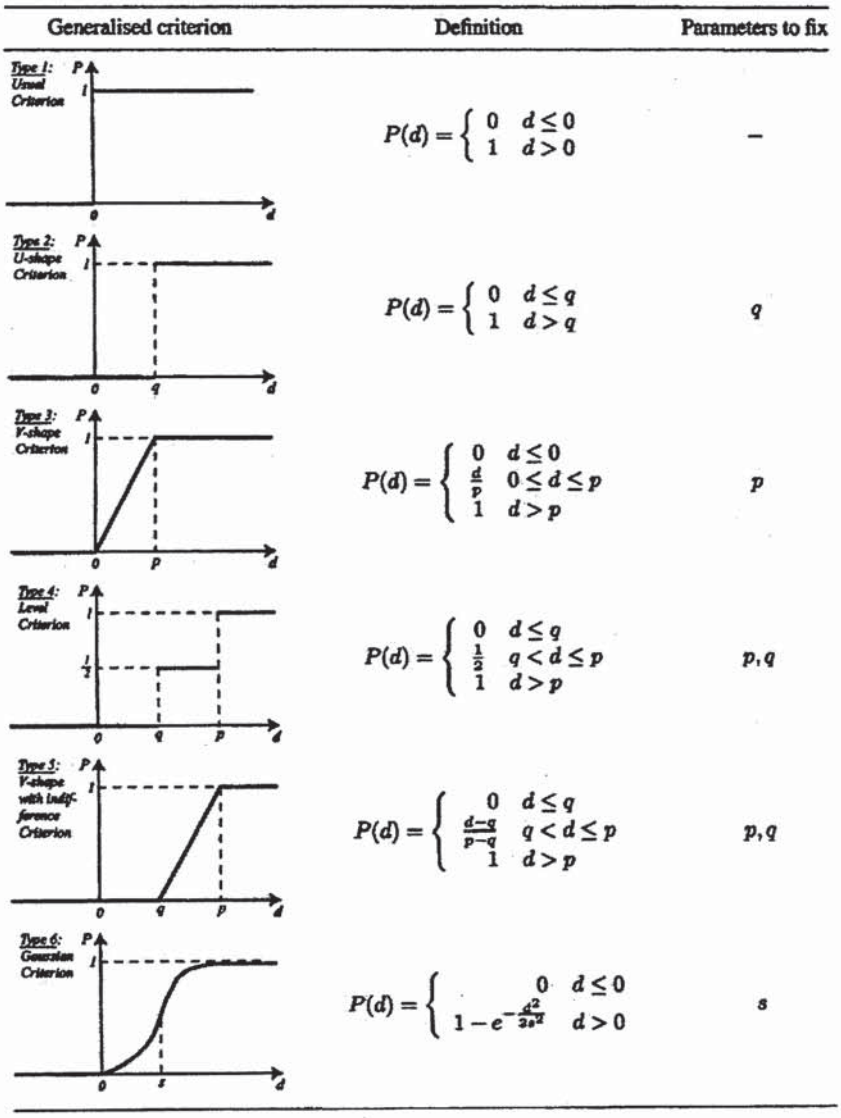


Figure 6: Types of generalized criteria.
Source: Brans and Mareschal, 2005

Pj(dj(a, b)) gives the degree of preference of a over b [dj(a, b) = gj(a) − gj(b)]. For each pair of alternatives (a, b), PROMETHEE I & II compute $\pi(a, b)=\sum wj \cdot Pj(a,b)$. The greater the value of $\pi(a, b)$, the greater the preference of a over b is (Corrente, 2013)

As described in a study conducted by Tomić et al., (2011), the PROMETHEE method is based on mutual comparison of each alternative pair with respect to each of the selected criteria. In order to perform alternative ranking by the PROMETHEE method, it is

2.4 Empirical Evidence

2.4.1 Empirical Evidence on measuring banks' efficiency in general

The banking sector is considered a vital element in the modern economy; therefore it is important for banks to be efficient. In order to ensure a healthy financial system and consequently an efficient economy, banks must be carefully evaluated and analysed. This paragraph will summarize some empirical evidences related to the measurement of banks' performance and efficiency.

It is organized in four parts: the first one deals with previous studies that used the PROMETHEE method to evaluate banks performance; the second one deals with previous studies that used the CAMELS method to analyze banks' efficiency; the third part is about empirical findings concerning the impact of banks' size on their performance; and the fourth part covers miscellaneous methods used to measure the performance of a bank.

PROMETHEE Approach and Efficiency

Keyser and Peeters (1996) discussed the importance of the PROMETHEE method in the world of outranking methods and pointed out the considerations that should be taken into account while applying the PROMETHEE method.

Kosmidou and Zopounidis (2008) used the PROMETHEE method including a number of financial ratios to evaluate the performance of commercial banks in Greece. They found that commercial banks are trying to increase their accounts in order to attract more customers and ameliorate their financial indices, in that way they become more competitive and they can maximize their profits.

Doumpos and Zopounidis (2009) developed a rating system to act as a supporting tool for the analysts at the Bank of Greece. They implemented a multi-criteria approach using the PROMETHEE II method. They selected criteria that comply with the

CAMELS framework and included both qualitative and quantitative measures. They provided a set of evaluation that enables the analysts to identify the strengths and weaknesses of the banks in the study.

Furthermore, Doumpos and Zopounidis (2010) discussed a case study on the implementation of a multi-criteria approach using the PROMETHEE II method to rate banks. They highlighted the importance of the multi-criteria methodology to evaluate banks due to the increase interest in monitoring and evaluating banks' performance especially after the recent financial crisis.

Mareschal and Mertens (1992) used the PROMETHEE and GAIA multi-criteria methodology for a database including over six hundred of the most important banks in the world. They computed fifteen financial ratios from the available data in order to position each bank within its regional sector. They described as well the strengths and weaknesses of each bank using this methodology.

Uzar (2013) demonstrated in her paper the possibility of using the PROMETHEE method in order to determine the financial performance of public banks in Turkey. She used two data sets with ten criteria for each bank (the first one covers the period from 2002 to 2007, and the second one covers the period from 2008 to 2012) in order to compare banks' performance for the two periods before the global financial crises (2002-2007), and during the global financial crises (2008-2012). She found that banks' rankings did not change for both periods (2002-2007 and 2008-2012) concluding that the financial crisis did not affect public banks in Turkey since the latter had strong liquidity position and capital adequacy.

Stathas et al. (2002) proposed a multi-criteria approach to evaluate banking performance over multiple criteria. They used the PROMETHEE method to rank Greek banks according to their financial performance during the period 1995-1999.

Moreover, Ginevicius and Podviezko (2013) evaluated the soundness and stability of commercial banks in Lithuania by using several multiple criteria methods including the PROMETHEE. They found that the level of soundness and stability of commercial

banks in Lithuania fluctuates a lot. They compared the results of the multiple approaches to find out the reasons of the fluctuations.

CAMELS Framework and Efficiency

This part is related to studies performed by different studies using the CAMELS framework to evaluate banks. In 2001, a research study on the Turkish banking sector analyzed the relationship between CAMELS rating and the possibility of failure of a bank by based on 1997 to 2000 data of Turkish commercial banks. The result was that only 17% of the banks that were pointed out as successful by CAMELS system have failed (Kaya, 2001).

However, in his literature review on performance evaluation of Turkish banks and banking groups, Öztorul (2011) concluded that several studies were not able to reach a consensus in terms of the power of CAMELS rating to predict bank failure. At the same time, it was found that CAMELS rating cannot eliminate bank failure.

Dzeawuni and Tanko (2008) conducted a study on eleven commercial banks in Nigeria over a period of nine years (from 1997 to 2005) to find the adequacy of CAMEL in capturing the overall performance of a bank and to show the relative weights of importance of all factors. They concluded that each factor in CAMEL cannot capture the holistic performance of a bank; therefore no factor in CAMEL is sufficient to depict the overall performance of a bank. They recommended the usage of the best identified ratios in CAMEL when evaluating banks' performance.

Sangmi and Nazir (2010) conducted a study to evaluate the financial performance of the two major banks operating in Northern India by using CAMEL parameters. They found that the position of the banks under study is sound and satisfactory in terms of capital adequacy, asset quality, management capability and liquidity.

The CAMELS method was also used in a study to evaluate the financial performance of the Turkish banking sector for the period 2004 to 2011 in terms of capital ownership and scale (Öztorul, 2011). The study concluded that the aggregated CAMELS components of groups obtained from grouping of banks in terms of capital ownership show

significant difference only in terms of A, M, E, and S. In terms of scale, it was obtained a significant separation between small banks and medium banks for asset quality and liquidity, a significant separation between small banks and large banks in terms of management, and a significant separation among all scales in terms of profitability and sensitivity to market risk.

Altan, Yusufazari and Beduk (2014) conducted a study using the CAMEL approach to investigate the performance and financial soundness of state-owned and private-owned banks in community of Turkish banks for the period 2005 to 2012. The objective was to rate studied banks using the CAMEL criteria. They observed that there is a significant difference between performance of state-owned and private-owned in Turkish banking system.

Ferrouhi (2014) analyzed the performance of major Moroccan financial institutions for the period 2001-2011 using CAMEL approach. He aimed to evaluate their capital adequacy, asset quality, management, earnings and liquidity in order to determine a proper ranking for these banks. The result was a ranking that ranges from 2.2 for the worst bank to 4.4 for the best bank using the CAMEL approach.

Size and Efficiency

The third part of this empirical evidence presents studies testing the relationship between bank size and performance. However, there is no consensus concerning the impact and significance of size on efficiency. While some researchers found that the largest the bank is, the more is its efficiency, other researchers concluded the opposite whereby the largest the bank is, the less its efficiency. On one side, a positive relationship might arise from the fact that larger banks are able to develop technical, financial, and material resources, leading to higher efficiency. On the other side, larger banks are more exposed to agency and coordination problems, contribution to lower efficiency.

On one side, and supporting the presence of economies of scale in large banks, Wheelock and Wilson (2012) found that large US banks are more efficient than small

banks and Styrin (2005) found the same result for Russian banks. Hughes et al (2001) found the presence of economies of scale that increases with size, similarly to Feng and Serlitis (2010) and Wheelock and Wilson (2012).
In parallel to these results, Konstandina (2007) studied the performance of Russian banks from the year 1999 till 2004 and found that performance of medium and big size performed better than small size banks in terms of efficiency.

The technical efficiency of large banks was examined by Miller and Noulas (1996) who showed that larger banks have higher levels of technical efficiency. Moreover, Drake and Hall (2003) supported the presence of a positive relationship between bank size and technical and scale efficiency in Japan. Similarly, largest banks were found to be relatively more efficient for Australian banks (Sathye, 2001) and for Hungarian banks (Hasan and Marton, 2003).
Seiford and Zhu (1999) used DEA approach on top fifty five US banks and found that large banks' performance was better than that of small banks.
However, according to Berger and Mester (1997), larger banks are more efficient than small ones only in terms of cost, but they are less efficient than small banks in terms of profit. They suggested that while large banks are able to better control their costs, they are not better in generating profits.

On the other hand, Miller and Noulas (1996) found that scale economies appear in small banks and not in large ones. Rime and Stiroh (2003) examined the production structure of Swiss banks for the period 1996 to 1999. They found that small and mid-size banks enjoyed economies of scale while not all large banks were able to achieve the scale economies.

Though, Srivastava (1999) found that medium sized banks have the highest efficiency, followed by large banks, then by small banks, suggesting a non-monotonic relationship between size and efficiency. In contrast, Allen and Rai (1996) found that largest banks in 15 countries studied have higher level of inefficiencies and Goldberg and Rai (1996) found similar results for banks in 11 European countries. Lang and Welzel (1996)

examined the efficiency and technical progress of German cooperative banks using the intermediation approach and concluded that although all banks enjoy productivity, productivity is higher in small banks.

Similarly, Isik and Hassan (2002) found a negative relationship between size and efficiency in Turkish banks.

Welton (2014) stated that although it is easier for large banks to profit from the economy of scale, many small banks are more efficient than large banks.

Different Approaches and Efficiency

This part presents studies that used different approaches to measure banks' efficiency. In his book, Jack Revell (1980) used interest margin as a performance measure for U.S. commercial banks. The author defined interest margin as the difference between interest income and expense divided by total assets.

However, the efficiency of commercial banks has been studied using a variety of techniques and samples. Recent studies typically used techniques that accommodate the multiple outputs of banks and measured the efficiency of individual banks relative to a standard set by peer institutions (Berger et al., 1993).

Furthermore, Yue (1992) demonstrated in his paper that many criteria should be considered to evaluate the performance of commercial banks and not only traditional financial ratios. He highlighted the importance of the DEA to analyze the relative efficiencies of commercial banks.

Moreover, Wheelock and Wilson (1995) described in his article four techniques to measure banks' efficiency. First, the "stochastic cost frontier" approach is an econometric methodology in which deviations of a firm's actual cost from predicted cost are presumed to be due to random error and inefficiency is assumed to have a particular statistical distribution. Second, the "thick frontier" approach is a variant in which deviations from predicted cost within the lowest average cost quartile of banks are assumed to be due to random error, and the differences between the predicted costs of banks in the highest and lowest quartiles are assumed to be due to inefficiency. Third, the 'distribution-free" approach is applicable when data for more than one year are available. It assumes that inefficiency is stable over time, while random errors average

out over time. Therefore, bank's inefficiency for a span of years is taken to be the mean of its measured inefficiency across all years within the period. Finally 'Data Envelopment Analysis' (DEA) is a non-parametric methodology in which linear programming is used to measure the distance of individual banks from the efficient, or 'best-practice,' frontier. All deviations from the efficient frontier are assumed to be due to inefficiency.

Yeh (1996) explained in his article how to apply Data Envelopment Analysis in conjunction with financial ratios to help bank regulators differentiate the efficient banks from the inefficient ones and to gain insight into various financial dimensions that are linked to the bank's financial operational decisions.

Chen and Yeh (1998) compared the data envelopment analysis results for measuring banks' performance to the financial ratios and proved the absence of no consistency between the results. Therefore, they concluded that higher performance bank cannot be determined only through financial analysis and recommended the use of non-parametric approach.

Miller and Noulas (1996) examined the factors that affect bank profitability for large commercial banks during the latter part of the 1980s, using both cross-section and pooled time-series cross-section regressions. They concluded that (i) large banks experienced poor performance because of a declining quality of the loan portfolio, (ii) real estate loans have a negative effect on large bank profitability but with a low level of significance, and (iii) construction and land development loans have a strong positive effect on bank performance.

Halkos and Salamouris (2004) used the data envelopment analysis (DEA) in measuring the performance of the Greek banking sector as an alternative or as a complement to ratio analysis. They found that the higher the size of total assets, the higher the efficiency and that the reduction in the number of small banks increases the efficiency.

Zeitun and Benjelloun (2013) evaluated the relative efficiency of the twelve Jordanian banks over the period 2005-2010. They measured efficiency using Data Envelopment

Analysis (DEA) and they found that only few Jordanian banks were efficient in managing their financial resources and generating profit and that the financial crisis had a significant impact on banks' efficiency.

Based on the above empirical evidences about the multiple methods used to measure the banks' performance, an emphasis will be done in chapter 4 on the CAMELS using both a traditional and multi-criteria approach, and an analysis comparing the results obtained from the PROMETHEE to the traditional CAMELS will be performed.

2.4.2 Empirical Evidence on measuring the efficiency of Lebanese banks

Recent studies about efficiency and performance measurement of Lebanese banks are limited. Osman, Hitti and Ayoubi (2008) introduced in their study the implementation of a Data Envelopment Analysis (DEA) approach to measure the relative performance of Lebanese banks over an 8-year period starting 1997 till 2004. In their paper, they demonstrated that DEA is an effective monitoring tool for central banks to track banks' efficiencies to maintain a sustainable growing sector and to provide early warning signals for a potentially risk bank.

Zreika and El Kanj (2011) identified in their research paper whether banks are working at full efficiency or not and spot the changes in efficiency for banks operating in Lebanon after 2007 financial crisis for the two sub-periods 2002-2006 and 2006-2009 using Data Envelopment Analysis (DEA). They found that after 2007 financial crisis, foreign banks had suffered more with decreasing technical efficiency, while local banks had a significant increase in technical efficiency. Small and medium banks are found to be working at increasing returns to scale, while large banks are working at decreasing returns to scale.

2.5 Conclusion

Monitoring and evaluating bank performance is gaining increasing interest within the context of the recent financial crisis. In this chapter, we have identified different

methods for measuring banks' efficiency. We have showed that multi-criteria approach provides a rigorous analysis for alternatives instead of providing a "final decision", which helps the decision-makers to achieve a better understanding and thus make better choices. Therefore, PROMETHEE method, one of the multi-criteria approaches, will be used in the thesis. In the next chapter, research questions and hypotheses needed to answer those questions will be developed, data used will be described, and the methodology adapted to rate and rank Lebanese banks and to find their weaknesses and their strengths will be elaborated.

Chapter 3

3 METHODOLOGY

3.1 Introduction

This thesis's aim is to rank the Lebanese banks according to their efficiencies and performances, using two types of data analysis: traditional CAMELS analysis and PROMETHEE (multi-criteria) analysis. This objective will be achieved by (i) calculating a score for ten Lebanese banks using these two approaches and by (ii) comparing the obtained score to the actual ranking and rating to check if there is any discrepancy.

Moreover, this thesis aims to compare the performance of listed banks to that of unlisted banks and large banks to that of small banks.

For the measurement and ranking of banks' efficiency and based on the literature review, two methods will be employed using mainly CAMELS variables. The outcome will be a single index, which will be used to rank the Lebanese commercial banks. This approach provides a more realistic picture for a better comprehensive evaluation of banks' efficiency.

The target population of this study is the top ten Lebanese banks based on their total assets in 2012 as reported in Bankscope. However, because of some missing information for the 10^{th} largest bank, the last bank will be eliminated from the sample and replaced by the 11^{th} largest bank. The data for the study covers the period from 2008 to 2012 (the most recent five years).

3.2 Research Design

The research design denotes the overall strategy chosen to integrate the different modules of the study in a clear way, thus, ensuring that the research problem is addressed effectively.

A research design is not just a work plan. While a work plan details what has to be done to complete the project, it should flow from the project's research design. Thus, the

function of a research design is to ensure that the evidence obtained enables the researchers to answer the initial question as unambiguously as possible. When designing the research, we need to ask: given this research question (or theory), what type of evidence is needed to answer the question (or to test the theory) in a convincing way? Similarly, in social research, the issues of sampling, method of data collection, design of questions are all subsidiary to the matter of what evidence you need to collect. (Kirshenblatt-Gimblett, 2006).

A research design can be quantitative, qualitative or mixed. First, a quantitative approach is one in which the investigator primarily uses measurement and observation for developing knowledge, employs strategies of inquiry such as experiments and surveys, and collects data on predetermined instruments that yield statistical data. It allows the researcher to measure and analyze data and it is mainly used to test hypotheses in experiments because of its ability to measure data using statistics. However, its main disadvantage is that a large sample of the population must be studied to get accurate results (Creswell, 2014).

Second, a qualitative approach is one in which the inquirer often makes knowledge claims based primarily on constructivist perspectives (for example individual experiences) or advocacy/participatory perspectives (for example political perspectives). It also uses strategies of inquiry such as case studies. This approach has many advantages. First, it is useful during the early stages of a study when it is still not very clear what will be exactly studied or what to focus on. Second, this type of research does not need a strict design plan before it begins, which gives the researcher the freedom to let the study unfold more naturally. Third, the researcher gains more detailed and rich data in the form of comprehensive written descriptions or visual evidence, such as photographs. This type of research looks at context and social meaning and how it affects individuals, which is advantageous particularly in the social sciences. The researcher interprets the research according to his or her own biased view, which skews the data gathered. However, its disadvantage is that it is very time consuming and can last for months or even years. Furthermore, the researcher will be deeply involved in the process, which might create subjectivity and bias views, leading to incorrect decisions (Creswell, 2014).

Finally, a *mixed* approach is one that incorporates both quantitative and qualitative approach and in which the researcher tends to base knowledge claims on pragmatic grounds. It employs strategies of inquiry that includes gathering both numeric and text information so that the final database represents both quantitative and qualitative information (Creswell, 2014). Despite its advantages, the main challenge is to make sure that the collection methods are complementing rather than duplicating each other, in order to avoid doubling costs.

Since this study is based on empirical research, the hypotheses raised from the research questions mentioned in the below questions will be answered by using statistical measurements deduced from the secondary data. Thus, the quantitative research design will be adopted in this study.

3.3 Research Questions and Hypotheses

The importance of banks in the Lebanese economy and the deficiencies and the contradictions in ranking them prompted the following research questions:

1. What are the scores and ranks of Lebanese banks based on two methods: Traditional CAMELS and PROMETHEE Methodology?
2. Are the scores based on traditional CAMELS approach in conformance with those based on multi-criteria approach using PROMETHEE methodology?
3. Is there a significance difference in PROMETHEE scores between listed and unlisted banks?
4. In case of significant difference between listed and unlisted banks, what factors discriminate between listed and unlisted banks?
5. Is there a significance difference in PROMETHEE scores between big and small size banks?
6. Are the actual ranking of banks based on their total assets in conformance with their Capital Intelligence Financial Strength Rating given by Bankscope?

In order to answer the research questions, a number of hypotheses should be formulated. A hypothesis is a clear statement of what is intended to be investigated. It should be specified before the research is conducted and should be openly stated in reporting the results. This allows identifying the research objectives and its relationship to both the problem statement and the literature review. In fact, a problem cannot be scientifically solved unless it is formulated into a hypothesis form.

According to Sarantakos (2005), a hypothesis is defined as a tentative explanation of the research problem, a possible outcome of the research, or an educated guess about the research outcome. As for Clark and Hockey (1981), a hypothesis is a statement or explanation that is suggested by knowledge or observation but has not, yet, been proved or disproved. Creswell (2014) defines the hypothesis as a formal statement that presents the expected relationship between an independent and dependent variable.

In order to formulate the hypothesis, it is required to be expressed as null and alternative hypothesis.

The null hypothesis represents a theory that has been put forward, either because it is believed to be true or because it is to be used as a basis for argument, but has not been proved. The alternative hypothesis, on the other side, is a statement of what a hypothesis test is set up to establish. Therefore, it is the opposite of the null hypothesis and is only reached if the null hypothesis is rejected (Whelan and McBratney, 2000).

The hypotheses that will be tested in this research will be as follows:

Research Question 2:

The null hypothesis ($H_{0,2}$): The banks' scores under the PROMETHEE method are not significantly different than the banks' scores under the Traditional method.

The alternative hypothesis ($H_{a,2}$): The banks' scores under the PROMETHEE method are significantly different than the bank's scores under the Traditional method.

Research Question 3:

The null hypothesis ($H_{0,3}$): The mean scores of the PROMETHEE method for listed banks is not significantly different and higher than the mean scores for unlisted banks.

The alternative hypothesis ($H_{a,3}$): The mean scores of the PROMETHEE method for listed banks is significantly different and higher than the mean scores for unlisted banks.

Research Question 4:

This hypothesis will be divided into 6 sub-hypothesis which are constructed to examine which of the 6 variables related to CAMELS discriminate between listed and unlisted banks

Hypothesis 4.1: *Capital Adequacy variable can discriminate between listed and unlisted banks.*

Hypothesis 4.2: *Asset Quality variables can discriminate between listed and unlisted banks.*

Hypothesis 4.3: *Management variables can discriminate between listed and unlisted banks.*

Hypothesis 4.4: *Earnings variables can discriminate between listed and unlisted banks.*

Hypothesis 4.5: *Liquidity variables can discriminate between listed and unlisted banks.*

Hypothesis 4.6: *Sensitivity to market risk variables can discriminate between listed and unlisted banks.*

Research Question 5:

The null hypothesis ($H_{0,5}$): The mean scores of the PROMETHEE method for big banks is not significantly different and higher than the mean scores for small banks.

The alternative hypothesis ($H_{a,5}$): The mean scores of the PROMETHEE method for big banks is significantly different and higher than the mean scores for small banks.

Research Question 6:

The null hypothesis ($H_{0,6}$): The actual rankings of banks based on their total assets is not significantly different than their Capital Intelligence Financial Strength Rating given by Bankscope.

The alternative hypothesis ($H_{a,6}$): The actual rankings of banks based on their total assets is significantly different than their Capital Intelligence Financial Strength Rating given by Bankscope.

3.4 Data and Selected Variables

3.4.1 Data and its Source

Data are classified as either primary or secondary. While the secondary data are data collected by others, the primary data are the one collected by the researcher to answer the specific research problem at hand. The study will focus on the top ten Lebanese banks, both listed on Beirut Stock Exchange (BSE) and non-listed banks. The data used in the empirical study are secondary yearly data retrieved from Bankscope and complemented by data obtained from the banks' annual reports when necessary. Bankscope database contains the financial statements of Lebanese banks. However, because some of the financial data are missing from this database, the relevant figures were obtained from banks' annual reports.

The banks included in this study should meet two criteria:

a. Banks classified as the top largest banks based on the total assets of the latest accounts date available on Bankscope. This criterion for choosing the banks is used since Lebanese banks are conventionally ranked based on the total assets.
b. Banks with no missing information for the study period

After the above filtering, the bank ranked in the tenth place is dropped and replaced by the bank ranked in the eleventh place. Therefore, the banks that will be investigated are: (1) Bank Audi, (2) BLOM Bank, (3) Byblos Bank, (4) Fransabank, (5) Bankmed, (6) Société Générale de Banque au Liban, (7) Bank of Beirut, (8) Banque Libano-Francaise, (9) Crédit Libanais, and (10) BBAC.

Data for the study cover the period from 2008 to 2012 (the most recent five years) resulting in 50 observations.

3.4.2 Variables

In order to test the hypotheses mentioned in the previous section and consequently to answer the research questions, variables related to these hypotheses/questions should be selected. The variables are classified into two categories: dependent and independent variables. While the independent variable is the variable that is varied or manipulated by the researcher to test its effects on the dependent variable, the dependent variable is the variable being tested and that depends on the independent variable. As the researcher changes the independent variable, the change in the dependent variable is observed and recorded.

Dependent Variable

Since the objective of this research is to calculate an efficiency score for Lebanese banks based on multi-criteria approach and to compare it to that based on traditional methods and to the current ranking system, the dependent variable is the bank score calculated as a function of multiple independent variables that will be elaborated in the next section.

Independent Variables

There are many financial variables that are used to analyze banks' performance, and thus they are expected to have an impact on banks' score; however the study will be restricted to ten financial ratios that are inspired from the **CAMELS** rating mentioned in chapter two. These variables will be grouped into 6 categories: **C**apital adequacy (C), **Asset** quality (A), **M**anagement (M), **E**arnings (E), **L**iquidity (L), and **S**ensitivity to market risk (S). Each one of these categories covers a particular aspect in the bank. These variables, their calculations, and their relationship with bank scores are presented as follows:

Capital Adequacy Ratios

Capital adequacy ratios measure the extent to which assets can fall before leading to insolvency. These ratios determine the capacity of the bank in terms of meeting their

liabilities and dealing with other risks such as credit risk, operational risk (Estrella et al., 2000). A minimum capital adequacy ratio has been developed to ensure that banks can absorb a reasonable level of losses before becoming insolvent, therefore promoting the stability and the efficiency of the financial system. For example, Basel Committee on Banking Supervision of the Bank of International Settlements had developed rules related to capital adequacy which member countries are expected to follow.

Wall (2013) mentioned that the capital adequacy ratios have been an important tool of prudential supervision dating back prior to the adoption of the first Basel Accords in 1988.

One capital adequacy ratios will be used in this thesis, which is Total Capital Ratio (TCR).

- Total Capital Ratio (TCR): It is defined as Tier 1 and Tier 2 capital divided by Risk-weighted Exposures. Tier 1 Capital is defined as Common Equity Tier 1 plus Additional Tier 1 and Total Capital is defined as Tier 1 Capital + Tier 2 Capital. The capital adequacy ratio can be measured as the amount of a bank's capital expressed as a percentage of its risk weighted credit exposures (Atkas and Tas, 2007). Risk-weighted exposures include weighted sum of the bank's exposures to credit. Banks' assets such as Government Treasury held, Loans to Corporates, Loans to Small Businesses and other exposures on or off the bank's balance sheet are multiplied by a weight. The weight depends on the riskiness of the asset and is determined in accordance with the Basel Committee guidance for assets of each credit rating class. This ratio is the basic ratio used for measuring the power of capital in terms of covering different types of risks such as credit, market, and operational risk.

Since banks with high capital adequacy ratios are more able to absorb unexpected losses, they are less likely to become insolvent. Therefore, we expect a positive relationship between this ratio and banks' score.

Asset Quality

Asset quality of a bank denotes the total risk assigned to the assets held by banks. This term is used to determine how many of banks' assets are at financial risk and how much allowance for potential losses banks must make. Loans are considered as the most common assets demanding a severe determination of asset quality since they can be non-performing if borrowers default on repayment obligations. In order to assess the quality of assets, risk managers usually assign a numerical ranking to each asset depending upon how much risk is involved (Abata, 2014). Thus, asset quality can be used to measure the performance of banks in terms of minimizing problem, overdue or rescheduled loans, maximizing the recovery of problematic loans, allocating enough loan loss reserves, and increasing loan volume in a healthy way (Trautmann, 2006).
Two variables will be used to assess the asset quality of banks, namely, asset quality index, and loan loss reserves ratio.

- Asset Quality Index (AQI): It is defined as the ratio of non-current assets other than plant, property and equipment to total assets, versus prior year (Warshavsky, 2012):

  $$AQI = \frac{1 - (\text{Current assets}_{t} + PP\&E)/\text{Total assets}_{t}}{1 - (\text{Current assets}_{t-1} + PP\&E_{t-1})/\text{Total assets}_{t-1}}$$

  Where: t = current year & t – 1 = prior year; PP&E = property, plant & equipment.
  Since AQI measures the proportion of total assets for which future returns are less certain, it is expected to have a negative relationship with the bank score.

- Loan Loss Reserve Ratio (LLR): This ratio is an asset quality ratio that deals with the quality of loans of a bank. It can be calculated by dividing the loan loss reserves by the average gross loans. The loan loss reserve is the portion of the gross loan portfolio that has been expensed in anticipation of losses due to

default. It represents the cumulative value of the loan loss provision expense, less the cumulative value of loans written off.

The gross loan represents all outstanding principal for all outstanding client loans, including current, delinquent and restructured loans, but exclude loans that have been written off, interest receivable and employee loans.

This ratio gives an indication of the management's expectation of future loan losses. As mentioned by Walter (1991), provision for loan losses has been found to be one of the most important factors affecting bank profitability. Thus, we expect a negative relationship between this ratio and banks' scores.

Management

The overall performance of banks and their risk profiles are measured by management ratios. Management refers to "the quality of the monitoring and support of the activities by the board and management and their ability to understand and respond to the risks associated with these activities in the present environment and to plan for the future" (Trautmann, 2006, p.22).

Two variables related to the management criterion will be considered in the analysis, namely, the cost to income ratio and the growth in assets.

- Cost to Income Ratio (C/I): It is defined as the total cost divided by the total income, denoting the management performance in keeping costs as low as possible and in getting higher profit. Given that a bank will have a higher performance if its cost is lower, we expect a negative relationship between this variable and the bank's score.

- Growth in Assets (GA): This ratio measures the percentage change in total assets in a given year, where the total assets are defined as the final amount of all gross investments, cash and equivalents, receivables, and other assets presented on the balance sheet. Thus, it reflects the bank's management performance in expanding its operations. The size of commercial banks is usually measured by

total assets (Rose & Hudgins, 2013) and banks are usually classified based on their total assets. Thus, this variable is expected to positively affect bank's score.

Earnings

Earnings represent the amount of profit generated during a specific period, which is usually defined as a quarter (three calendar months) or a year. They usually refer to after-tax net income. By indicating whether the business will be profitable and successful in the long run, earnings have an impact on the share price of a bank. This ratio is needed to measure whether earnings are sufficient enough to cover losses, provide enough capital, and compensate shareholders.
Two variables will be used in order to assess the earnings of banks which are Return on Equity (ROE) and Return on Assets (ROA).

- Return on equity (ROE): Defined as the net profit divided by the total equity, this ratio represents the rate of return to shareholders or the return on each $ of equity invested in the bank. The net profit or income can be found from the bank's income statement while the shareholders' equity can be found from the bank's balance sheet. According to Moussu and Petit-Romec (2013), ROE is a central measure of performance in the banking industry used to allocate capital inside and across divisions. Since the Return on Equity measures how effectively banks are using investors' capital to generate profit, a positive relationship is expected between ROE and the bank's score.

- Return on Assets (ROA): Defined as the net profit divided by the total assets, this ratio reveals how much profit a company earns for each $ of assets. The net profit can be found from the bank's income statement while the assets can be found from the left side of the bank's balance sheet. According to Petersen and Schoeman (2008), ROA is an indicator on how efficiently a bank is being run and management is using its assets to generate earnings. The more the bank's

efficiency is, the higher its score would be. Therefore we expect a positive relationship between the ROA and the bank's score.

Liquidity

Liquidity is defined as the bank's ability to meet its financial obligations as they are due by generating cash or turning its short term assets into cash quickly and a fair price.
According to Balasubramanyan and Haubrich (2013), a financial firm is considered liquid if it can obtain immediately spendable funds at a reasonable cost exactly when it needs them. Thus, ensuring adequate liquidity is an integral part of a financial institution's management.
Similarly, Samad (2004) mentioned that liquidity is the life and blood of a commercial bank. Attention to liquidity had increased dramatically after the 2008 financial crisis where new international banking regulations, especially those of the "Third Basel Accord" started to address this issue.
Two independent variables will be used in this research to capture banks' liquidity. These variables are net loans total asset ratio (NTTA) and liquid assets over total assets (LATA).

- Net Loans to total asset ratio (NLTA): It measures the percentage of assets tied up in loans and is defined as the total loans over the total assets. A higher ratio indicates that a bank is loaned up and its liquidity is low. Thus, the higher the ratio, the higher the liquidity risk is. Therefore, we expect a negative relationship between this variable and the bank's score.

- Liquid Assets over Total Assets (LATA): It is defined as liquid assets over total assets. Liquid Assets include cash, money market securities, and any other assets can be converted into cash easily. The ratio of liquid assets to total assets shows how liquid are the bank's assets. In other terms, this indicator shows the ability of the bank to generate cash or to turn quickly short term assets into cash

(Olagunju et al., 2011). Thus, we expect a positive relationship between this variable and banks' scores.

Sensitivity to Market Risk

The sensitivity to market risk shows the impact of changes and fluctuations in market interest rate, foreign exchange rates, commodity prices, and share prices on bank's performance. Sensitivity of earnings and equity to negative changes in market conditions and to performance of management in terms of forecasting and controlling this risk are main concerns (Trautmann, 2006).

Although sensitivity to market risk is typically measured by rate sensitive assets divided by rate sensitive liabilities, it will be proxied by the risk weighted assets over total assets due to data unavailability.

- Risk Weighted Assets over Total Assets (RWTA): Risk weighted assets is a measure of the amount of a bank's assets, adjusted for risk. They are computed by adjusting each asset class for risk in order to determine the bank's real world exposure to potential losses. The risk weighting varies according to each asset's inherent potential for default and what the likely losses would be in case of default. For example, a loan secured by property is less risky and given a lower multiplier than an unsecured loan (Jackson and Kronman, 1979). We expect a negative relationship between this variable and the bank's score.

3.5 Methodology

Research methodology refers to the way used to solve a research problem. It is considered as a science of studying scientifically how a research is done by analyzing the different steps that are adopted by the researcher in analyzing the research problem.

The research methodology differs from the research methods/techniques used for conducting the research. In fact, the research methods or techniques refer to the methods

which are used by the researcher during the course of studying his/her research problem. They are divided into three groups:

- Methods related to the collection of data: used when the data already available are not sufficient to arrive at the required solution.
- Methods related to statistical techniques: used for establishing relationships between the data and the unknowns.
- Methods used to evaluate the accuracy of the results obtained (Cohen et al., 2007).

The research methods constitute a part of the research methodology. A researcher needs to know not only how to develop certain indices or tests, or how to calculate the mean, the mode, the median, and the standard deviation but also which of the methods or techniques are relevant and which are not, and why the hypotheses have been formulated. Therefore, designing the research methodology is important since it differs from problem to problem. This thesis is made of two methodologies: the first one is related to the traditional approach while the second one is related to PROMETHEE, a multi-criteria approach.

3.5.1 Variable Selection Method

The literature review is the main determinant in choosing the financial variables. Since these variables are the essence of the evaluation, they should not miss valuable characteristics and must not correlate between themselves. Thus, in order to obtain unbiased results, we found it most appropriate to use variables related to the well-known CAMELS framework which outlines bank stability and soundness. These variables include important criteria for banks' ranking such as the capital adequacy of banks, asset quality, management, earnings, liquidity, and sensitivity to market risk.

3.5.2 Ranking based on Traditional Approach Methodology

Bank efficiency and score will be measured in two ways: the traditional way based on CAMELS framework and the multi-criteria approach based on PROMETHEE

framework. This part will describe the traditional CAMELS methodology used to find the score of each bank in a certain year. The score will be created by setting an index for each of the 6 criteria (capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk) that define the CAMELS. Then, a single score for each bank i for a certain year t will be computed as the average of the six indexes calculated earlier.

$Score_{i,t}$ = (Capital Adequacy $index_{i,t}$ + Asset Quality $index_{i,t}$ + Management $index_{i,t}$ + Earning $index_{i,t}$ + Liquidity $index_{i,t}$ + Sensitivity $index_{i,t}$)/6

To find the index for each independent variable or criterion, the following steps are used:

Step 1: Find the ten ratios described earlier, which are related to Capital Adequacy, Asset Quality, Management, Earning, Liquidity, and Sensitivity to Market Risk.

Step 2: Find a reference value of each variable, which is simply the average value of each variable in a certain year. For example, the reference value of ROE in a given year t is equal to the sum of ROE of all banks in a given year t divided by the number of banks, which is ten in our case.

$$\text{Reference value of ROE} = \sum_{i=1}^{10} \frac{(ROE\ bank\ i)}{10}$$

Step 3: Find an intermediate index for each ratio and for each bank i by dividing the value of this variable for bank i by the reference value computed in Step 2. For example, the intermediate ROE index for Byblos bank is equal to:

Intermediate index= [ROE of Byblos bank/Reference value of ROE] × 100

Step 4: Find the variable index for bank i for each criterion as follows:

- If the variable is positively related to bank score, the index is equal to Intermediate index – 100
- If the variable is negatively related to bank score, the index is equal to 100 - intermediate index.

Then, the index for each of the CAMELS criterion is calculated by using the average index of each of the independent variables defining the criterion. For example, the index for the Earning criterion is calculated as follows:

Earning index bank i = (ROE index bank i + ROA index bank i)/2

Step 5: Calculate the consolidated CAMELS value for each bank and year as the average of each of the Intermediate Index.

Table 2 summarizes the ratios used in the CAMELS analysis, with the expected signs between them and the bank score.

Table 2: Expected relationship between bank scores and CAMELS variables.

PERFORMANCE INDICATOR		Ratio	Expected Relationship with Banks Scores
C	Capital Adequacy	Total Capital Ratio TCR	+
A	Asset Quality	Asset quality index AQI	-
		Loan Loss Reserve Ratio LLR	-
M	Management	Cost to Income Ratio (C/I)	-
		Growth in Assets	+
E	Earnings	Return on equity ROE	+
		Return on Assets ROA	+
L	Liquidity	Net Loans to total asset ratio (NLTA)	-
		Liquid Assets over Total Assets (LATA)	+
S	Sensitivity to Market Risk	Risk Weighted Assets over Total Assets (RWTA)	-

3.5.3 Ranking based on PROMETHEE Methodology

3.5.3.1 Introduction

The second and main methodology used to create a single index to score and rank the Lebanese commercial banks is the PROMETHEE method.

The PROMETHEE methods are designed to analyze data within a multi-criteria table including a number of actions and several criteria. The action designates either a possible decision or an item to evaluate while the criterion is an attribute associated to each action that makes it possible to compare the actions.

In mathematical terms, the problem can be written as follows (VPSolutions, 2013):

$$\max\{f_1(a), f_2(a), \dots, f_j(a), \dots, f_k(a) | a \epsilon A\}$$

Where A is a finite set of n actions and f_1 to f_k are k criteria. $f_j(a)$ is the evaluation of action a on criterion f_j. The evaluations of the actions on the criteria form a two-way multi-criteria table as shown in Table 3.

Table 3: Two-way multi-criteria table

	f_1	f_2	...	f_j	...	f_k
a_1	$f_1(a_1)$	$f_2(a_1)$	...	$f_j(a_1)$	...	$f_k(a_1)$
a_2	$f_1(a_2)$	$f_2(a_2)$	...	$f_j(a_2)$	...	$f_k(a_2)$
⋮	⋮	⋮		⋮		⋮
a_i	$f_1(a_i)$	$f_2(a_i)$	...	$f_j(a_i)$	...	$f_k(a_i)$
⋮	⋮	⋮		⋮		⋮
a_n	$f_1(a_n)$	$f_2(a_n)$	...	$f_j(a_n)$	...	$f_k(a_n)$

Source: VPSoultions, 2013

The decision maker's expectation is to identify the optimal action according to all criteria. Because the latter is impossible as the criteria are more or less conflicting with each other, the objective of a multi-criteria decision analysis (MCDA) is to identify the best compromise decisions. One common way to solve this multi-criteria decision problem is to aggregate all the criteria into a single summary score (VPSolutions, 2013). The simplest and most often used way is to compute a weighted average of the evaluations as shown in the Equation below:

$$V(a) = \sum_{j=1}^{k} w_j \times f_j(a) \ )$$

where:

- $w_j > 0$ is the weight allocated to criterion f_j (the more important f_j the larger w_j),
- $V(a)$ is the resulting score of action a.

The actions can then be ranked according to their V scores, from the largest to the smallest value. However, this approach has several limitations and can be dangerous for many reasons. First, it is a compensatory approach which means that a very bad

evaluation on one criterion can always be compensated for by better values on other criteria. Second, the weights of the criteria are linked to the scales of measurement of the criteria in a way that is difficult to manage. Third, reducing an action to a single score means lost information about the conflicts among the criteria that have to be solved to take a decision.

In order to have more balanced compromise solutions, PROMETHEE analysis uses another type of methods, called "The outranking methods". The outranking methods are used to compare one solution to another instead of trying to define what is good and what is bad, which can be very difficult especially when facing a new problem for which there are very few reference points. Outranking methods use the results of the pairwise comparison of the actions to build a relative ranking of the actions from the best one to the worst one.

For a better multi-criteria approach, the following seven requisites should be included in outranking methods (VPSolutions, 2013):

- Requisite 1: The amplitude of the deviations between the evaluations of the actions for each criterion should be taken into account (an additional payment of $10 is not the same as an additional $1,000).
- Requisite 2: Usually each criterion has a specific scale and measurement unit, thus scaling effects should be avoided. It cannot be acceptable to make conclusions while depending on the scales used in the evaluation (changing a currency from Euro to Dollar should not impact the analysis results).
- Requisite 3: When comparing two actions x and y, three situations can appear:
  - x is preferred to y
  - x and y are indifferent
  - x and y are incomparable because they are very different from each other: one is much better than the other on some criteria only.
- Requisite 4: Different multi-criteria methods request different additional information and conduct different calculation procedures so that the solutions they propose can be different. It is therefore important to develop methods being understandable by the decision-maker.

- Requisite 5: A good multi-criteria method should not include technical parameters that are non-significant to the decision-maker.
- Requisite 6: A good multi-criteria method should provide information on the existing conflicts between the criteria.
- Requisite 7: Most multi-criteria methods are using weights to define the relative importance of the criteria. It is usually not easy to define values for the weights. These weights can also be seen as degrees of freedom for the decision-maker to explore possible solutions. A good multi-criteria method should therefore include appropriate sensitivity analysis tools.

These seven requisites have been taken into account in the development of the PROMETHEE methods since the latters are among the most widely used outranking methods.

Requisites 1, 2 and 5 are addressed by the introduction of preference functions that will be described in the next section. Requisite 3 is taken into consideration in the PROMETHEE I and II rankings. Requisite 4 is achieved by trying to keep the PROMETHEE methods as simple as possible. Requisite 6 is addressed by the GAIA method, while requisite 7 is tackled by the various sensitivity analysis tools that have been developed for PROMETHEE.

3.5.3.2 Steps in the PROMETHEE Software

3.5.3.2.1 Defining Actions and Criteria

In order to rank banks for each of the years 2008 to 2012, the PROMETHEE software based on multi-criteria approach will be used. First, actions should be defined, which are the ten Lebanese banks mentioned earlier in the thesis and for which we have to compute a score. Second, criteria should be defined, which are based on the CAMELS rating (total capital ratio for **C**, asset quality index and loan loss reserve ratio for **A**, cost to income and growth in assets for **M**, return on equity and return on assets for **E**, net loans to total assets and liquid assets over total assets for **L**, and risk weighted assets over total assets for **S**).

Once the actions and criteria are introduced in the software, preference functions and weights should be allocated to each criterion.

3.5.3.2.2 Determining Preference Functions

PROMETHEE requires associating a preference function to each criterion in order to model the way the decision-maker perceives the measurement scale of the criterion. In PROMETHEE, preference levels are measured on a scale going from 0 to 1, where 0 means no preference at all while 1 means a full preference (VPSolutions, 2013).

Depending on the type of the preference function that has been selected, up to two of three thresholds have to be assessed, which are (1) Q - the indifference threshold; (2) P- the preference threshold; and (3) S - the Gaussian threshold (VPSolutions, 2013).

First, Q – the indifference threshold is the largest deviation that is considered as negligible by the decision-maker. Therefore, it is the value just below the first significant value. We will consider half of the standard deviation for each variable as not relevant for the decision making process.

Second, P – the preference threshold is the smallest deviation that is considered as sufficient to generate a full preference. Therefore it is the value that is slightly above the one that develops hesitation about the preference. We will consider that a value above the standard deviation for each variable as relevant for the decision making process.

Third, S – the Gaussian threshold corresponds to the inflection point of the Gaussian curve (similarly to the standard deviation in statistics). It is thus a deviation for which the preference degree is equal to 0.39 so it is between a Q and a P value. Because it is very difficult to assess, a rule of thumb is to determine a Q and a P value and to set S equal to their average (S = (Q+P) / 2).

There are six different types of preference functions available in the PROMETHEE methods as shown in Figure 7

- **Type I: Usual preference function**: The Usual preference function is very simple. It is a good choice for qualitative criteria including a small number of evaluation levels (like the often used 5-point scale ranging from very bad to very good). This function corresponds to optimization (the larger the value, the better) but it does not include any threshold. Using the Usual preference function with a quantitative criterion such as a price would mean that you consider a price difference of $10 and a price difference of $1,000 as equivalent, which is not appropriate.
- **Type II: U-shape preference function**: The U-shape preference function introduces the notion of an indifference threshold.
- **Type III: V-shape preference function**: The V-shape preference function is a special case of the linear preference function (Type V) where the Q indifference threshold is equal to 0. It is thus well suited to quantitative criteria when even small deviations should be accounted for.
- **Type IV: Level preference function**: The Level preference function is better suited to qualitative criteria when the decision-maker wants to modulate the preference degree according to the deviation between evaluation levels. It is a good choice for qualitative criteria with a larger number of levels.
- **Type V: Linear preference function:** The Linear preference is the best choice for quantitative criteria when a Q indifference threshold is wished.
- **Type VI: Gaussian preference function**: The Gaussian preference function is an alternative to the linear one. It has a smoother shape but it is more difficult to set up because it relies on a single S threshold which is between the Q and P thresholds. Because it has less obvious interpretation, this function is seldom used (VPSolutions, 2013).

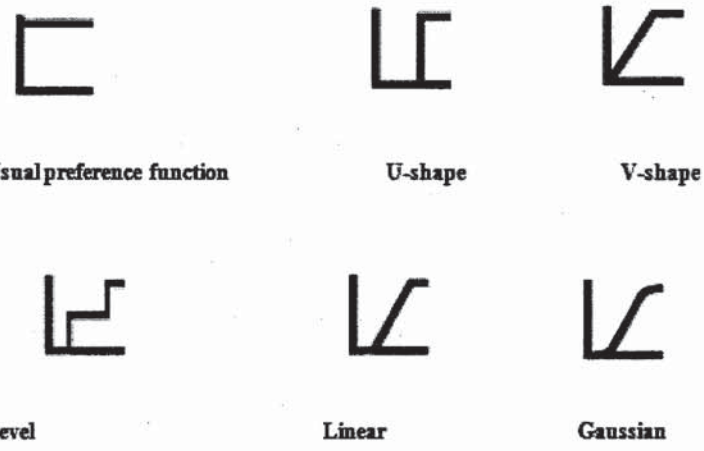


Figure 7: Types of Preference Functions
Source: VPSolutions, 2013

Because all criteria in this thesis are quantitative, they will be assigned a linear preference function.

3.5.3.2.3 Criteria Values and Weights

After choosing the criteria, they must be transformed to maximizing or minimizing ones. Maximizing criteria means that the best value is achieved at its maximum value, while minimizing criteria means that the best value is achieved at its minimum value.

There are five minimizing criteria among the ten chosen variables namely, asset quality index, loan loss reserves, cost to income, net loans to total assets, and risk weighted assets to total assets. The remaining five variables are maximizing criteria and they are capital ratio, asset growth, return on equity, return on assets and liquid assets to total assets.

Then a weight should be assigned to each criterion since it is an essential parameter to reflect the priorities of the decision-maker. The weights of the criteria are positive numbers representing the relative importance of the criteria. In PROMETHEE, they are

defined independently from the scale of measurement of the criteria. More important criteria are given larger weights while less important ones are assigned smaller weights. PROMETHEE automatically normalizes the weights so that their sum is equal to 1 (100%) (Ginevičius and Podviezko, 2013).

However, assessing weights to the criteria is not straightforward. It involves the priorities and perceptions of the decision-maker. Therefore, several sensitivity analyses will be performed in Visual PROMETHEE in order to enhance the decision-making. In our case, in order to provide the same importance to each of the CAMELS criterion, the following weights will be assigned:

- 1 for the total capital ratio representing Capital Adequacy Criterion (C),
- 0.5 for the asset quality index and 0.5 for the loan loss reserve so that they provide a weight of 1 for Asset Quality criterion (A) when they are combined,
- 0.5 for the cost to income and 0.5 for the growth in assets so that they provide a weight of 1 for Management criterion (M) when they are combined,
- 0.5 for the return on equity and 0.5 for the return on assets so that they provide a weight of 1 for Earning criterion (E) when they are combined,
- 0.5 for the net loans to total assets and 0.5 for the liquid assets over total assets so that they provide a weight of 1 for Liquidity criterion (L) when they are combined,
- 1 for the risk weighted assets over total assets, representing Sensitivity to Market Risk criterion (S).

Table 4 summarizes the inputs used in the PROMETHEE software.

Table 4: PROMOTHEE Input

Actions	Criteria	Preference Function	Indifference Threshold	Preference Threshold	Weight	Criterion to be max or min	Unit
Bank Audi	Total Capital Ratio TCR	Linear	Standard Deviation/2	Standard Deviation	1.00	Max	Percentage
BLOM Bank	Asset quality index AQI	Linear			0.50	Min	Percentage
Byblos Bank	Loan Loss Reserve Ratio LLR	Linear			0.50	Min	Percentage
Fransabank	Cost to Income Ratio (C/I)	Linear			0.50	Min	Percentage
Bankmed	Growth in Assets GA	Linear			0.50	Max	Percentage
Bank of Beirut	Return on equity ROE	Linear			0.50	Max	Percentage
SGBL	Return on Assets ROA	Linear			0.50	Max	Percentage
Banque Libano Francaise	Net Loans to total asset ratio (NLSTA)	Linear			0.50	Min	Percentage
Credit Libanais	Liquid Assets over Total Assets (LATA)	Linear			0.50	Max	Percentage
BBAC	Risk Weighted Assets over Total Assets (RWTA)	Linear			1.00	Min	Percentage

3.5.3.3 Ranking different actions

3.5.3.3.1 Pairwise Comparisons

Because PROMETHEE is an outranking method, it is based on the principle of pairwise comparison of the actions. Thus, a first step in the PROMETHEE modeling is to compare each action with each other.

To compare actions *a* and *b* using *fj* criteria (*j* = 1 to k), a multi-criteria preference index is computed as follows (VPSolutions, 2013):

$$\pi(a,b) = \sum_{j=1}^{k} w_j \times P_j(a,b)$$

Where:

- *wj* > 0 is the normalized weight allocated to criterion *fj* (the more important *fj*, the larger *wj*),
- *Pj* (*a*,*b*) is the value of the preference function for criterion *fj* when action *a* is compared to action *b*.

With normalized weights, π (*a*,*b*) is a number between 0 and 1. It expresses how much a is preferred to b taking into account all the criteria and their weights. For instance, if π (*a*,*b*) = 0, then, all the *Pj* (a,b) values are equal to 0 which means that a is never preferred to b on any criterion. If π (a,b) = 1 , then all the *Pj* (*a*,*b*) values are equal to 1 which means that a is strongly preferred to b on all the criteria. Thus, π (a,b) $\approx$ 0 means that there is a weak preference for a over b, while π (*a*,*b*) $\approx$ 1 means that there is a strong preference for *a* over *b* (VPSolutions, 2013).

3.5.3.3.2 Preference Flows

The PROMETHEE rankings are based on the computation of preference flows that are computed to consolidate the results of the pairwise comparisons of the actions and to rank all the actions form the best to the worst one. Three different preference flows are computed: (1) Phi+ (ϕ^+), the positive (or leaving) flow; (2) Phi- (ϕ^-), the negative (or entering) flow; and (3) Phi (ϕ), the net flow (VPSolutions, 2013).

- Phi+ (ϕ^+): The positive preference flow $\phi^+(a)$ measures how much an action a is preferred to the other n-1 ones. It is a global measurement of the strengths of action a. The larger $\phi^+(a)$, the better the action.

$$\phi^{+}(a)=\frac{1}{n-1}\sum_{b\neq a}\pi(a,b)$$

- Phi- (ϕ^{-}): The negative preference flow $\phi^{-}(a)$ measures how much the other n-1 actions are preferred to action a. It is a global measurement of the weaknesses of action a. The smaller $\phi^{-}(a)$ the better the action.

$$\phi^{-}(a)=\frac{1}{n-1}\sum_{b\neq a}\pi(b,a)$$

- Phi (ϕ): The net preference flow $\phi(a)$ is the balance between the positive and negative preference flows. It thus takes into account and aggregates both the strengths and the weaknesses of the action into a single score. $\phi(a)$ can be positive or negative. The larger $\phi(a)$, the better the action.

$$\phi(a)=\phi^{+}(a)-\phi^{-}(a)$$

3.5.3.4 PROMETHEE Output

3.5.3.4.1 PROMETHEE I Ranking

The PROMETHEE I ranking is a partial ranking. This means that all the actions are not necessarily compared and that the ranking can include in-comparabilities. The ranking is based on the two following preference flows:

- Phi+ (ϕ^{+}): the positive (or leaving) flow
- Phi- (ϕ^{-}): the negative (or entering) flow.

The two preference flows are consolidating the pairwise comparisons of the actions according to opposite points of view, thus, they usually induce two different rankings on the set of actions. The PROMETHEE I partial ranking is the intersection of these two rankings. So action a is preferred to action b in the PROMETHEE I ranking if and only if it is preferred to b according to both preference flows. That is:

$$aP^{I}b \text{ if and only if } \phi^{+}(a) \geq \phi^{+}(b) \text{ and } \phi^{-}(a) \leq \phi^{-}(b)$$

Where P^{I} stands for "is preferred to in the PROMETHEE I ranking" and at least one of the two inequalities should be strict (otherwise the two actions are indifferent). Whenever the two preference flows give opposite rankings of the actions, the actions become incomparable (VPSolutions, 2013).

3.5.3.4.2 POMOTHEE II Ranking

The PROMETHEE II ranking is a complete ranking. This means that all the actions are compared and that the ranking includes no incomparabilities even when comparison is difficult. The resulting ranking can thus be more disputable, especially in the presence of strongly conflicting criteria. The ranking is based on the net preference flow. It combines the two other preference flows in a single summary score. So action a is preferred to action b in the PROMETHEE II ranking if and only if it is preferred to b according to the net preference flow. That is:

$$aP^{II}b \text{ if and only if } \phi(a) > \phi(b)$$

Where P^{II} stands for "is preferred to in the PROMETHEE II ranking" (VPSolutions, 2013).

Both PROMETHEE I and II will be used in this thesis in order to rank the ten Lebanese banks.

3.5.3.4.3 Visual Stability Intervals

The visual stability interval is used to perform a sensitivity analysis to check the effect of changing the weight of one criterion on the overall bank performance.

The visual stability interval window can be drawn for each criterion for each year. It has a horizontal axis that corresponds to the weight of the criterion and a vertical axis that corresponds to the Phi net flow score. For each bank, a line is drawn that shows the net flow score as a function of the weight of the criterion (VPSolutions, 2013).

3.5.3.4.4 GAIA Plane

The objective of GAIA is to describe the major features of the decision problems graphically. GAIA plane tries to find answers to the following questions

- How much are actions different or similar to each other? Are there clusters of similar actions?
- Which criteria are conflicting with each other? Are there strong conflicts to solve? Are there groups of criteria expressing similar preferences?
- What is the impact of the weighing of the criteria on the PROMETHEE rankings?

Similar actions are expected to be close to each other and their location in the k-dimensional space indicates their strengths and their weaknesses. The relative positions of the actions also reveal the links and the possible conflicts between the criteria. However, it is difficult to use this information when there are more than two criteria because the k-dimensional space cannot be visualized. GAIA uses a dimension-reduction technique inspired from a statistical data technique called the principal components analysis (PCA). PCA allows defining a series of orthogonal dimensions (principal components) that keep as much information as possible on the relative positions of the actions in the k-dimensional space.

In the original GAIA method, the two first principal components (named U and V) are computed and displayed in the GAIA plane. The latter is the best two-dimensional representation of the multi-criteria problem. It retains the maximum possible quantity of information from the k-dimensional representation (VPSolutions, 2013).

The information that appears in the GAIA plane are actions, criteria, and the interaction between them.

- Actions: They are represented by points. While actions that are similar to each other appear close to each other in the GAIA plane, those that are very different from each other appear far away from each other. Therefore, subsets of similar actions can be identified.
- Criteria: They are represented by axes drawn from the center of the plane. Criteria expressing similar preferences are represented by axes oriented in similar directions, while criteria expressing conflicting (opposite) preferences are represented by axes oriented in opposite directions. Moreover, the length of a criterion axis is representative of its relative discriminating power; the longer the axis, the more discriminating the criterion is. Thus, subsets of criteria expressing similar preferences can be identified and the relative discriminating power of the criteria can be assessed.

  The identification of subsets of criteria makes it easier to understand the conflicts that have to be solved in making a decision.
- Actions and criteria: The position of the actions with respect to the criteria axes indicate how well actions are performing on the different criteria. What is important is the direction of the corresponding axis. If for example the criteria axis is oriented to the left, the more an action is located to the left of the GAIA plane, the better it is with respect to this criterion.

  By selecting a criterion, the red line extends the direction of the criterion axis. The 'best' values are on the left and the 'worst' are on the right side according to the criterion axis orientation.

  Each action is projected orthogonally on the criterion direction. The projections show the relative performance of the actions on the selected criterion. The distance to the criterion is meaningful. What matters is the place where the action projects on the criterion (VPSolutions, 2013).

The positions of the actions in the GAIA plane are directly related to the profiles of the actions. However, the GAIA plane has a limited quality level and there can be some distortions. Therefore, the PROMETHEE software allows showing the exact action profiles to complement the GAIA information.

3.5.4 Comparisons between groups of banks

In order to answer research questions 3, 4, and 5, banks' scores obtained using the PROMETHEE software will be compared first between listed and unlisted banks, and second between large and small banks. SPSS, a statistical software, will be used to carry this analysis. Therefore, to understand whether there is a difference between the banks' scores of two different groups, either the t-test or the Mann Whitney will be used.

The independent samples t-test will be used to compare the means between two unrelated groups on the dependent variable in case the data is normally distributed. However for non-normal distribution, the Mann Whitney test will be used to compare either the means or the median between the two groups.

First, to analyze the data using an independent t-test, six assumptions are required to give valid results (Laerd, 2011a). The six assumptions are summarized hereafter:

- Assumption 1: The dependent variable should be measured on a continuous scale.
- Assumption 2: The independent variable should consist of two categorical, independent groups.
- Assumption 3: There should be independence of observations, which means that there is no relationship between the observations in each group or between the groups themselves.
- Assumption 4: There should be no significant outliers or single data points within the data that do not follow the usual pattern. The problem with outliers is that they can have a negative effect on the independent t-test, reducing the validity of the results.
- Assumption 5: The dependent variable should be approximately normally distributed for each group of the independent variable. Normality will be tested using the Shapiro-Wilk test of normality (Laerd, 2011b).
- Assumption 6: There needs to be homogeneity of variances. This will be verified using Levene's test for homogeneity of variances.

Second, and in case assumption 5 is violated, the Mann Whitney test can be used as long as assumptions 1, 2 and 3 of the t-test are valid. In addition, we should check whether the two distributions of the independent variables have the same shape or not. If they have the same shape, then, the Mann-Whitney U test that compares the medians of the dependent variable will be used (Laerd, 2011c). On the other hand, if the two distributions have a different shape, then, the Mann-Whitney U test that compares the means will be used. In order to test whether the distributions have the same shape or not, Kruskal Wallis test will be used where the null hypothesis is that the distributions are same and the alternative hypothesis is that the distributions are not the same. If the p-value of the Krustal Wallis test is less than α, the null hypothesis will be rejected, suggesting that the distributions are different (Laerd, 2011d).

In summary, the validity of the above mentioned assumptions will be tested to decide whether the t-test or the Mann-Whitney test will be used to compare the means or the medians first between listed and unlisted banks and second between big and small banks. In case there is a significance difference between listed and unlisted banks (Research Question 3), we will assess which CAMELS variables contribute to this difference (Research Question 4). This will be done using either t-test or the Mann-Whitney test following the same criteria. A significant different in the mean of one variable suggests the contribution of this variable in explaining the difference in the performance between the two groups of banks.

Chapter 4

4 FINDINGS

4.1 Introduction

This chapter will report the findings and analyze the results. First, it will display the descriptive statistics and the correlation between variables. Second, it will describe the findings based on the traditional model explained in the previous section. Third, it will present the findings of PROMETHEE GAIA analysis. The comparison between all ratings and ranking obtained will be presented as a conclusion of this chapter. Consequently, the research questions formulated in chapter 3 will be answered and the hypotheses will be either accepted or rejected. Unexpected findings might arise, contributing to the research results.

4.2 Descriptive statistics and Correlation Analysis

4.2.1 Descriptive Statistics

Table 5 shows the descriptive statistics such as the mean, minimum, maximum and standard deviation of each variable for all the banks for all the years from 2008 till 2012.

According to the table, most variables comprise 50 observations indicating the presence of a balanced panel data. Growth in assets and risk weighted assets over total assets present larger standard deviation as compared with other variables with a value of 15.21 and 11.07, respectively. It reveals that the growth of assets and their compositions have more significant variance than other variables. Furthermore, the fact that the capital adequacy ratio has low standard deviation suggests the adherence to the statutory regulations imposed through the central bank of Lebanon.

The variables related to profitability, such as ROE and ROA display smaller standard deviation, implying that banks' profitability from the year 2008 till the year 2012

remains practically stable. The asset quality reveals somehow a high standard deviation suggesting a difference in the asset quality between one bank and another and from year to year. Finally cost to income ratio and Liquid assets/total assets represent a relatively low standard deviation as compared to the remaining variables suggesting a stable bank performance in terms of management and liquidity.

Table 5: Descriptive Statistics for CAMELS Variables

Variables	Number of Observations N	Mean	Min	Max	Standard Deviation
Total Capital Ratio (TCR)	50.00	13.94	5.95	25.01	4.12
Asset Quality Index (AQI)	50.00	102.25	80.82	145.26	10.46
Loan Loss Res / Gross Loans (LLR)	50.00	5.71	0.76	25.34	5.07
Cost To Income Ratio (C/I)	50.00	50.21	35.87	62.75	6.10
Growth in Assets (GA)	50.00	14.97	0.17	105.68	15.21
Return On Equity (ROE)	50.00	13.36	7.90	20.18	2.87
Return On Assets (ROA)	50.00	1.15	0.65	1.75	0.23
Net Loans / Total Assets (NLTA)	50.00	26.91	17.86	35.28	4.47
Liquid Assets / Total Assets (LATA)	50.00	25.96	14.76	37.01	6.07
Risk Weighted Assets / Tot Assets (RWTA)	50.00	56.57	25.12	68.56	11.07

4.2.2 Correlation Analysis

Correlation is the most common and useful statistical technique used to show whether and how strongly pairs of variables are related. The correlation coefficient "r", the main result of a correlation, is a number between -1 and +1. The more r is close to +1 or -1, the more closely the two variables are related. If r is close to 0, it means there is no relationship between the variables. While a positive r means that as one variable increases the other increases, a negative coefficient means that as one of the variables increases, the other variable decreases (Stockburger, 2013).

Table 6 shows the correlation between the variables.

Table 6: Correlation between CAMELS Variables

Variable	Total Capital Ratio TCR	Asset Quality Index AQI	Loan Loss Res // Gross Loans LLR	Cost To Income Ratio C/I	Growth in Assets GA	Return On Equity (ROE)	Return On Assets (ROA)	Net Loans // Tot Assets NLTA	Liquid Assets // Tot Assets LATA	Risk Weighted Assets // Tot Assets RWTA
Total Capital Ratio TCR	1.00	0.28	-0.01	-0.07	-0.22	-0.02	-0.02	-0.42	0.03	-0.78
Asset Quality Index AQI	0.28	1.00	-0.12	-0.07	0.03	-0.01	-0.03	-0.32	-0.24	-0.26
Loan Loss Res // Gross Loans LLR	-0.01	-0.12	1.00	0.17	0.28	0.49	0.26	-0.13	-0.33	-0.23
Cost To Income Ratio C/I	-0.07	-0.07	0.17	1.00	0.20	-0.44	-0.58	0.38	-0.33	-0.19
Growth in Assets GA	-0.22	0.03	0.28	0.20	1.00	0.05	-0.02	-0.04	-0.19	0.01
Return On Equity (ROE)	-0.02	-0.01	0.49	-0.44	0.05	1.00	0.78	-0.31	-0.03	-0.09
Return On Assets (ROA)	-0.02	-0.03	0.26	-0.58	-0.02	0.78	1.00	-0.20	0.07	0.21
Net Loans // Tot Assets NLTA	-0.42	-0.32	-0.13	0.38	-0.04	-0.31	-0.20	1.00	0.08	0.34
Liquid Assets // Tot Assets LATA	0.03	-0.24	-0.33	-0.33	-0.19	-0.03	0.07	0.08	1.00	0.13
Risk Weighted Assets // Tot Assets RWTA	-0.78	-0.26	-0.23	-0.19	0.01	-0.09	0.21	0.34	0.13	1.00

As we can see from the table above, there is a low correlation among most of the variables which means that a good performance in one aspect of the CAMELS variables does not necessarily mean a good performance in other aspects.

The only relatively high correlations are between the total capital ratio TCR and the risk weighted assets to total assets RWATA (-0.78) and between the return on assets ROA and the return on equity ROE (0.78). The high negative correlation between TCR and RWATA suggests that a bank with a high capital adequacy (high TCR) is supplemented by a less sensitivity to the market risk (low RWATA). Moreover, the positive correlation between ROA and ROE suggests that banks with high ROE tend to have high ROA.

4.3 Analysis based on traditional CAMELS framework

This section will show and compare banks' efficiency and scores based on CAMELS results. First, it will analyze the performance index values for the ten banks for each of the CAMELS criterion for the years 2008 to 2012. Second, it will assess the overall CAMELS rating for the ten banks for the same years.

4.1.1. Performance of banks on different criteria

Figures 8 to 37 show the performance index values for the ten banks in terms of each of the CAMELS indicators for the years 2008 to 2012 respectively.

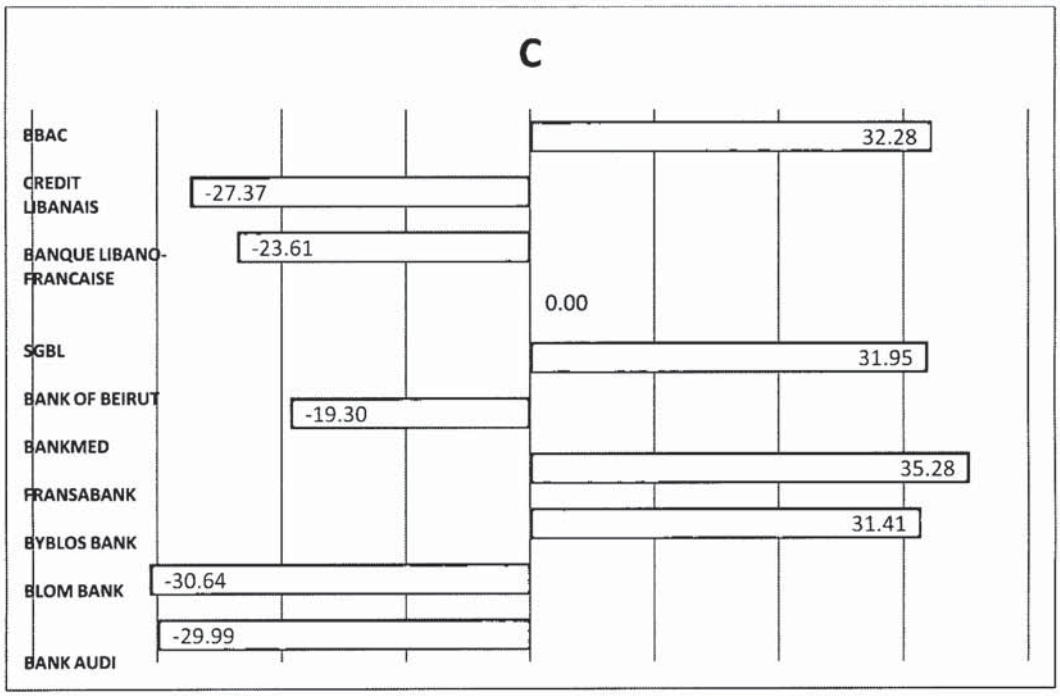


Figure 8: Performance index of banks in Capital Adequacy in 2008

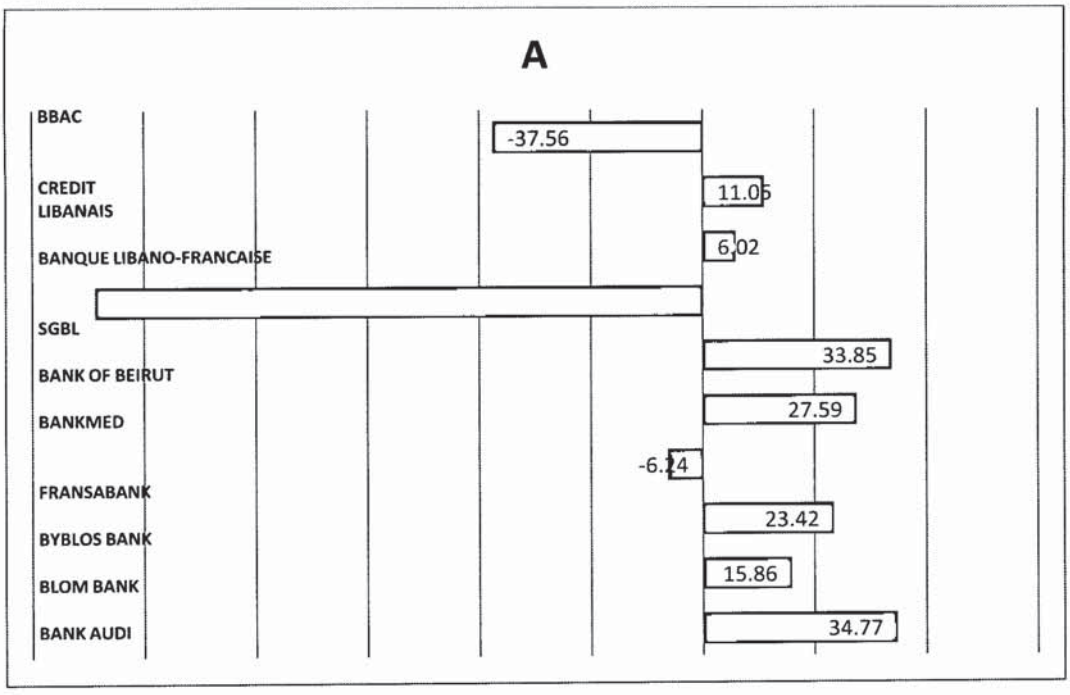


Figure 9: Performance index of banks in Asset Quality in 2008

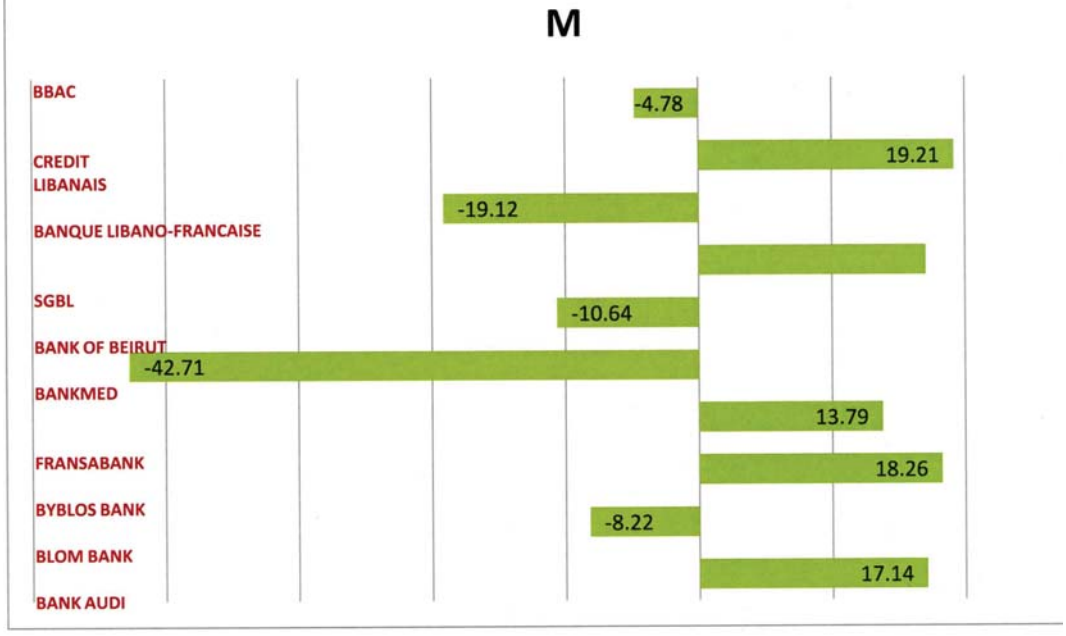


Figure 10: Performance index of banks in Management in 2008

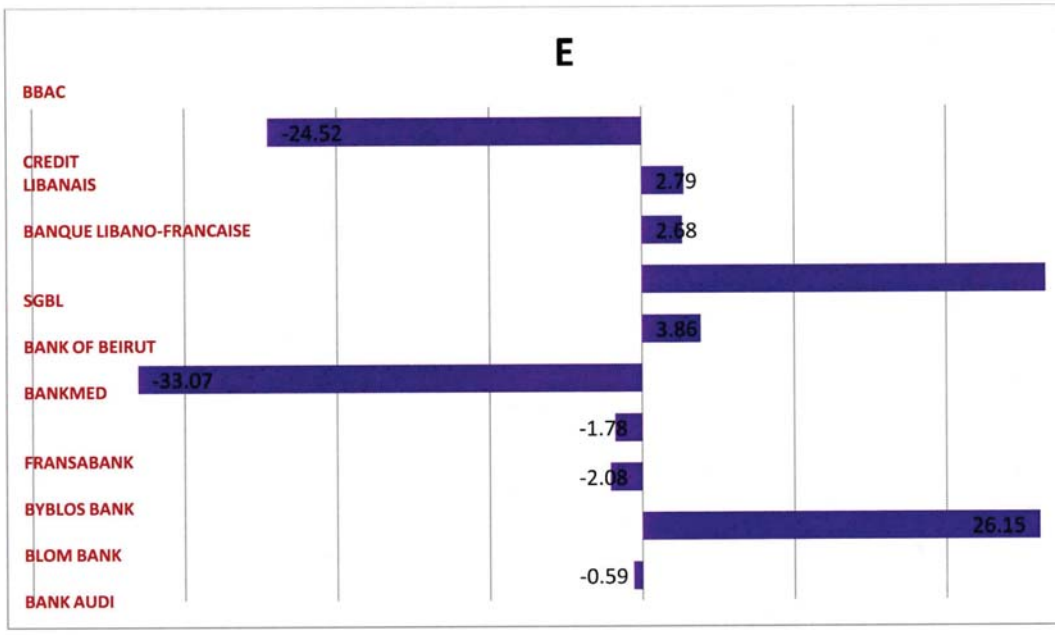


Figure 11: Performance index of banks in Earnings in 2008

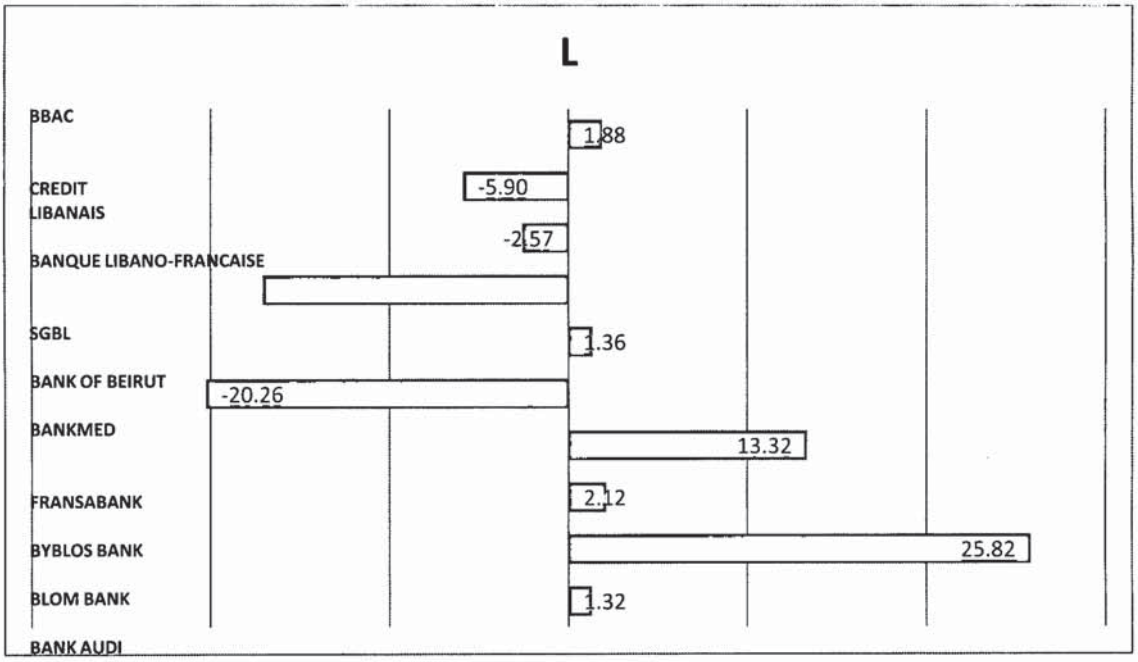


Figure 12: Performance index of banks in Liquidity in 2008

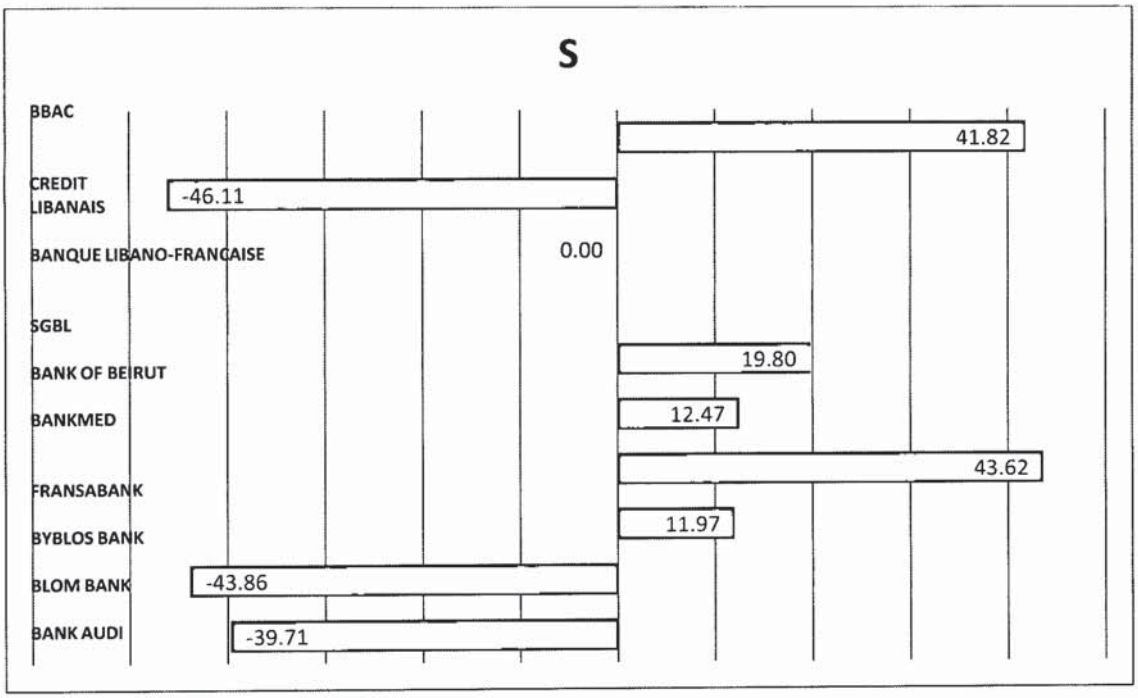


Figure 13: Performance index of banks in Sensitivity to Market Risk in 2008

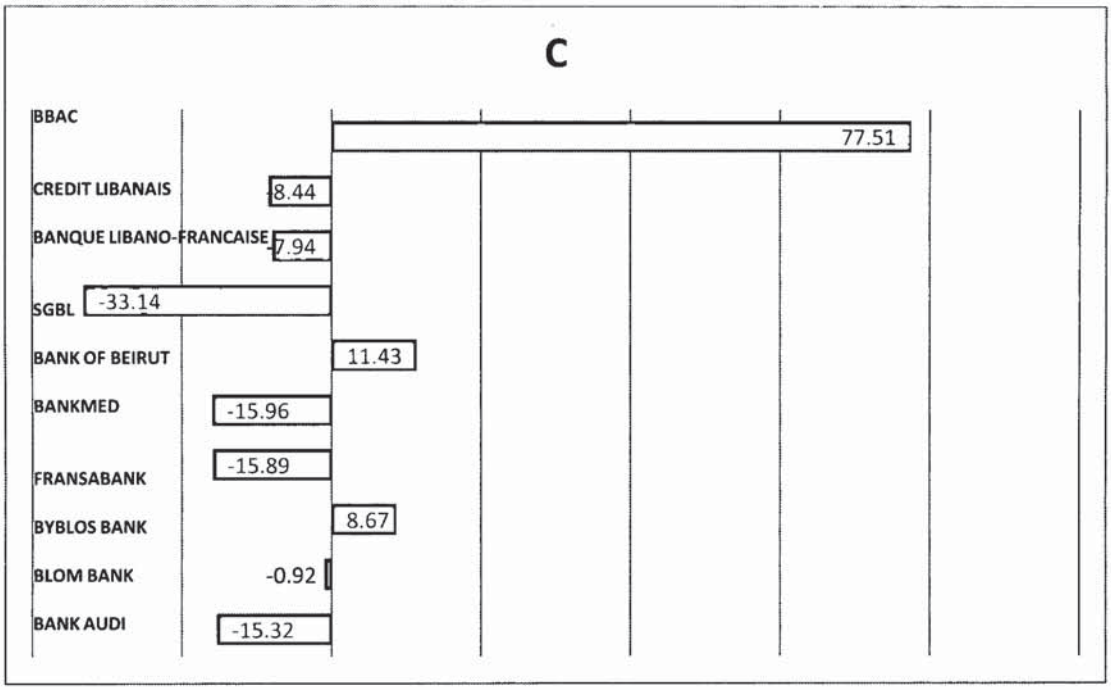


Figure 14: Performance index of banks in Capital Adequacy in 2009

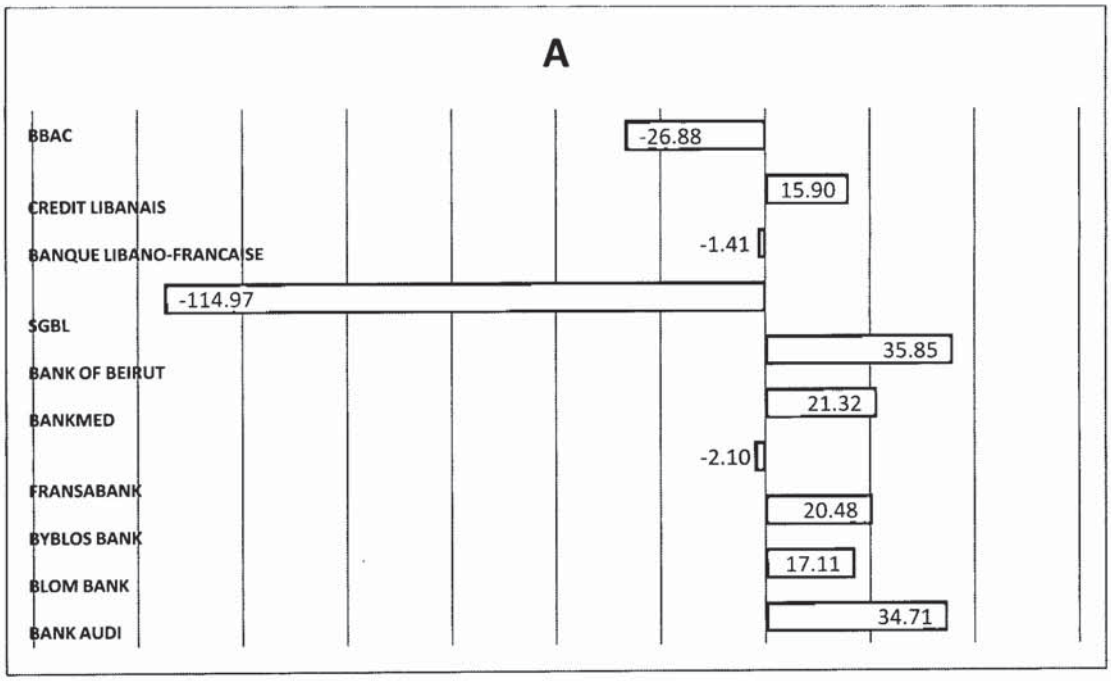


Figure 15: Performance index of banks in Asset Quality in 2009

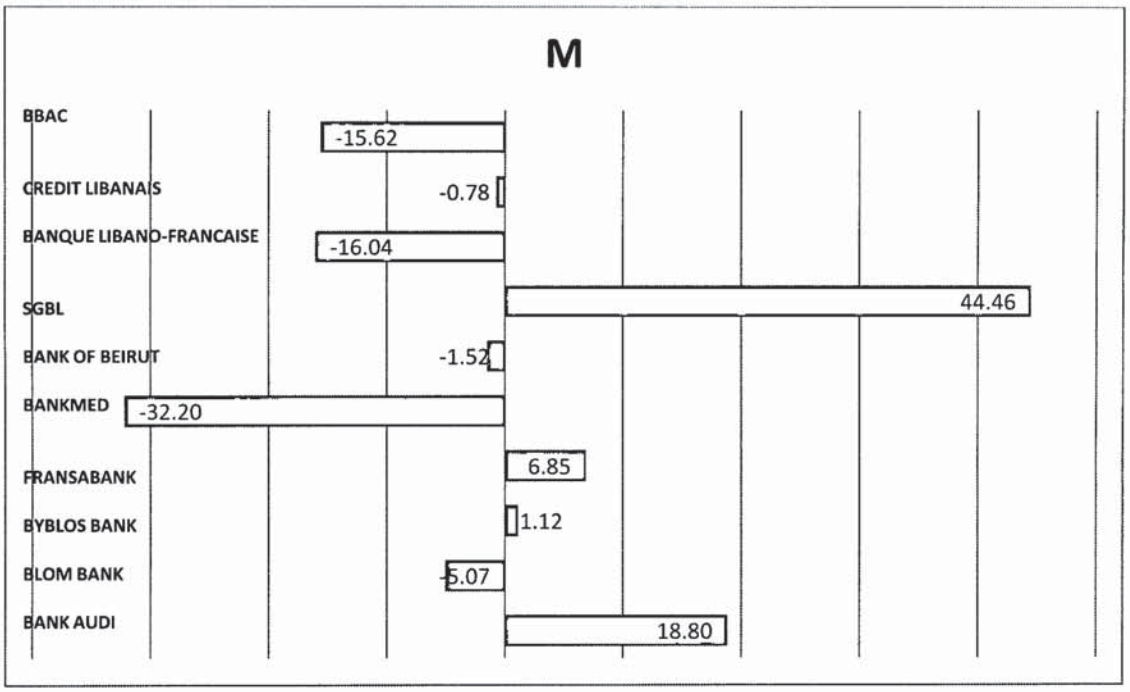


Figure 16: Performance index of banks in Management in 2009

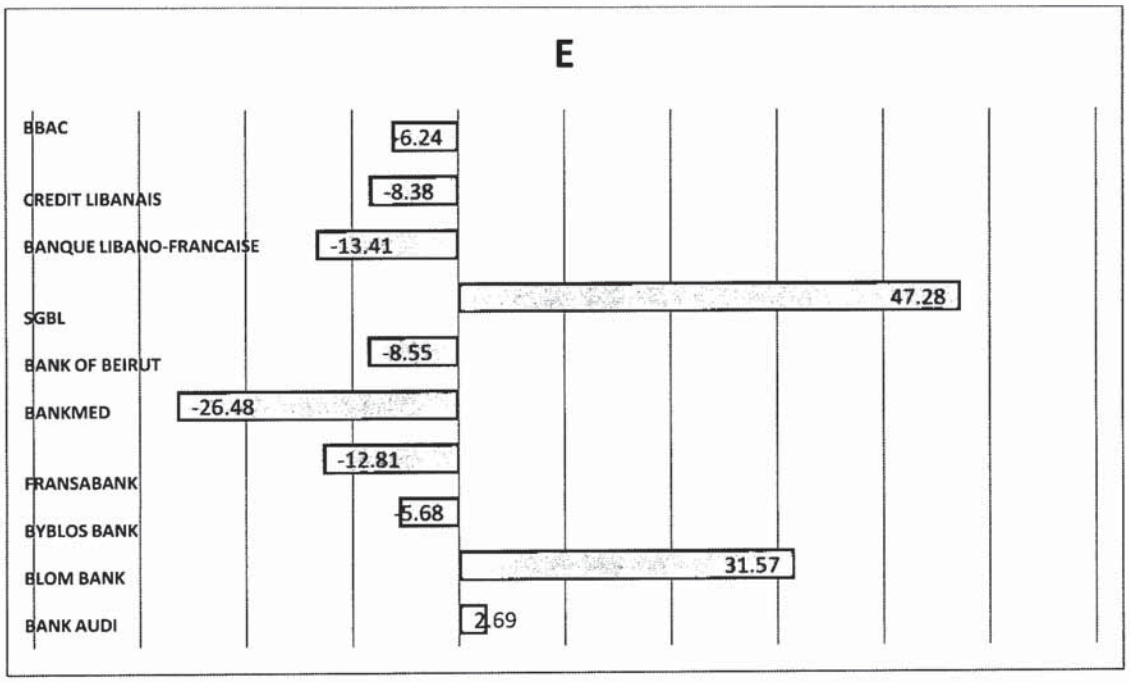


Figure 17: Performance index of banks in Earnings in 2009

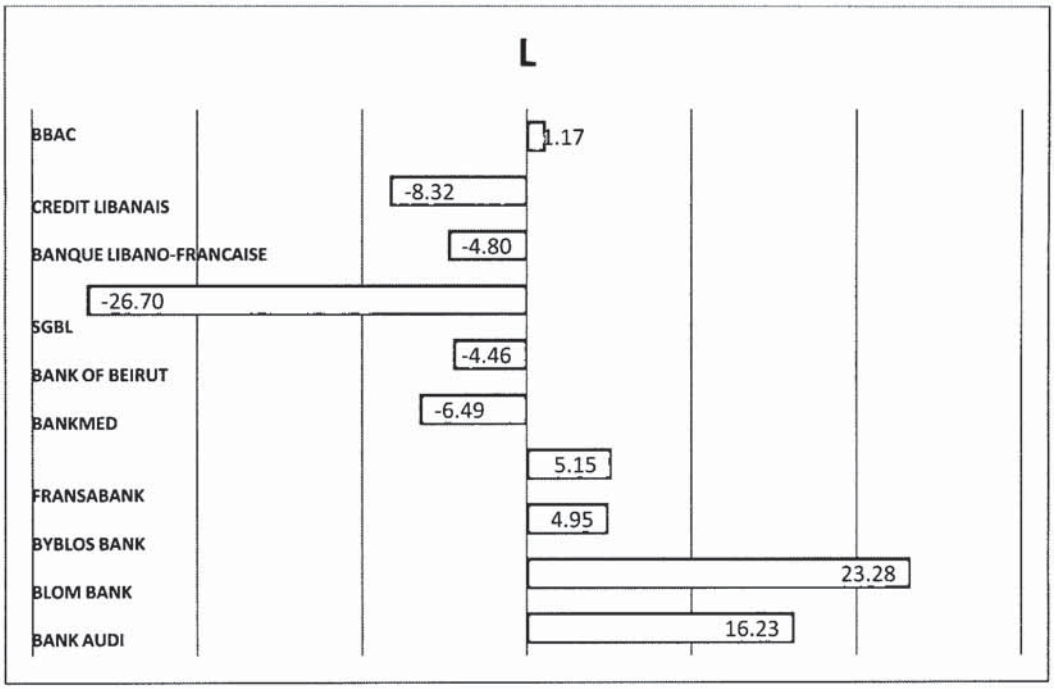


Figure 18: Performance index of banks in Liquidity in 2009

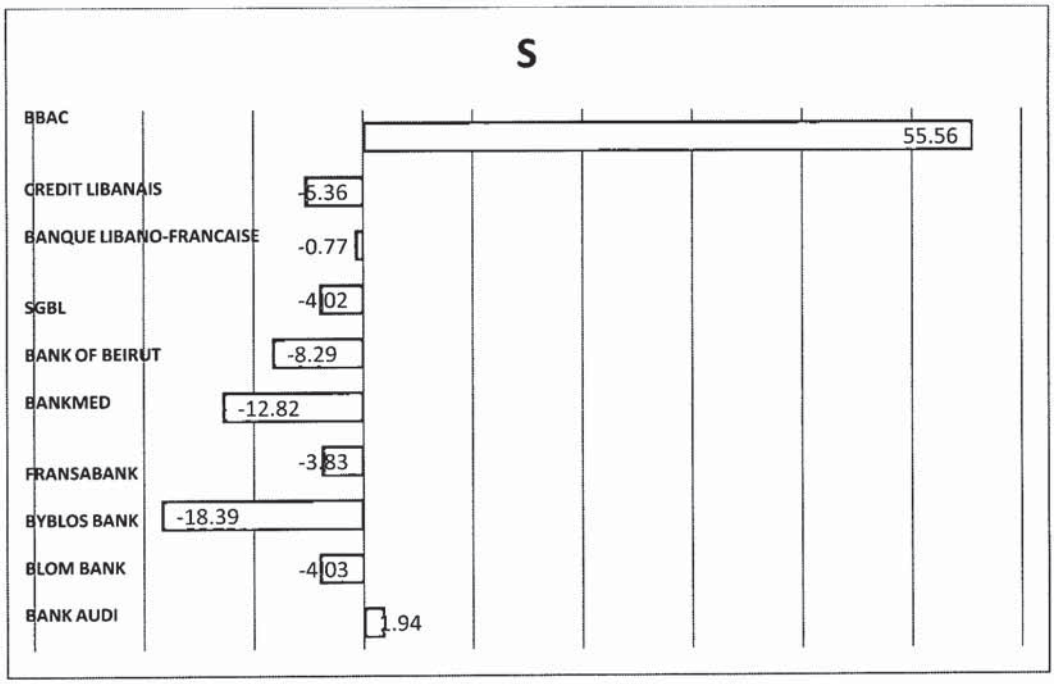


Figure 19: Performance index of banks in Sensitivity to Market Risk in 2009

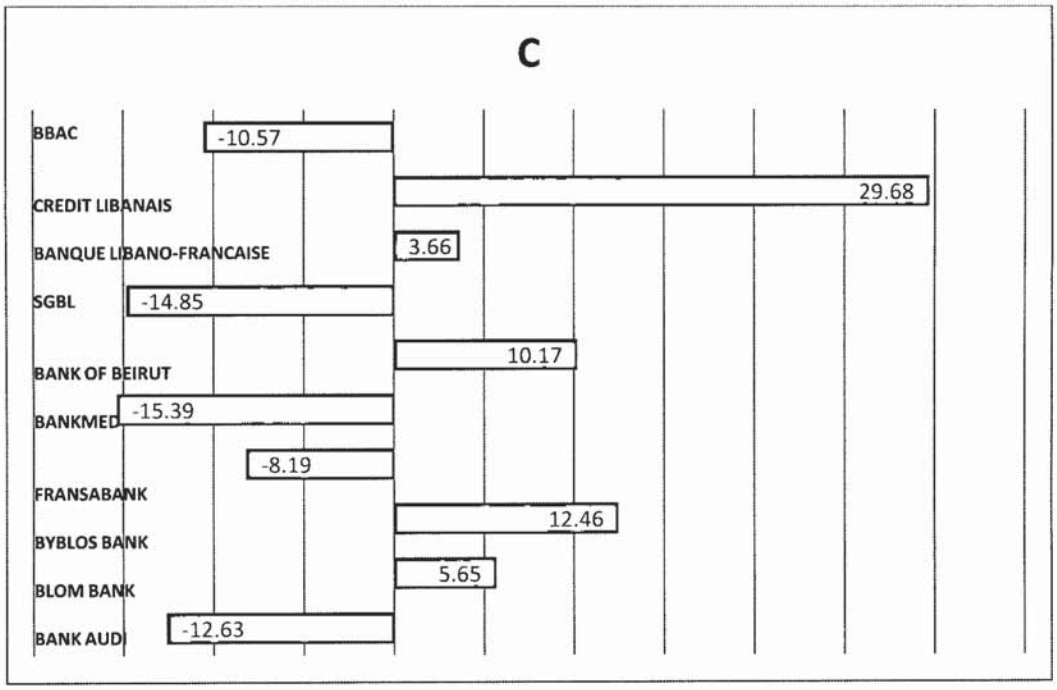


Figure 20: Performance index of banks in Capital Adequacy in 2010

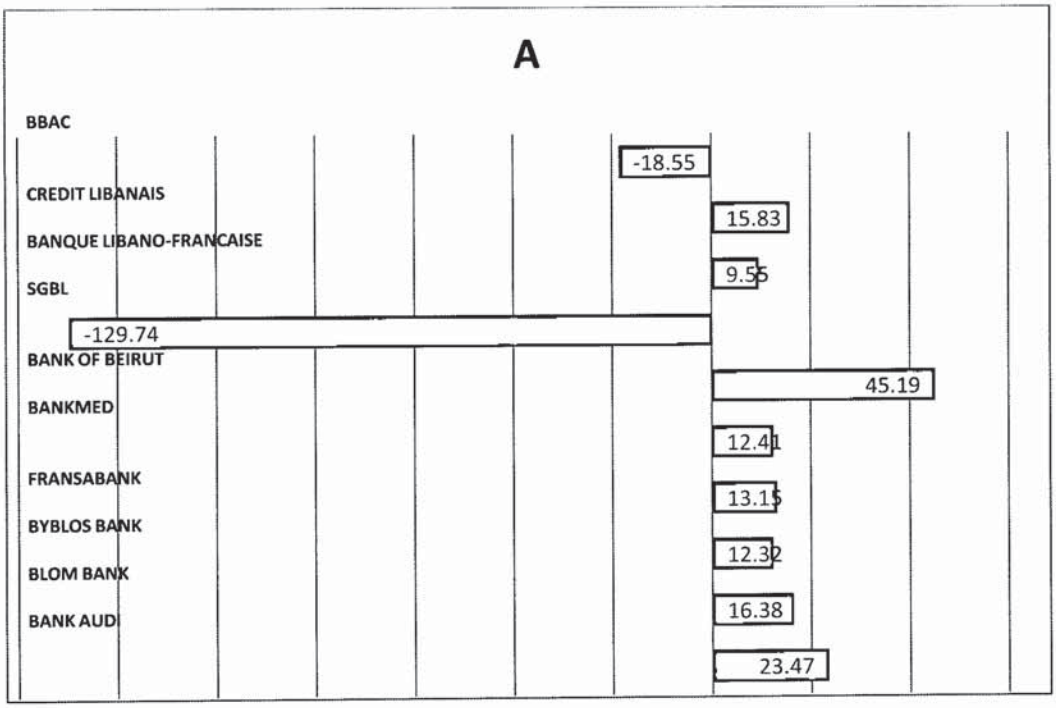


Figure 21: Performance index of banks in Asset Quality in 2010

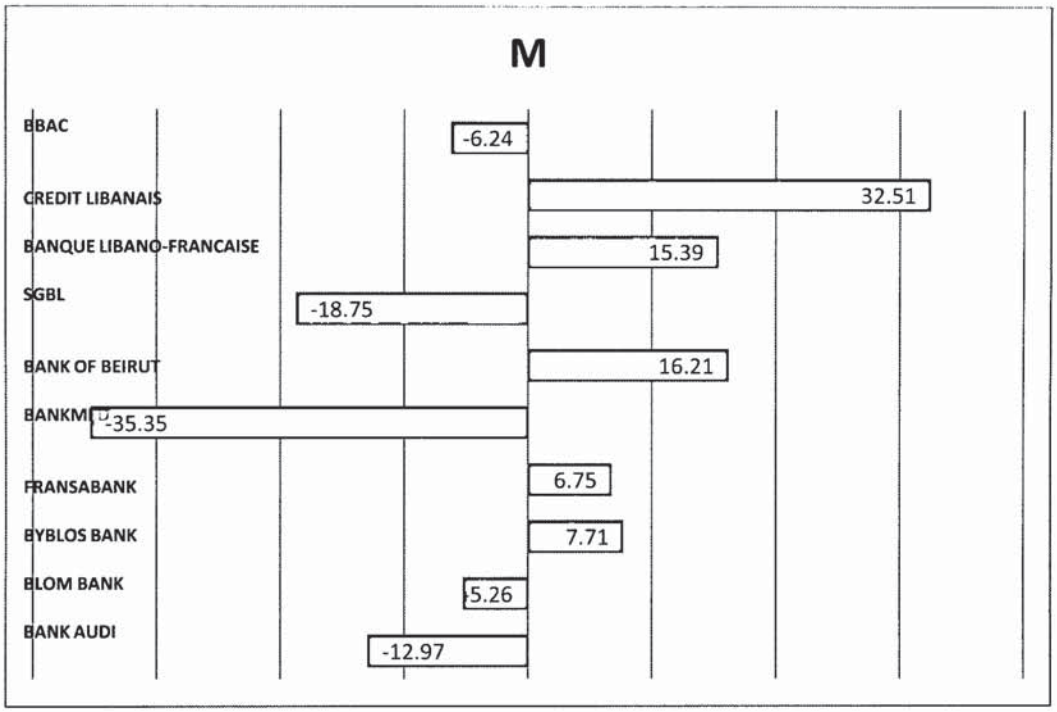


Figure 22: Performance index of banks in Management in 2010

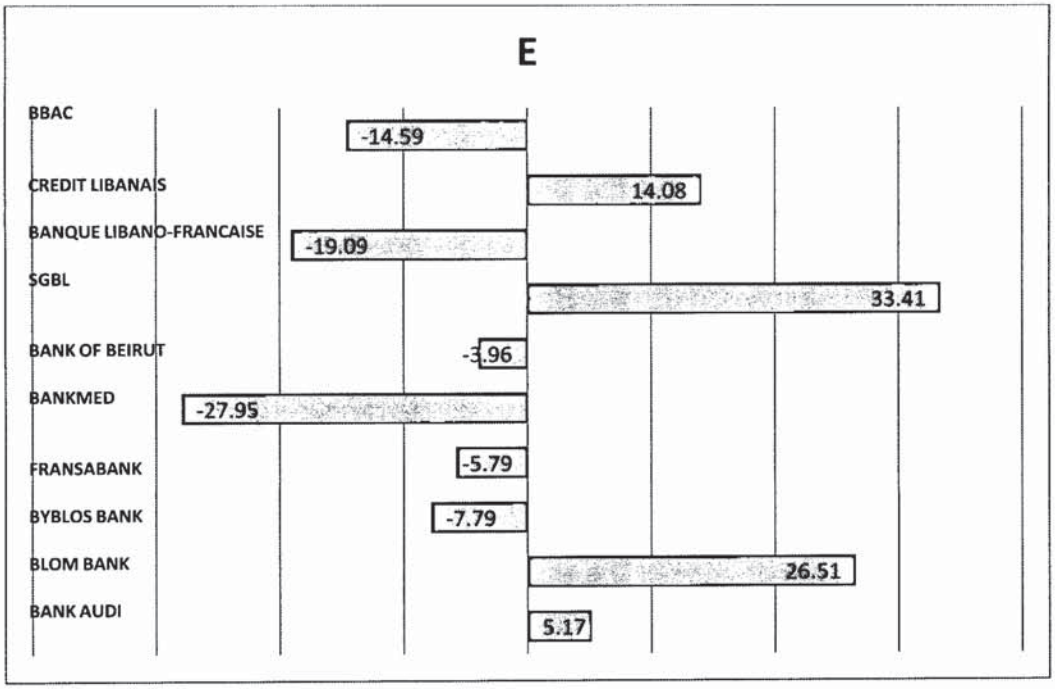


Figure 23: Performance index of banks in Earnings in 2010

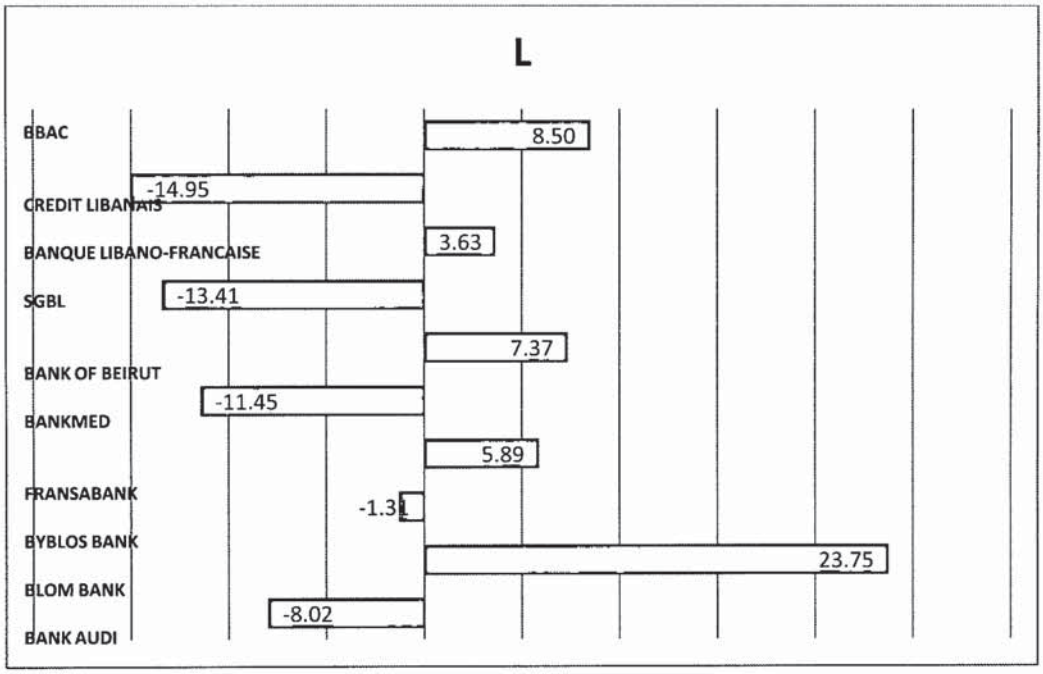


Figure 24: Performance index of banks in Liquidity in 2010

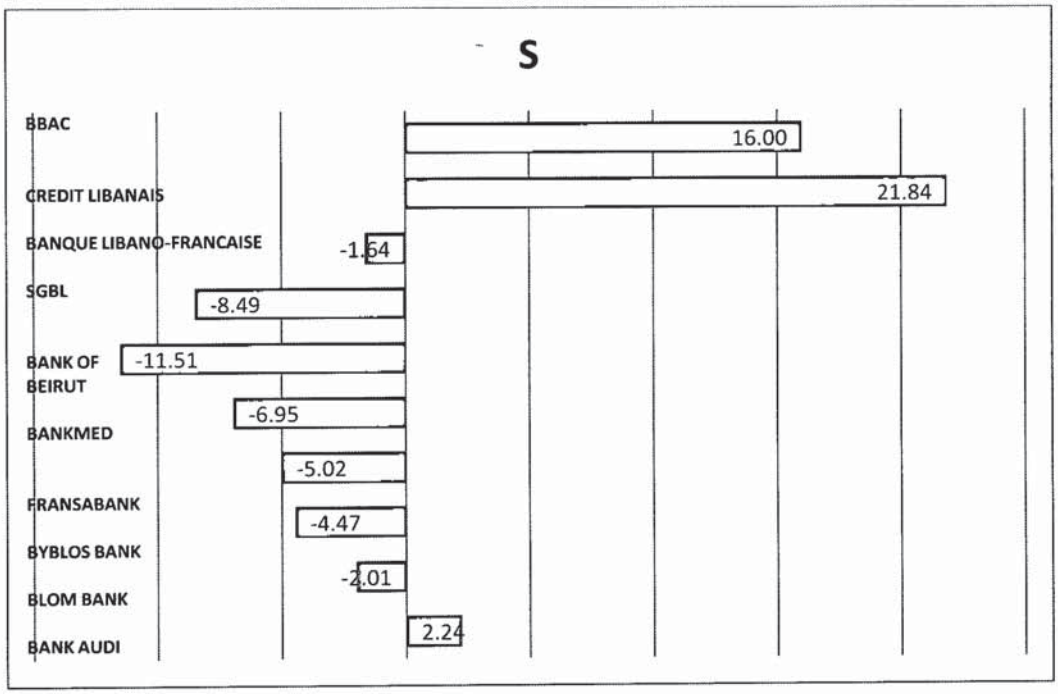


Figure 25: Performance index of banks in Sensitivity to Market Risk in 2010

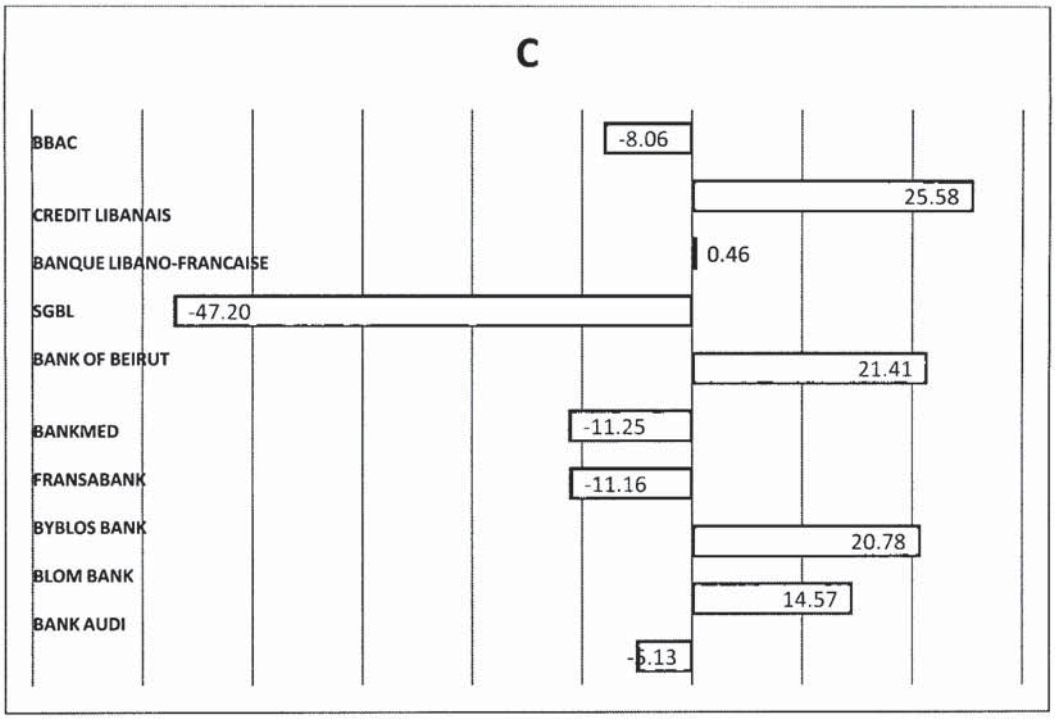


Figure 26: Performance index of banks in Capital Adequacy in 2011

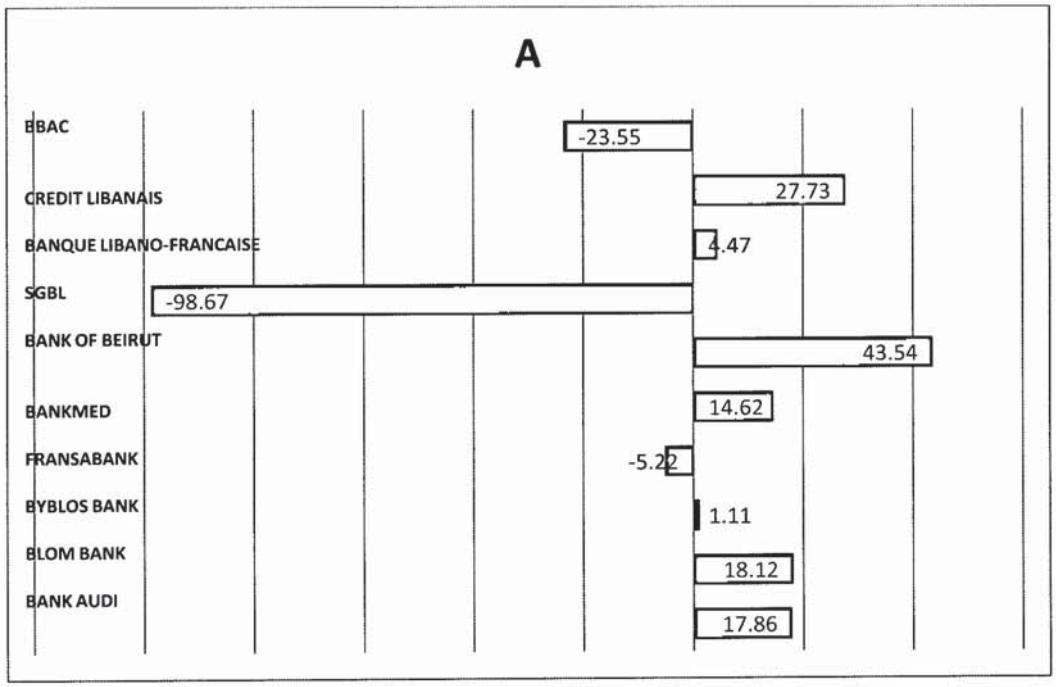


Figure 27: Performance index of banks in Asset Quality in 2011

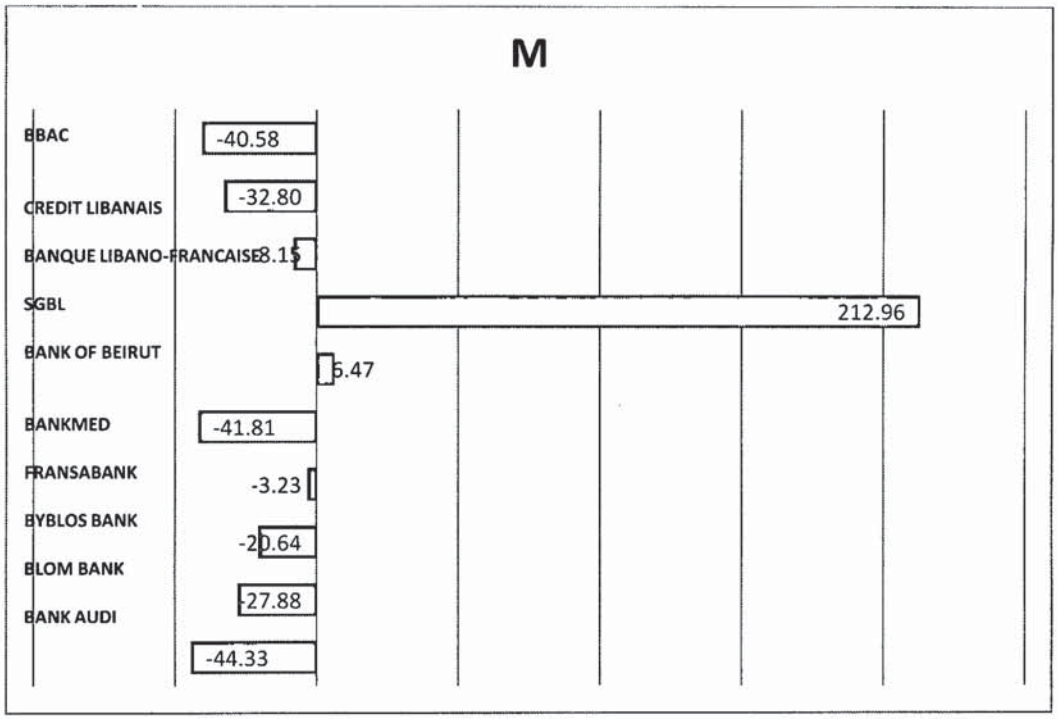


Figure 28: Performance index of banks in Management in 2011

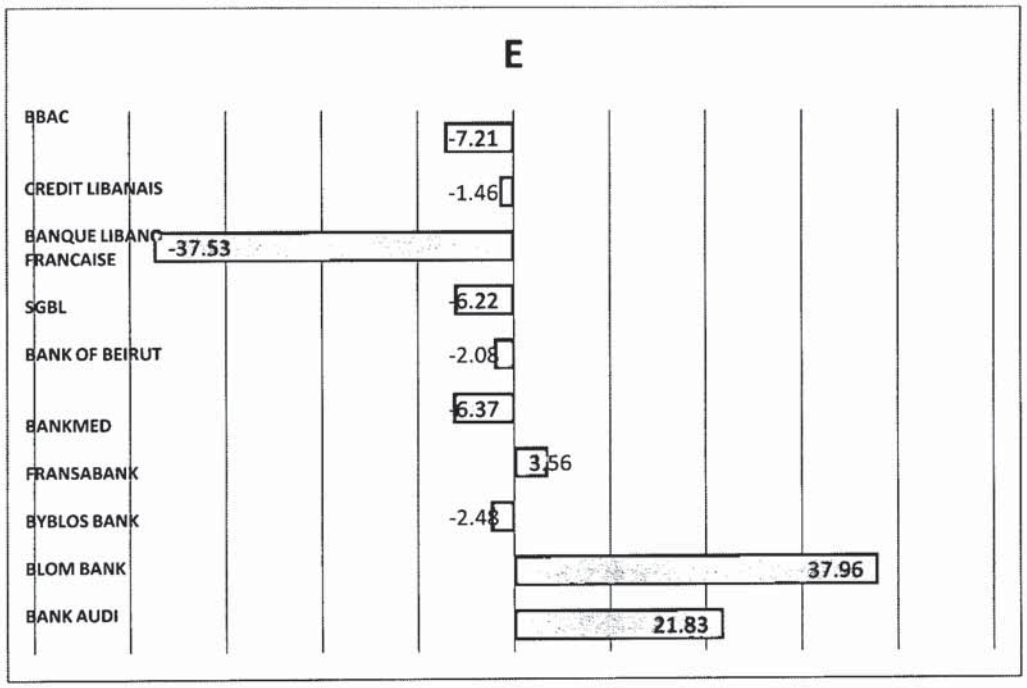


Figure 29: Performance index of banks in Earnings in 2011

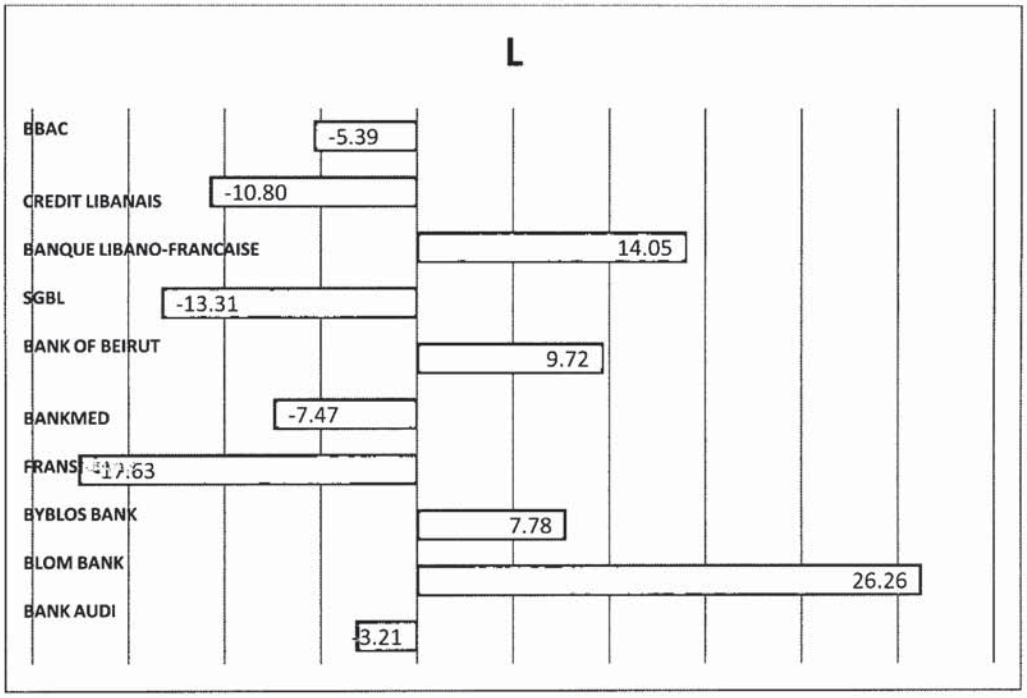


Figure 30: Performance index of banks in Liquidity in 2011

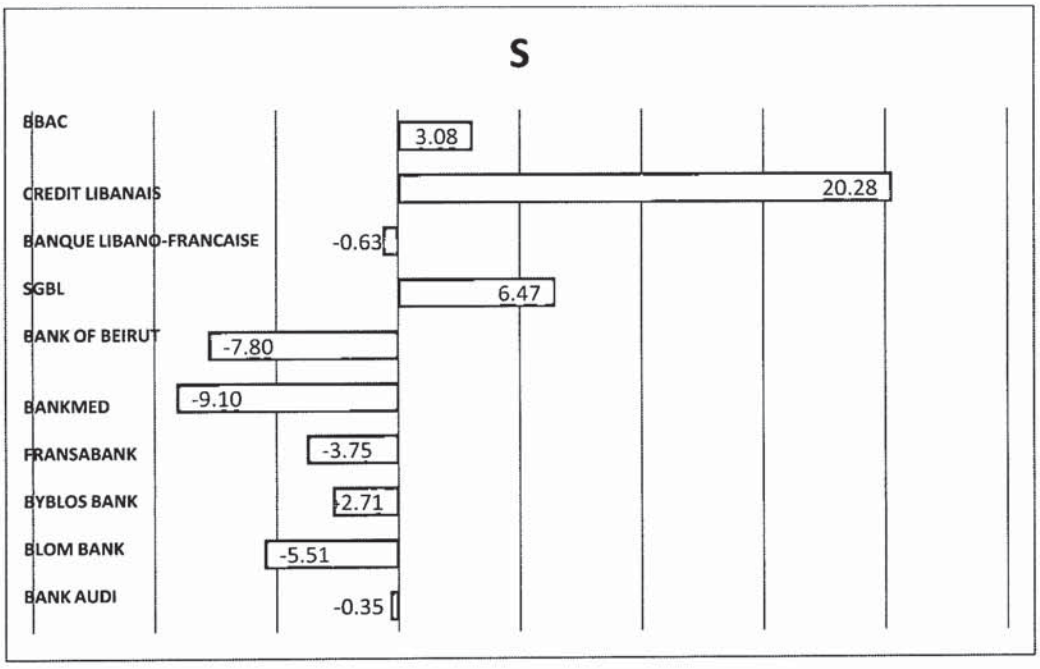


Figure 31: Performance index of banks in Sensitivity to Market Risk in 2011

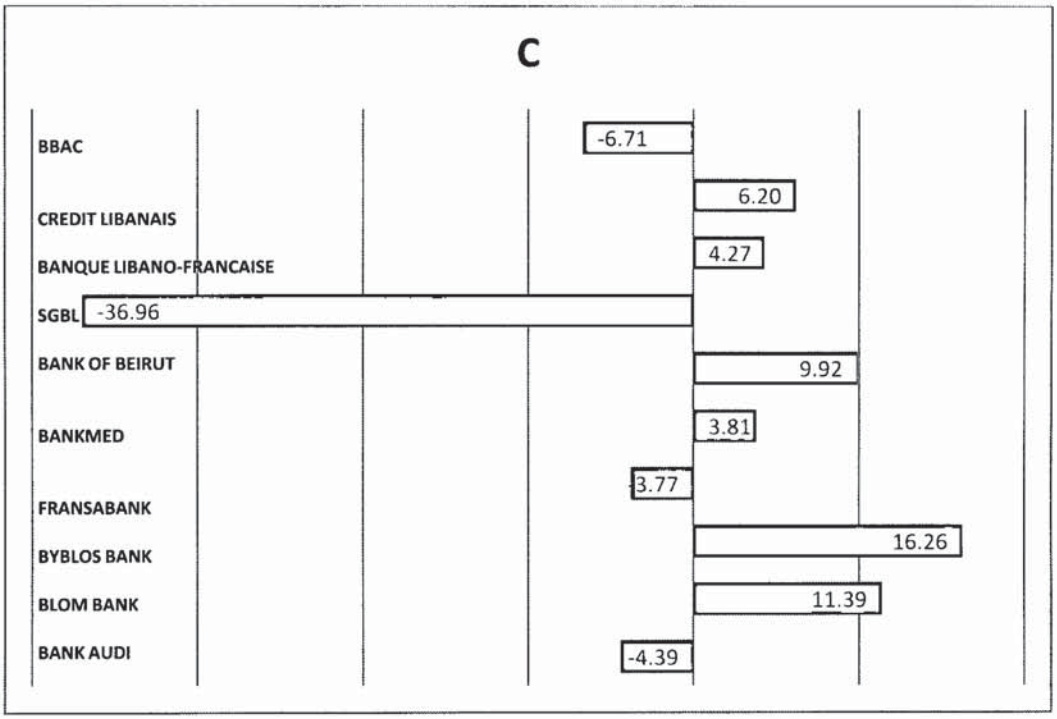


Figure 32: Performance index of banks in Capital Adequacy in 2012

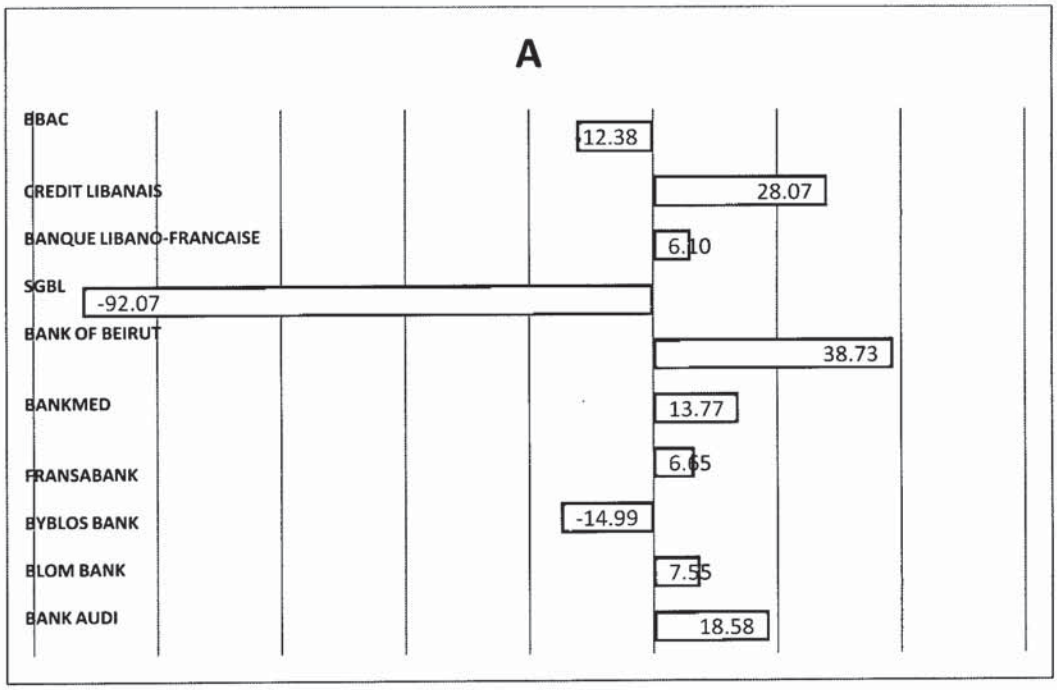


Figure 33: Performance index of banks in Asset Quality in 2012

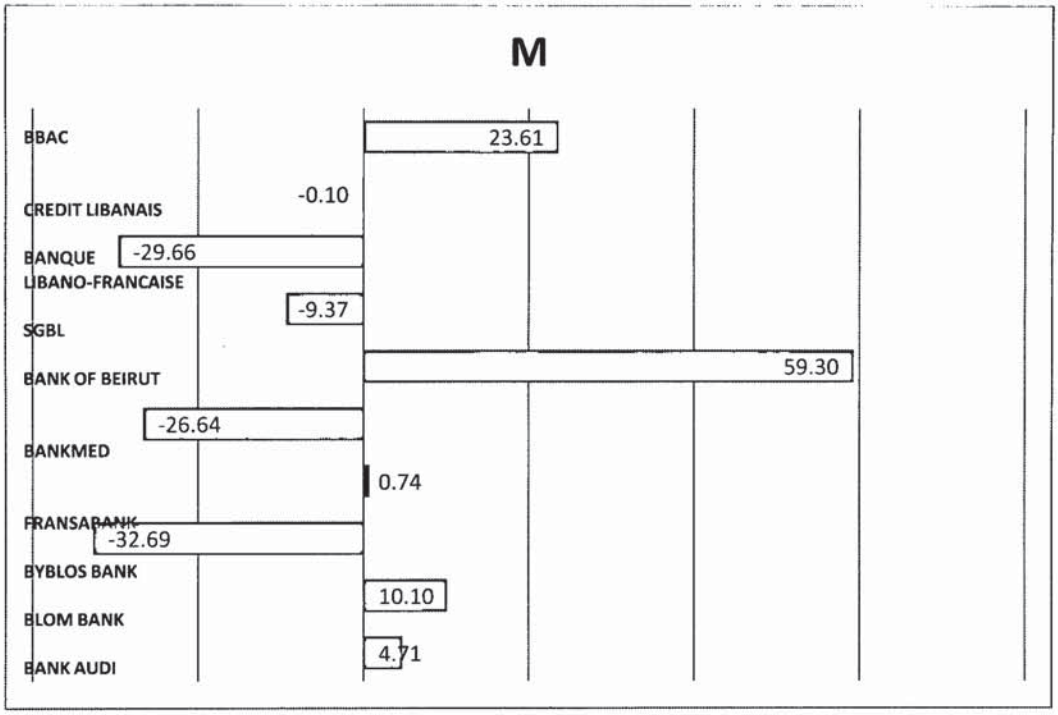


Figure 34: Performance index of banks in Management in 2012

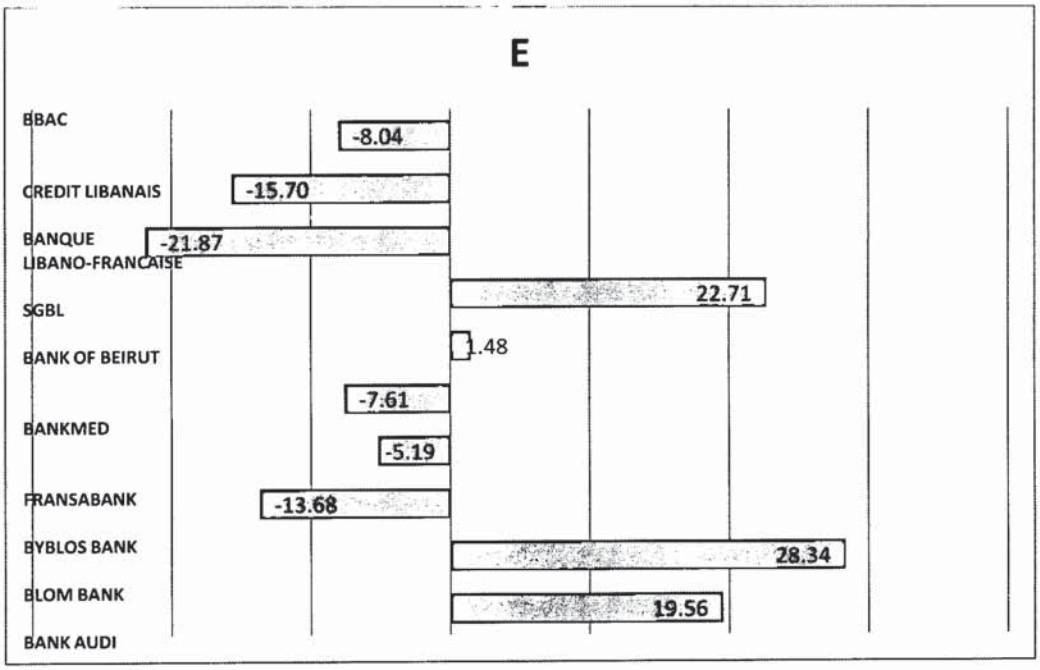


Figure 35: Performance index of banks in Earnings in 2012

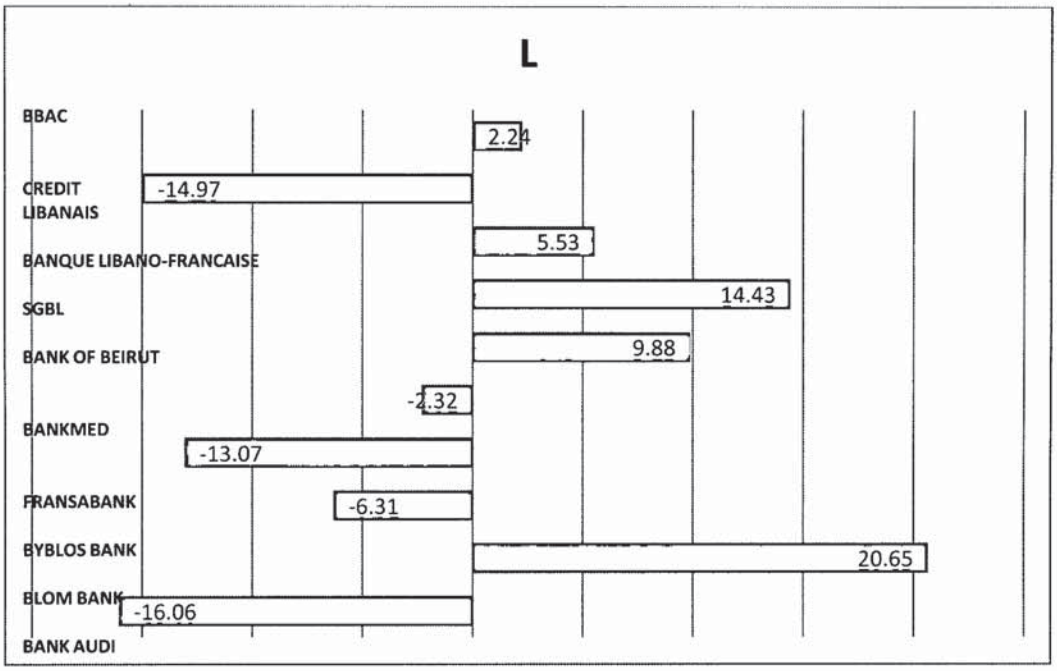


Figure 36: Performance index of banks in Liquidity in 2012

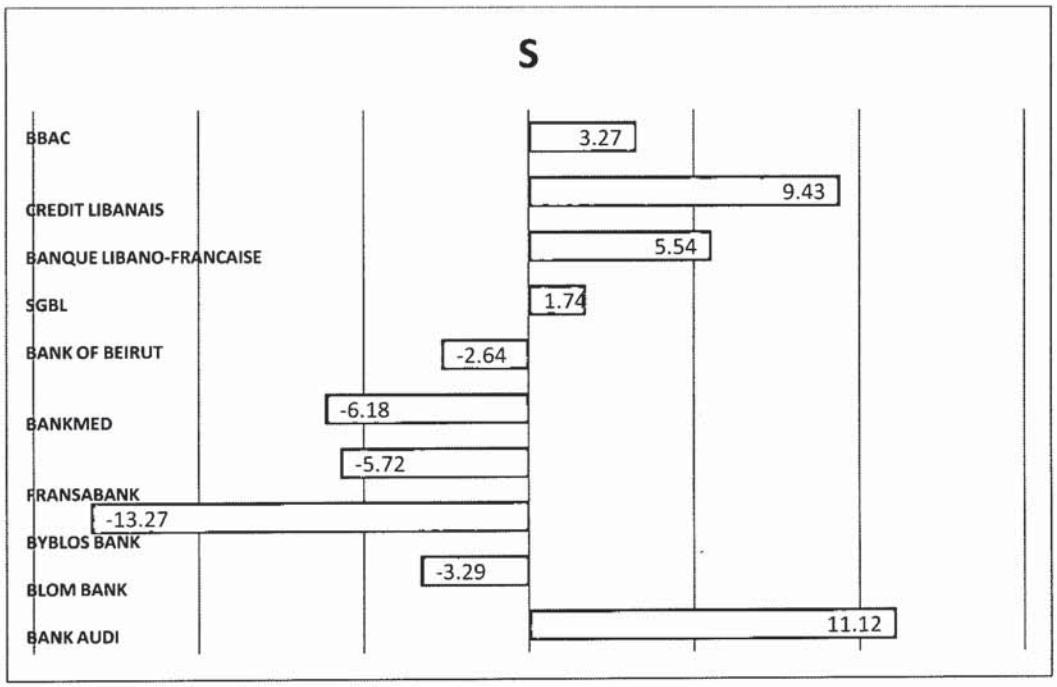


Figure 37: Performance index of banks in Sensitivity to Market Risk in 2012

In 2008, according to the Figure 8, the capital adequacy index ranges from a minimum value of -30.54 to a maximum value of 35.28. BLOM Bank has the lowest capital adequacy index as compared to the nine other banks while Fransabank has the highest performance in terms of capital adequacy. While Byblos bank, Bank of Beirut and BBAC are above the average in terms of capital adequacy, SGBL is on the average and the remaining banks are far below the average therefore having a bad performance in terms of capital adequacy.

The asset quality index ranges from a minimum value of -108.75 to a maximum value of 34.77 (Figure 9). There is a high fluctuation in this index between the best (Bank Audi) and the worst bank (SGBL). BBAC and Fransabank are below the average, thus, they have weaknesses in terms of asset quality. The asset quality of the remaining banks is good since it is higher than the average value of this indicator.

In terms of management skills (Figure 10), the index value varies from a minimum of -42.71(Bankmed) to a maximum value of 19.21 (Credit Libanais). The management performance of Credit Libanais is high when compared to the nine banks while the performance of Bankmed is far from the average. Bank Audi, Byblos bank and SGBL have a good management performance and their indexes are very close to the one related to Credit Libanais. Fransabank, as well, is above the average. However the remaining banks have weaknesses in terms of management skills since their index values are far from the average value.

The earnings index ranges from a minimum value of -33.07 to a maximum value of 26.15 (Figure 11). Bankmed and SGBL have respectively the lowest and the highest earnings performance. The performance of BLOM Bank in terms of earnings is very good when compared to the remaining banks; its index is very close to the one of SGBL. However the earnings performance of BBAC is very bad when compared to the other banks and it has a very close index to the one of Bankmed. The earnings indicator for all the remaining banks fluctuates positively or negatively but remains very close to the average value.

In terms of liquidity, the indicator value varies from a minimum value of -20.26 to a maximum value of 25.82 (Figure 12). Bankmed has the lowest indicator in terms of

liquidity; also, it has the lowest indicator in terms of management and earnings skills as shown previously. Fransabank has a high liquidity according Figure 12 while SGBL and Credit Libanais have a low liquidity indicator. The remaining banks are more or less close to the average value.

The sensitivity to market risk indicator ranges from a minimum value of -46.11 for Credit Libanais to a maximum value of 43.62 for Fransabank (Figure 13). The results suggest that the former is very sensitive to any fluctuation in the market while the latter is not volatile against market fluctuations. BBAC is also not volatile against market fluctuation with an indicator of 41.82. Moreover, according Figure 13, while Byblos Bank, Bankmed and Bank of Beirut are less sensitive to market risk, Bank Audi and BLOM Bank are very sensitive to market risk. Finally, SGBL and Banque Libano Francaise are on the average in terms of their sensitivity to market risk.

As for 2009, in accordance with Figure 14, the capital adequacy index ranges from a minimum value of -33.14 for SGBL to a maximum value of 77.51 for BBAC. Byblos bank and Bank of Beirut retain their status as being above the average; BLOM improves to be on the average; and the remaining banks are far below the average.

The asset quality index ranges from a minimum value of -114.97 to a maximum value of 35.85, with a high fluctuation between the best (Bank of Beirut) and the worst bank (SGBL) (Figure 15). BBAC and Fransabank remain below the average, maintaining their weaknesses in terms of asset quality.

In terms of management skills, the index value varies from a minimum of -32.2 (Bankmed) to a maximum value of 44.46 (SGBL) (Figure 16). Similar to 2008, Bankmed maintains its worst place. The management performance of Bank Audi is higher than average similar to Byblos bank and Fransabank whilst Credit Libanais is slightly below average. As for the remaining banks, they have weaknesses in terms of management skills since their index values are far from the average value.

BankMed and SGBL maintains their lowest (-26.48) and their maximum (47.28) performance in terms of their earnings index, respectively (Figure 17). The performance of BLOM Bank in terms of earnings is very good with an index very close to the one of

SGBL. In addition to that, Bank Audi has an index above average whilst the earnings indicator for all the remaining banks drops below the average Value.

In terms of liquidity, the indicator value varies from a minimum value of -26.7 to a maximum value of 23.28 (Figure 18). SGBL has the lowest indicator in terms of liquidity; also, it has the lowest indicator in terms of capital adequacy and asset quality as shown previously. Bank Audi has a high liquidity according Figure 18 while Bank Med and Credit Libanais have a low liquidity indicator. The remaining banks are more or less close to the average value.

The sensitivity to market risk indicator ranges from a minimum value of -18.39 for Bank Byblos to a maximum value of 55.56 for BBAC (Figure 19). The results suggest that the former is very sensitive to any fluctuation in the market while the latter is not volatile against market fluctuations. Moreover, according to Figure 19, all other banks are very sensitive to market risk except for Bank Audi being slightly above average.

In 2010, with reference Figure 20, Bank Med shows the lowest capital adequacy index with a value of -15.39 while Crédit Libanais has the highest performance with a capital adequacy index value of 29.68. In this year, only Byblos, Bank of Beirut, BLOM and Banque Libano-Francaise are above the average in terms of capital adequacy while all remaining banks are far below the average.

In terms of asset quality index, the best bank (Bank of Beirut) scored 45.19 and the worst bank (SGBL) scored -129.74. A high fluctuation in this ratio can be noticed in Figure 21, with BBAC bank also scoring below the average, thus, having weaknesses in terms of asset quality. The asset quality of the remaining banks is higher than the average value of this indicator, indicating a good performance.

In terms of management skills, the index value varies from a minimum of -35.35 (Bankmed) to a maximum value of 32.51 (Credit Libanais) (Figure 22). The management performance of Credit Libanais is high when compared to the nine banks while the performance of Bankmed is far from the average. Byblos bank, Fransabank, Bank of Beirut and Banque Libano-Francaise have a good management performance and their indexes are above the average. However, the remaining banks have

weaknesses in terms of management skills since their index values are far from the average value.

Bankmed and SGBL have respectively the lowest (27.95) and the highest (33.41) earning index scores as shown in Figure 23. BLOM Bank has a very good score also (very close to SGBL's). When compared to the remaining banks; SGBL and BLOM Bank have the best earnings performance. The earnings performances of Bankmed and of Banque-Libano-Francaise are very bad when compared to the other banks. The earnings indicators for all the remaining banks fluctuate positively or negatively but remain very close to the average value except for Credit Libanais having an index above average by far.

In terms of liquidity, as shown in Figure 24, Crédit Libanais has the lowest indicator value and BLOM Bank has the highest value. SGBL, Bankmed and Bank Audi have low liquidity indicator scores. The remaining banks are more or less close to the average value excluding BBAC with a slightly above average index.

The sensitivity to market risk indicator ranges from a minimum value of -11.51 for to a maximum value of 21.84 according to Figure 25. The results of the sensitivity to market risk indicator suggest that Bank of Beirut is very sensitive to any fluctuation in the market while Credit Libanais is not responsive to market fluctuations. BBAC is also not sensitive to market fluctuation with an indicator of 16.00. Moreover, all other banks are very sensitive to market risk apart from Bank Audi with a value of 2.24.

The 2011 results of the capital adequacy index scores in Figure 26 show that SGBL has the lowest capital adequacy ratio compared to the nine other banks while Crédit Libanais has the highest performance. On the other hand, Byblos bank, Bank of Beirut and BLOM bank are above the average, Banque Libano-Francaise is on the average and the remaining banks are far below the average therefore having a bad capital adequacy performance.

For this year, the asset quality index in Figure 27 shows a high fluctuation, ranging from a minimum value of -98.67 to a maximum value of 43.54. . Bank of Beirut has the best performance and SGBL has the worst performance according to this index. BBAC and

Fransabank have also weaknesses in terms of asset quality. The asset quality of the remaining banks is good since it is higher than the average value of this indicator.

In terms of management skills, Figure 28 shows that only Bank of Beirut is above average. All remaining banks have weak management skills since their index values are far below the average value.

The earnings index ranges from a minimum value of -37.53 to a maximum value of 37.96 in 2011 (Figure 29). Banque Libano-Francaise and BLOM Bank have respectively the lowest and the highest earnings performance. The performance of Bank Audi is very good when compared to the remaining banks; its earnings index is very close to the one of BLOM Bank. Furthermore, the earnings performance of Fransabank is acceptable when compared to the other banks for being above the average. The earnings indicators for all the remaining banks drop negatively but remain very close to the average value.

In terms of liquidity, Figure 30 shows that the indicator value varies between -17.63 for Fransabank and 26.26 for BLOM Bank and Banque Libano-Francaise. The remaining banks are more or less close to the average value.

The sensitivity to market risk indicator values in Figure 31 suggests that Bankmed is very sensitive to any fluctuation in the market while Crédit Libanais is not volatile against market fluctuations. BBAC and SGBL are also not volatile against market fluctuation with an indicator of 3.08 and 6.47 respectively. Bank Audi and Banque Libano-Francaise are on the average in terms of sensitivity to market risk, while the remaining banks are very sensitive to market risk.

By inspecting the 2012 results, it can be seen in Figure 32 that the capital adequacy index for SGBL is the lowest while that of Byblos Bank is the highest. While BLOM bank, BankMed, Bank of Beirut and Libano-Francaise are above the average, the remaining three banks are below the average with a bad capital adequacy performance.

The asset quality index values in Figure 33 range from a minimum of -92.07 to a maximum of 38.73, showing a high fluctuation between the best (Bank of Beirut) and the worst bank (SGBL). Only BBAC and Byblos Bank have a weak performance with

respect to this index, by scoring below the average. The asset quality of the remaining banks is good since it is higher than the average value of this indicator.

In terms of management skills shown in Figure 34, the index values show a good management performance for Bank of Beirut and BBAC when compared to the remaining banks. While the performance of Bankmed is far from the average, Bank Audi and BLOM Bank have a good management performance with above average indexes. Fransabank and Crédit Libanais have an average performance. Finally, the remaining banks are weak in terms of management skills since their index values are far from the average value.

With reference to Figure 35, the earnings index ranges from a minimum value of -21.87 to a maximum value of 28.34. Banque Libano-Francaise and BLOM Bank have respectively the lowest and the highest earnings performance. The performances of SGBL and of BLOM Bank in terms of earnings are very good when compared to the remaining banks. The earnings indicators for all the remaining banks fluctuate positively or negatively but remain more or less close to the average value.

The values of the liquidity indicator vary from a minimum value of -16.06 for Bank Audi to a maximum value of 20.65 for BLOM Bank. According Figure 36, Fransabank and Crédit Libanais have a low liquidity indicator and the remaining banks are close to the average value.

The sensitivity to market risk indicator ranges from a minimum value of -13.27 to a maximum value of 11.12 as shown in Figure 37. The results suggest that Byblos Bank is very sensitive to any fluctuation in the market, while Bank Audi is not volatile against market fluctuations. SGBL, Banque Libano-Francaise, Crédit Libanais and BBAC are also not volatile against market fluctuation with indicators above average. All remaining banks are very sensitive to market risk having their indicators below average.

4.3.1 Overall CAMELS Score and Ranking

To answer Research Question 1, Tables 7 and 8 show respectively the overall CAMELS score and the classification of each bank from the year 2008 till the year 2012.

Table 7: CAMELS banks scores from year 2008 till year 2012

CAMELS Banks Scores from year 2008 till year 2012					
Bank/Year	**2008**	**2009**	**2010**	**2011**	**2012**
Bank Audi	-2.84	9.84	-0.46	-2.22	5.59
BLOM Bank	-2.48	10.32	10.84	10.59	12.46
Byblos Bank	14.18	1.86	3.15	0.64	-10.78
Fransabank	**16.33**	-3.77	1.13	-6.24	-3.40
Bankmed	-12.55	-12.11	-14.11	-10.23	-4.20
Bank of Beirut	13.36	4.08	10.58	**11.88**	**19.44**
SGBL	**-13.70**	**-14.52**	**-25.31**	9.01	**-16.59**
Banque Libano Francaise	-6.10	-7.40	1.92	-4.56	-5.01
Credit Libanais	-7.72	-2.56	**16.50**	4.75	2.16
BBAC	1.52	**14.25**	-4.24	**-13.62**	0.33

Table 8: CAMELS banks ranking from year 2008 till year 2012

CAMELS Banks Ranking from year 2008 till year 2012					
Bank/Year	**2008**	**2009**	**2010**	**2011**	**2012**
Bank Audi	6	3	7	6	3
BLOM Bank	5	2	2	2	2
Byblos Bank	2	5	4	5	9
Fransabank	**1**	7	6	8	6
Bankmed	9	9	9	9	7
Bank of Beirut	3	4	3	**1**	**1**
SGBL	**10**	**10**	**10**	3	**10**
Banque Libano Francaise	7	8	5	7	8
Credit Libanais	8	6	**1**	4	4
BBAC	4	**1**	8	**10**	5

As we can see in the table above, Bank Audi was ranked number 6 in 2008; jumping during 2009 to be ranked number 3. In 2010 the bank did not maintain its good performance, declining to a rank of 7. In 2011, it improved its ranking slightly to number 6 before moving forward in 2012 to be ranked number 3.

As for BLOM Bank, it had a more stable ranking moving from number 5 in 2008 to number 2 in the following years. It maintained its second rank from 2009 to 2012.

Byblos Bank was among the most effective banks based on the CAMELS in 2008, being ranked 2. Its performance dropped in 2009, but it was stable until 2011. More specifically, between 2009 and 2011, it maintained almost the same position varying between number 4 and 5. However, in 2012, its performance dropped significantly to the top bottom, reaching number 9. Although Fransabank was ranked 1 in 2008, it did not retain its good position and moved down to be ranked between the 6th and the 8th position in the remaining years. Bankmed was among the least performed banks over all the years being number 9 from 2008 till 2011 and number 7 in 2012. As for Bank of Beirut, it retained its position in the top four ranks. Its rank was between 3 and 4 between 2008 and 2010. In 2011, its performance increased significantly to reach number 1, a rank that was maintained by the bank in 2012.

As it is shown in the table above, SGBL has the lowest performance and was ranked number 10 in all the years except in 2011 where it made an exceptional move and was ranked number 3. Bank Libano Francaise maintained almost the same position moving between number 5 and number 8. Credit Libanais had a lot of fluctuations. It was ranked number 8 in 2008, moving forward to number 6 in 2009. It made a big jump in 2011 to be ranked number 1. However it did not maintain its good performance and moved downward to number 4 in the years 2011 and 2012.

Finally, BBAC was ranked number 4 based on the CAMELS criteria in 2008. It enhanced its performance compared to the remaining banks and was ranked number 1 in 2009. However its good performance did not last long and the bank made a big drop as compared to the remaining banks to be ranked number 8 in 2010 then number 10 in 2011. In 2012, it made an enhancement and it was ranked number 5 to be on the average among the banks.

4.4 PROMETHEE GAIA Analysis

This section will show and compare banks' efficiency, scores, and ranking based on PROMETHEE results. First, it will present banks' profiles in terms of each criterion and their evolution in time from year 2008 till year 2012. Second, it will show the ranking of banks per each year using both the absolute ranking and the complete one (Research

Question 1). Ranking will be analyzed for each bank and from year 2008 till year 2012 in order to assess banks' overall performance from year to year. Third, it will run a sensitivity analysis in order to check the impact of each variable on banks' ranking. Fourth, it will present the GAIA analysis in order to discover conflicts and similarities among banks and among criteria. Finally, it will compare the obtained scores between listed and unlisted banks on one side (Research Questions 3 and 4) and between small and large banks on the other side (Research Question 5).

4.4.1 Banks Profiles per year

Tables 9 to 13 show the value of each criterion for each of the ten banks along with average value for all banks from year 2008 till year 2012 respectively.

Table 9: Bank Profiles- Year 2008

CRITERIA	Total Capital Ratio TCR	Asset Quality Index AQI	Loan Loss Res / Gross Loans LLR	Cost to Income Ratio C/I	Growth in Assets GA	Return On Equity (ROE)	Return On Assets (ROA)	Net Loans / Tot Assets NLTA	Liquid Assets / Tot Assets LATA	Risk Weighted Assets / Tot Assets RWTA
TYPE OF CRITERIA	MAX	MIN	MIN	MIN	MAX	MAX	MAX	MIN	MAX	MIN
Bank Audi	12.84	109.94	2.25	54.96	17.84	12.56	1.26	30.03	33.30	62.24
BLOM Bank	12.72	117.07	4.56	39.40	7.57	17.68	1.46	19.39	35.19	64.08
Byblos Bank	24.10	121.21	3.16	47.34	16.26	13.28	1.17	24.85	28.12	39.21
Fransabank	24.81	96.52	9.19	54.80	16.95	13.86	1.13	20.29	29.32	25.12
Bankmed	14.80	110.98	3.24	62.75	4.51	9.64	0.75	32.71	24.38	38.99
Bank of Beirut	24.20	109.78	2.39	48.80	9.26	14.45	1.21	24.96	27.83	35.72
SGBL	18.34	80.82	25.34	59.17	18.86	18.31	1.41	28.87	21.94	44.55
Libano-Francaise	14.01	97.23	7.33	48.32	6.98	14.72	1.16	30.75	31.95	44.55
Crédit Libanais	13.32	110.95	5.67	53.22	17.95	13.61	1.25	22.32	20.98	65.09
BBAC	24.26	145.26	10.54	50.46	11.16	11.19	0.82	18.54	21.15	25.91
Average value	**18.34**	**109.98**	**7.37**	**51.92**	**12.73**	**13.93**	**1.16**	**25.27**	**27.42**	**44.55**

Table 10: Bank Profiles- Year 2009

CRITERIA / TYPE OF CRITERIA	Total Capital Ratio TCR MAX	Asset Quality Index AQI MIN	Loan Loss Res // Gross Loans LLR MIN	Cost to Income Ratio C/I MIN	Growth in Assets GA MAX	Return On Equity (ROE) MAX	Return On Assets (ROA) MAX	Net Loans // Tot Assets NLTA MIN	Liquid Assets // Tot Assets LATA MAX	Risk Weighted Assets // Tot Assets RWTA MIN
Bank Audi	11.93	94.76	2.27	48.60	29.77	13.90	1.23	25.47	37.01	55.72
BLOM Bank	13.96	101.70	4.05	40.70	15.67	18.50	1.52	19.38	34.11	59.12
Byblos Bank	15.31	99.32	3.78	46.29	20.89	12.29	1.17	23.55	28.74	67.27
Fransabank	11.85	104.24	6.31	56.40	27.89	11.39	1.08	21.35	26.42	59.00
Bankmed	11.84	93.72	4.02	57.20	10.88	9.73	0.90	29.61	29.21	64.11
Bank of Beirut	15.70	102.50	1.64	50.11	21.40	11.52	1.17	25.79	26.08	61.53
SGBL	9.42	100.28	20.79	48.88	41.30	20.18	1.75	29.33	17.89	59.11
Libano-Francaise	12.97	105.51	6.15	53.83	16.58	12.50	0.97	30.39	30.99	57.26
Crédit Libanais	12.90	99.28	4.36	53.16	23.07	12.85	1.06	23.57	21.53	59.87
BBAC	25.01	100.77	9.65	49.61	14.91	13.79	1.03	17.86	20.39	25.25
Average value	**14.09**	**100.21**	**6.30**	**50.48**	**22.24**	**13.66**	**1.19**	**24.63**	**27.24**	**56.82**

Table 11: Bank Profiles- Year 2010

CRITERIA / TYPE OF CRITERIA	Total Capital Ratio TCR MAX	Asset Quality Index AQI MIN	Loan Loss Res // Gross Loans LLR MIN	Cost to Income Ratio C/I MIN	Growth in Assets GA MAX	Return On Equity (ROE) MAX	Return On Assets (ROA) MAX	Net Loans // Tot Assets NLTA MIN	Liquid Assets // Tot Assets LATA MAX	Risk Weighted Assets // Tot Assets RWTA MIN
Bank Audi	11.42	124.75	2.01	47.42	8.31	15.27	1.28	29.80	21.82	58.73
BLOM Bank	13.81	104.97	3.88	38.37	7.93	18.37	1.54	23.15	30.87	61.28
Byblos Bank	14.70	111.84	3.98	45.53	12.62	12.15	1.23	24.67	20.54	62.76
Fransabank	12.00	101.97	4.41	49.06	13.24	12.34	1.26	25.66	24.73	63.09
Bankmed	11.06	110.80	4.02	57.99	5.69	9.40	0.97	31.48	21.67	64.25
Bank of Beirut	14.40	96.74	1.05	46.32	14.76	11.92	1.35	29.11	28.38	66.99
SGBL	11.13	100.33	20.78	49.18	7.40	18.67	1.68	27.64	17.46	65.17
Libano-Francaise	13.55	100.33	4.91	50.73	15.62	11.77	0.98	33.34	30.26	61.06
Crédit Libanais	16.95	109.72	3.69	49.06	19.16	17.32	1.32	25.32	14.76	46.95
BBAC	11.69	98.35	8.22	48.85	10.20	13.01	0.98	20.70	21.69	50.46
Average value	**13.07**	**105.98**	**5.70**	**48.25**	**11.49**	**14.02**	**1.26**	**27.09**	**23.22**	**60.07**

Table 12: Bank Profiles- Year 2011

CRITERIA / TYPE OF CRITERIA	Total Capital Ratio TCR MAX	Asset Quality Index AQI MIN	Loan Loss Res // Gross Loans LLR MIN	Cost to Income Ratio C/I MIN	Growth in Assets GA MAX	Return On Equity (ROE) MAX	Return On Assets (ROA) MAX	Net Loans // Tot Assets NLTA MIN	Liquid Assets // Tot Assets LATA MAX	Risk Weighted Assets // Tot Assets RWTA MIN
Bank Audi	10.69	97.77	2.95	45.66	0.17	15.29	1.27	29.91	23.53	63.06
BLOM Bank	12.91	96.84	2.96	37.99	3.68	17.12	1.46	24.13	32.97	66.31
Byblos Bank	13.61	95.57	4.53	43.38	8.59	10.97	1.13	24.14	24.02	64.55
Fransabank	10.01	110.26	4.44	50.00	17.97	12.03	1.16	30.64	17.16	65.20
Bankmed	10.00	94.36	3.39	56.70	5.41	11.23	1.02	35.28	25.98	68.56
Bank of Beirut	13.68	95.50	0.76	49.92	21.75	10.58	1.17	32.03	31.58	67.75
SGBL	5.95	105.51	12.95	57.45	105.68	13.15	0.86	27.80	16.87	58.78
Libano-Francaise	11.32	100.28	4.02	55.19	18.04	7.90	0.65	32.81	34.33	63.24
Crédit Libanais	14.15	96.84	2.11	58.99	9.83	13.32	0.95	27.55	17.88	50.10
BBAC	10.36	104.78	6.31	54.69	5.12	12.27	0.92	24.47	17.92	60.91
Average value	**11.27**	**99.77**	**4.44**	**51.00**	**19.62**	**12.39**	**1.06**	**28.88**	**24.22**	**62.85**

Table 13: Bank Profiles- Year 2012

CRITERIA / TYPE OF CRITERIA	Total Capital Ratio TCR MAX	Asset Quality Index AQI MIN	Loan Loss Res // Gross Loans LLR MIN	Cost to Income Ratio C/I MIN	Growth in Assets GA MAX	Return On Equity (ROE) MAX	Return On Assets (ROA) MAX	Net Loans // Tot Assets NLTA MIN	Liquid Assets // Tot Assets LATA MAX	Risk Weighted Assets // Tot Assets RWTA MIN
Bank Audi	12.36	100.45	2.73	45.66	8.93	15.27	1.28	33.31	23.26	52.05
BLOM Bank	14.40	97.36	3.94	35.87	8.14	16.13	1.39	24.06	34.67	60.49
Byblos Bank	15.03	105.77	5.66	46.33	2.49	10.14	1.00	24.21	19.87	66.33
Fransabank	12.44	93.58	4.21	50.22	9.05	11.52	1.06	30.72	22.41	61.91
Bankmed	13.42	91.27	3.65	60.53	6.07	11.13	1.04	34.65	32.16	62.18
Bank of Beirut	14.21	95.89	1.04	47.21	18.79	10.87	1.26	29.94	34.38	60.11
SGBL	8.15	97.23	13.42	50.93	7.40	18.66	1.06	25.75	32.86	57.54
Libano-Francaise	13.48	80.82	4.90	45.16	2.81	10.25	0.81	32.36	34.31	55.32
Crédit Libanais	13.73	98.61	1.92	60.85	10.79	11.88	0.81	28.11	18.84	53.04
BBAC	12.06	92.12	6.09	51.39	13.27	12.30	0.94	23.96	24.37	56.64
Average value	**12.93**	**95.31**	**4.76**	**49.41**	**8.77**	**12.81**	**1.07**	**28.71**	**27.71**	**58.56**

The analysis will be limited to the last year (2012) by taking Bank Audi as an example. The analysis of the remaining banks for the remaining years can be done in the same manner.

Audi is barely below the average in terms of total capital ratio, suggesting slightly low capital adequacy as compared to the remaining banks. While its asset quality index is above the average, its loan loss reserve (LLR) ratio is below the average. Since these two variables are negatively correlated with bank's efficiency, the lowest these values, the better is the bank. Therefore, Bank Audi is on average in terms of asset quality since it has a good performance in one variable and a bad performance in the other variable.

As for bank management, it is measured by two variables. While the cost to income ratio is negatively correlated with bank score, the growth in assets is positively corrected with the bank score. Since Audi has a lower cost to income ratio than the average (better index) and higher growth in assets than the average (better index), one can say that Bank Audi is characterized by having a good management in year 2012.

The banks' earnings in 2012 are good since its return on equity and its return on assets are above the average value.

As for the bank liquidity, Bank Audi suffers from liquidity problems in 2012. In fact, its net loans to total assets ratio is above the average and its liquid assets to total assets ratio is below the average, both indicating bad liquidity.

Finally, Bank Audi is not sensitive to market risk since the risk weighted assets to total assets, the only criterion that measures this index, is below the average.

Thus, in summary, Bank Audi has a favorable index in its management (M), earnings (E), and sensitivity to market risk (S), while it suffers from some problems in its capital adequacy (C) and liquidity (L). Thus, we cannot say whether Bank Audi is good or bad, suggesting the need for a multi-criteria decision tool to measure its efficiency and to calculate its score.

The position of each bank according to each specific variable is displayed graphically in Appendix A. These are called banks profiles.

4.4.2 Partial and Complete Banks' Ranking

Figures 38 to 42 show the partial ranking of banks using PROMETHEE Network while figures 43 to 47 show the complete ranking using PROMETHEE II for each of the years 2008 till 2012 respectively.

First, in the PROMETHEE Network, each bank is presented by a node and preferences are presented by arrows. Since the phi+ is a measurement of the strengths of the banks, the highest the value, the better is the bank's performance. As shown in figure 38, in 2008, the banks are ranked as follows from the highest phi+ value (best performance) to the lowest phi+ value (lowest performance): Fransabank, Bank of Beirut, Byblos bank, BBAC, SGBL, BLOM Bank, Banque Libano-Francaise, Bank Audi, BankMed and Credit Libanais.

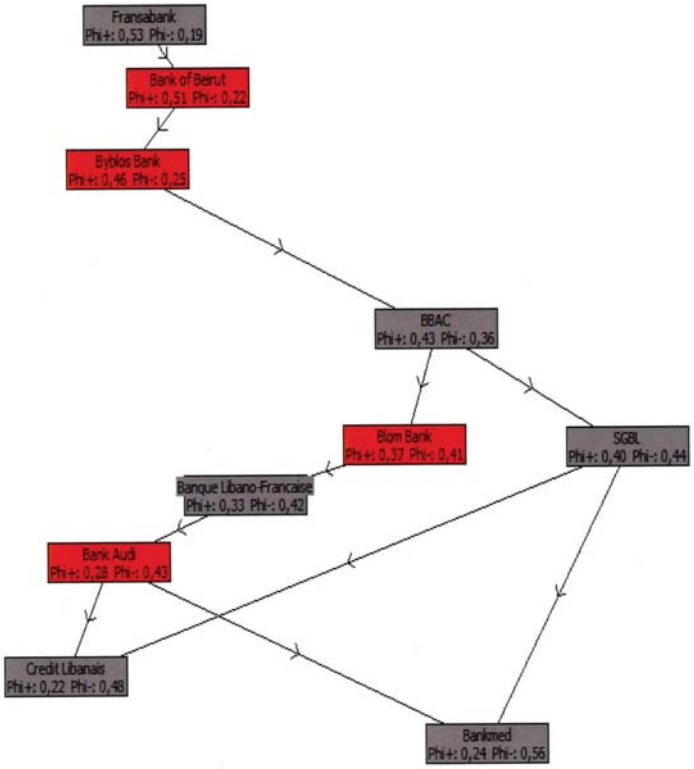


Figure 38: PROMETHEE I partial ranking in year 2008

However, this is not the only indicator for banks' performance since the phi- values measure the weaknesses of the banks. So these values should be minimized. As shown in figure 38, in 2008, the banks are ranked as follows from the lowest phi- value (lowest weaknesses therefore highest performance) to the highest phi- value (highest weaknesses therefore lowest performance): Fransabank, Bank of Beirut, Byblos bank, BBAC, BLOM Bank, Banque Libano-Francaise, Bank Audi, SGBL, Credit Libanais and BankMed.

Therefore, we can say that Fransabank is the best bank (highest phi+ and lowest phi-), followed by Bank of Beirut in the partial ranking of PROMETHEE I since it has a higher phi+ value (better strengths) and lower phi- value (lower weaknesses). Similarly, Bank of Beirut is better than Byblos bank, and the latter is better than BBAC. Although BBAC is better than BLOM and SGBL, BLOM bank cannot be compared to SGBL because even though the latter has a higher phi+ (better strengths), it also has a higher

phi- (more weaknesses). Furthermore, BLOM bank is better than Banque Libano Francaise and the latter bank is better than Bank Audi. Moreover, both Bank Audi and SGBL are better than Credit Libanais and BankMed, but Credit Libanais cannot be compared to BankMed since the latter has more strengths (higher phi+) and more weaknesses (higher phi-) than Credit Libanais. Thus, it is important to have a complete ranking using PROMETHEE II.

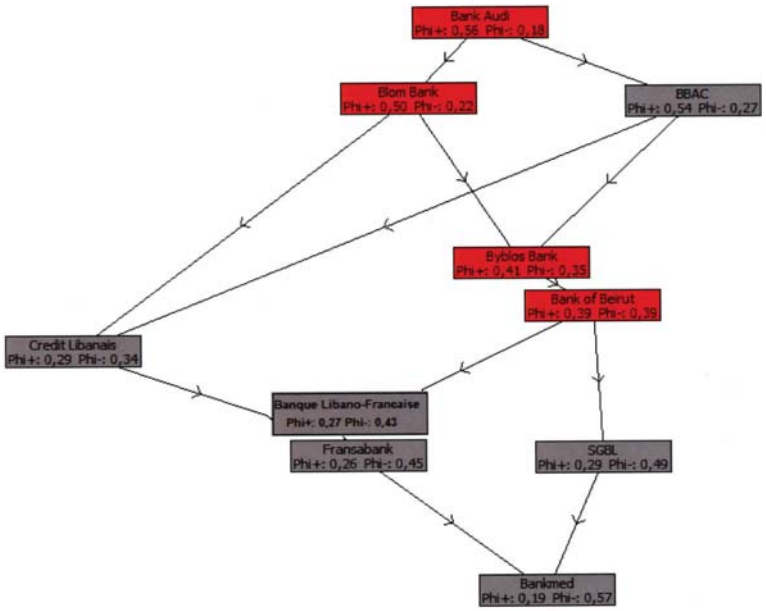


Figure 39: PROMETHEE I partial ranking in year 2009

In the year 2009 as shown in Figure 39, the banks are ranked as follows according to their strengths (highest to lowest phi+ values): Bank Audi, BBAC, BLOM Bank, Byblos Bank, Bank of Beirut, Credit Libanais and SGBL, Bank Libano Francaise, Fransabank and Bankmed. According to their weaknesses (phi- values), the banks are ranked as follows: Bank Audi, BLOM Bank, BBAC, Credit Libanais, Byblos Bank, Bank of Beirut, Banque Libano Francaise, Fransabank, SGBL and finally Bankmed. Therefore, Bank Audi is better than both BBAC and BLOM bank since it has higher strengths and lower weaknesses. However BBAC cannot be compared to BLOM Bank because although the latter has more strengths, it has at the same time more weaknesses.

Furthermore, we cannot compare Credit Libanais with Byblos Bank on one side and with Bank of Beirut on the other side. Similarly, Fransabank and SGBL cannot be compared, although both banks are better than BankMed.

Comparing banks becomes harder in 2010 as shown in Figure 40. Credit Libanais and BLOM bank are better than Bank of Beirut although we cannot say whether Credit Libanais is better than BLOM bank without using the complete ranking. Similarly, Bank of Beirut is better than both Banque Libano-Francaise and BBAC, although these banks cannot be compared. Likewise, BBAC is better than both Fransabank and Bank Audi, but we cannot say whether Fransabank is better than Bank Audi or not. Finally, BankMed is ranked at the lowest, being worse than SGBL.

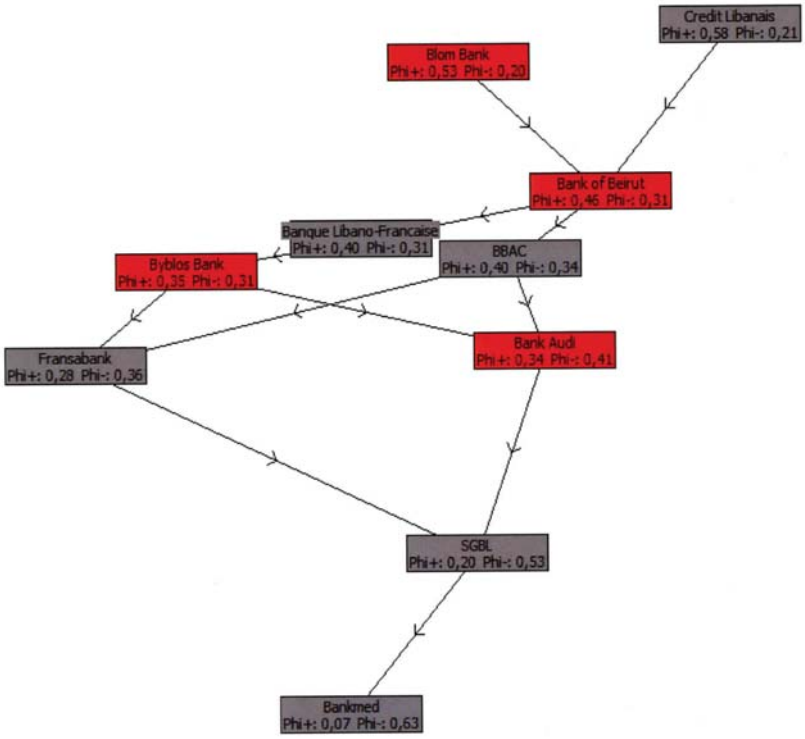


Figure 40: PROMETHEE I partial ranking in year 2010

In the year 2011 shown in Figure 41, BLOM bank is better than Credit Libanais having higher phi+ value and lower phi- value. However, Credit Libanais has a higher phi+

value than Byblos bank but also a higher phi- value so the PROMETHEE I partial ranking cannot tell which bank is better. Similarly, Banque Libano-Francaise cannot be compared to SGBL and SGBL cannot be compared to Fransabank although both banks are better than BankMed.

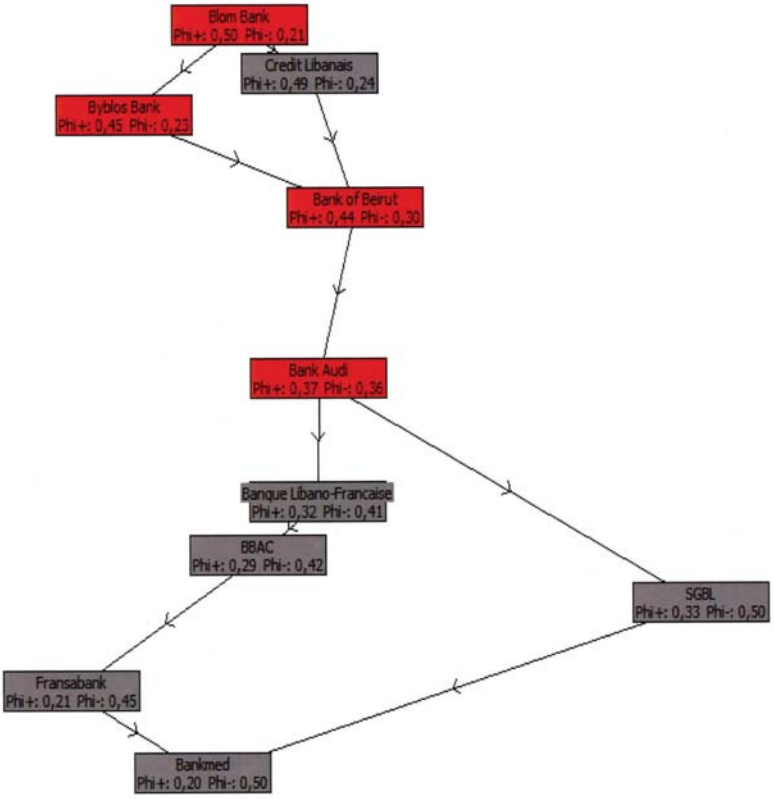


Figure 41: PROMETHEE I partial ranking in year 2011

Finally, in the year 2012 (Figure 42), BLOM Bank and Bank of Beirut are the top two banks having the highest phi+ scores and the lowest phi- scores while Byblos Bank and Bankmed have the lowest phi+ scores values and among the highest phi- scores. The remaining banks are intercalated in a way that it is difficult to assess their performance using the PROMETHEE I ranking since the bank that has a high phi+ score has at the same time a high phi- score. Therefore it is mandatory to use the complete PROMETHEE II ranking.

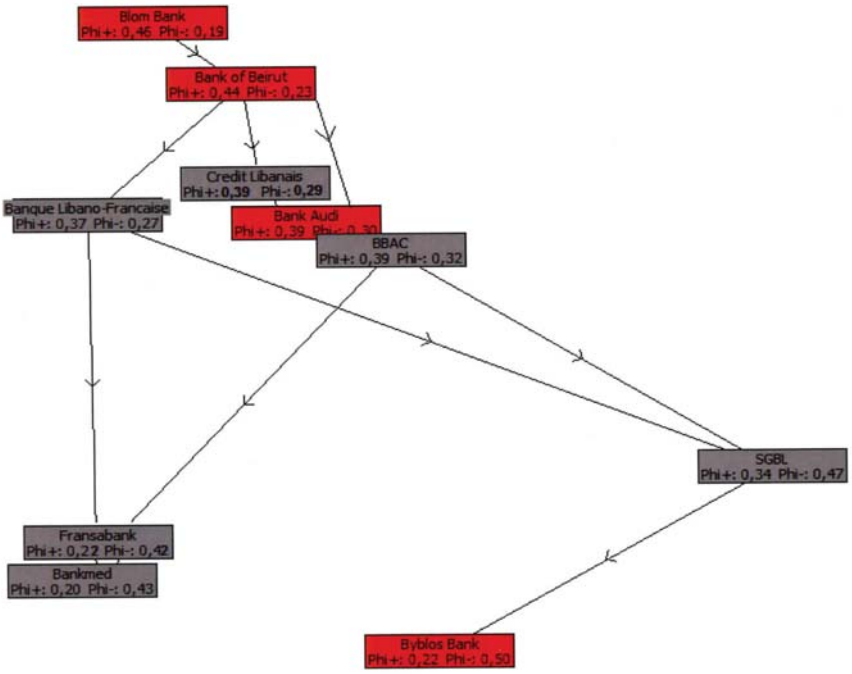


Figure 42: PROMETHEE I partial ranking in year 2012

The graphs showing the PROMETHEE I partial ranking are presented in Appendix B.

Since a complete ranking cannot be made using PROMETHEE I, the PROMETHEE II combines the two preference flows in a single score which is the (phi+)-(phi-), yielding a complete ranking. Thus, the complete ranking that combines the two scores in a single score by taking into account the strengths and weaknesses of the banks gives a better idea about banks and their ranking. Thus, banks can be ranked according to these scores and results are reported in Table 14. The highest the score, the better is the bank performance.

In 2008, the banks shown in Figure 43 are ranked as follows from the best to the lowest performance: Fransabank (0.3448), Bank of Beirut (0.2864), Byblos bank (0.2109), BBAC (0.0631), BLOM Bank (-0.0431), SGBL (-0.0466), Banque Libano-Francaise (-0.0889), Bank Audi (-0.1507), Credit Libanais (-0.2561) and BankMed (- 0.3199).

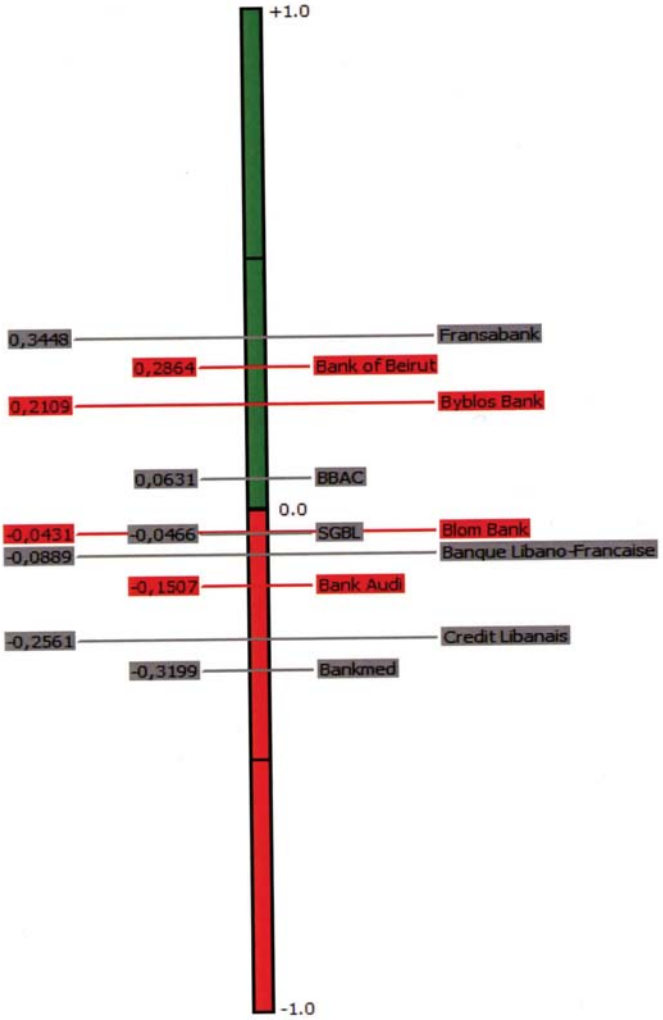


Figure 43: PROMETHEE II complete ranking in year 2008

As of 2009 (Figure 44), the banks are ranked as follows: Bank Audi (0.3763), BLOM Bank (0.2758), BBAC (0.2711), Byblos Bank (0.0597), Bank of Beirut (0.0020), Credit Libanais (-0.0546), Bank Libano Francaise (-0.1653), Fransabank (-0.1944), SGBL (-0.1973), and Bankmed (-0.3733).

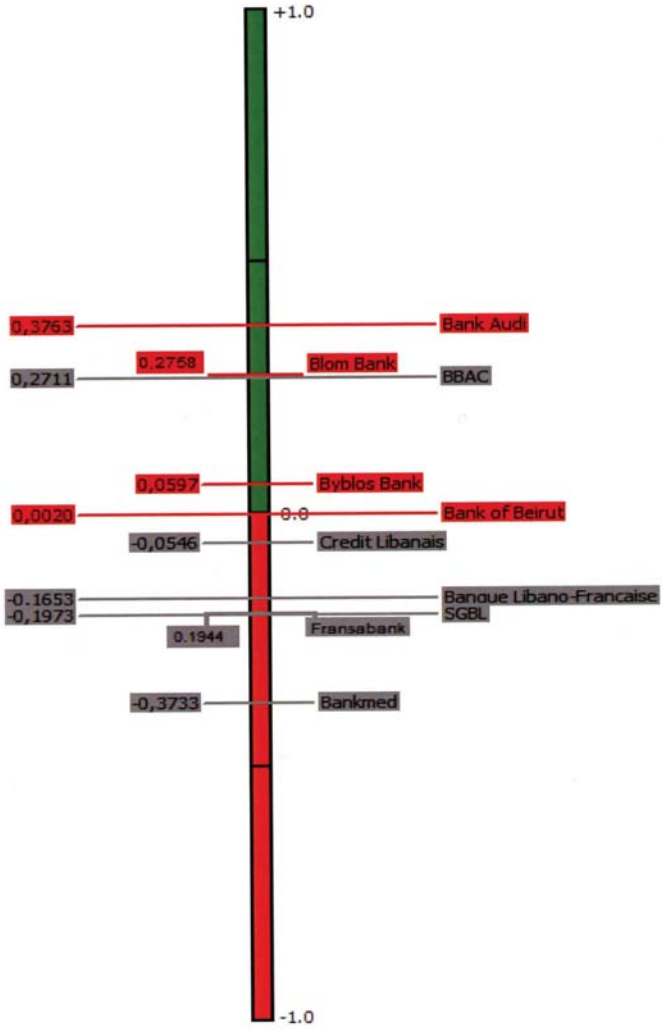


Figure 44: PROMETHEE II complete ranking in year 2009

In 2010, their ranking reported in Figure 45 becomes as follows: Credit Libanais (0.3727), BLOM Bank (0.3234), Bank of Beirut (0.1495), Bank Libano Francaise (0.0865), BBAC (0.0597), Byblos Bank (0.0437), Bank Audi (-0.0642), Fransabank (-0.0816), SGBL (-0.3367), and Bankmed (-0.5531).

Figure 45: PROMETHEE II complete ranking in year 2010

The complete ranking for the year 2011 is as follows (Figure 46): BLOM Bank (0.2966), Credit Libanais (0.2573), Byblos Bank (0.2239), Bank of Beirut (0.1490), Bank Audi (0.0117), Bank Libano Francaise (-0.0884), BBAC (-0.1313), SGBL (-0.1711), Fransabank (-0.2406), and Bankmed (-0.3070).

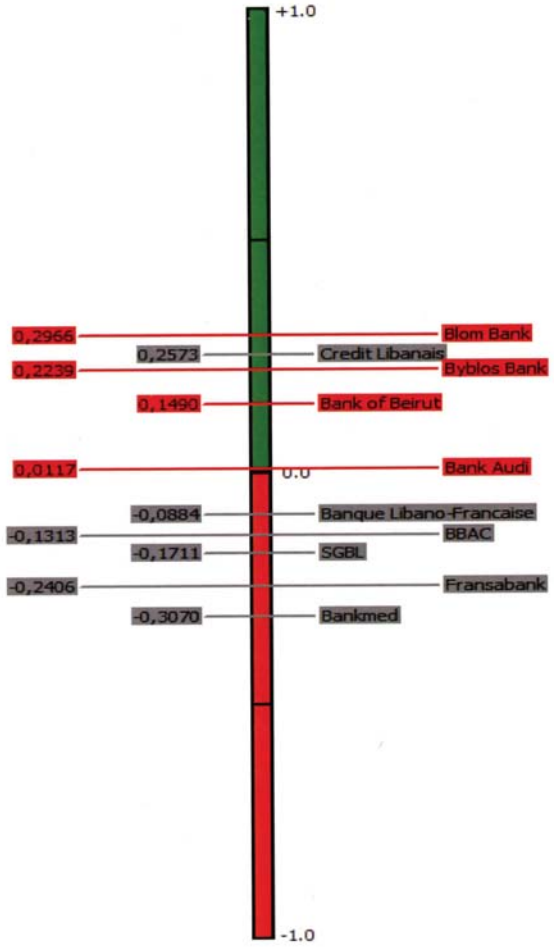


Figure 46: PROMETHEE II complete ranking in year 2011

Finally, in the year 2012, the complete PROMETHEE II ranking ranks the banks as follows according to their single score phi=(phi+)-(phi-): BLOM Bank (0.2678), Bank of Beirut (0.2133), Credit Libanais (0.0998), Bank Libano Francaise (0.0993), Bank Audi (0.0908), BBAC (0.0661), SGBL (-0.1260), Fransabank (-0.2015), Bankmed (-0.2230), and Byblos Bank (-0.2868).

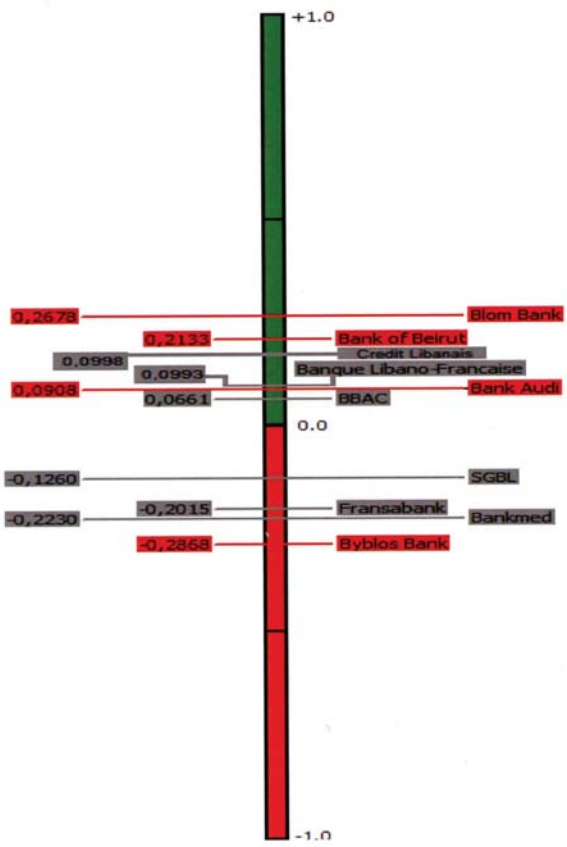


Figure 47: PROMETHEE II complete ranking in year 2012

Tables 14 and 15 show respectively the overall PROMETHEE phi scores and the related classification of each bank from the year 2008 till the year 2012.

Bank Audi was ranked number 8 in 2008; it made a high performance during the year 2009 moving 8 ranks upward to reach number 1. However, it lost its good performance to fall to a rank of 7 in the year 2010. Then, it made a small progress in the two following years to be ranked number 5 in years 2011 and 2012.

As for BLOM Bank, it was ranked number 5 in 2008 (slightly better than SGBL), then it enhanced its performance in the following years to be ranked number 2 in the years 2009 (slightly better than BBAC) and in 2010 and number 1 in the years 2011 and 2012.

Table 14: Summary table for PROMOTHEE Banks Scores (phi) from year 2008 till year 2012

PROMETHEE Banks Scores (phi) from year 2008 till year 2012					
Bank/Year	**2008**	**2009**	**2010**	**2011**	**2012**
Bank Audi	-0.1507	**0.3763**	-0.0642	0.0117	0.0908
BLOM Bank	-0.0431	0.2758	0.3234	**0.2966**	**0.2678**
Byblos Bank	0.2109	0.0597	0.0437	0.2239	**-0.2868**
Fransabank	**0.3448**	-0.1944	-0.0816	-0.2406	-0.2015
Bankmed	**-0.3199**	**-0.3733**	**-0.5531**	**-0.3070**	-0.2230
Bank of Beirut	0.2864	0.0020	0.1495	0.1490	0.2133
SGBL	-0.0466	-0.1973	-0.3367	-0.1711	-0.1260
Banque Libano Francaise	-0.0889	-0.1653	0.0865	-0.0884	0.0993
Credit Libanais	-0.2561	-0.0546	**0.3727**	0.2573	0.0998
BBAC	0.0631	0.2711	0.0597	-0.1313	0.0661

Table 15: Summary table for PROMOTHEE banks Ranking from year 2008 till year 2012

PROMETHEE Banks Ranking from year 2008 till year 2012					
Bank/Year	**2008**	**2009**	**2010**	**2011**	**2012**
Bank Audi	8	**1**	7	5	5
BLOM Bank	5	2	2	**1**	**1**
Byblos Bank	3	4	6	3	**10**
Fransabank	**1**	8	8	9	8
Bankmed	**10**	**10**	**10**	**10**	9
Bank of Beirut	2	5	3	4	2
SGBL	6	9	9	8	7
Banque Libano Francaise	7	7	4	6	3
Credit Libanais	9	6	**1**	2	4
BBAC	4	3	5	7	6

Byblos Bank was among the best banks in 2008 where it was ranked number 3. In 2009, its performance has decreased a little bit compared to the remaining banks to be ranked number 4. In 2010 it moved down further to be ranked number 6. Then it made a jump

4.4.3 Sensitivity Analysis

Indeed, ranking of banks is influenced by the weights allocated to each criterion. Thus, a sensitivity analysis is essential to multi-criteria decision aid as it shows how much the results and especially the final ranking of banks are influenced by fluctuations in the weight coefficients of the criteria. Such a sensitivity analysis tool is valuable when the decision maker has no predetermined weights in mind. In the PROMETHEE, "Visual Stability Intervals" is a powerful tool that can perform sensitivity analysis by changing the weights of the criteria and checking the impact on the rating.

The visual stability interval window can be drawn for each criterion for each year. While the horizontal dimension corresponds to the weight of the criterion, the vertical dimension corresponds to the Phi net flow score. For each bank, a line is drawn that shows the net flow score as a function of the weight of the criterion.

As an example, Figure 48 shows the visual stability interval window for the cost to income ratio criterion in the year 2008.

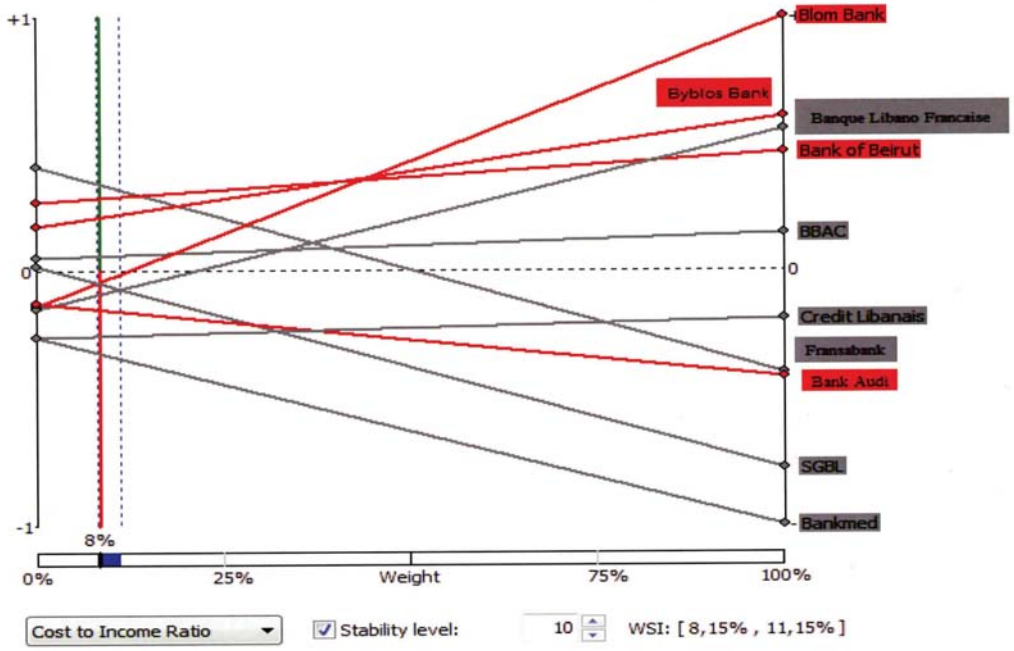


Figure 48: Cost to income visual stability interval for the year 2008

At the right edge of the display, the weight of the C/I is equal to 100% and the banks are ranked according to that single criterion. At the left edge, the weight of the C/I is equal to 0%. The position of the vertical green and red bar corresponds to the current weight of the C/I which is 8%. The intersection of the lines related to each bank with the vertical bar gives the PROMETHEE II complete ranking.

As we can see in the figure above, the scores of BLOM, Byblos, Banque Libano-Francaise, and Bank of Beirut increase when the weight of the C/I criterion increases while the scores of BankMed , SGBL, Audi, and Fransabank decrease when the weight of C/I increases. This is because the first group of banks has lower cost to income ratio while the second group of banks has higher cost to income ratio.

The two dotted vertical lines are drawn to show the weight stability interval (WSI) within which the top of the PROMETHEE II complete ranking remains unchanged. It is between 8.15% and 11.5% for C/I, suggesting that if the weight of the Cost to Income criterion changes between 8.5% and 11.5%, the phi scores values for the ten banks remain the same.

In general, a big interval of any criterion suggests that a change in the weight assigned to this criterion might have a small effect on banks' ranking. On the other side, a small interval suggests that a small change in the weight given to this criterion will have a dramatic change on the overall ranking of banks. Since the weight stability interval (WSI) for C/I is a small interval (roughly 3%), it means that a small change in the weight given to criterion will affect the PROMETHEE II ranking.

Table 16 shows the weight stability intervals for each of the criterion for the years 2008 till 2012 in addition to the current weight allocated for each criterion for all the years. In other words, Table 16 reports the weight's range within which the ratings of the banks remain unchanged in each year. Results in Table 16 show that most of the criteria have a small interval except the Return on Assets where the interval is [0.00%, 100.00%]. Therefore any weight allocated to the ROA does not change banks' ranking.

As for the current weight allocated for each criterion, it is either 16.67% which is equal to 1/6 (6 CAMELS Variables) or 8.33% which is equal to 0.5/6 (in case the CAMELS variable is made of 2 criteria). So, it is the weight of the criterion over the total weight.

Table 16: Weight Stability Intervals for the year 2008 till year 2012

Variable	Current Weight for all years	Weight Stability Intervals / 2008	Weight Stability Intervals / 2009	Weight Stability Intervals / 2010	Weight Stability Intervals / 2011	Weight Stability Intervals / 2012
Total Capital Ratio TCR	16.67%	[10.52%,17.03%]	[16.30%,17.17%]	[14.12%,17.98%]	[11.37%,24.91%]	[16.25%,21.93%]
Asset Qualty Index AQI	8.33%	[0.00%,8.54%]	[0.30%,8.60%]	[7.34%,9.65%]	[0.00%,11.57%]	[7.89%,8.37%]
Loan Loss Res / Gross Loans LLR	8.33%	[8.05%,12.34%]	[7.91%,16.23%]	[6.38%,10.18%]	[3.77%,14.20%]	[8.28%,9.47%]
Cost To Income Ratio C/I	8.33%	[8.15%,11.15%]	[7.77%,8.56%]	[4.99%,10.08%]	[6.45%,10.07%]	[5.61%,8.37%]
Growth in Assets GA	8.33%	[5.55%,8.56%]	[2.12%,8.94%]	[5.34%,10.24%]	[4.01%,10.69%]	[8.30%,9.13%]
Return On Equity (ROE)	8.33%	[2.58%,13.89%]	[7.62%,8.52%]	[5.88%,21.10%]	[3.25%,12.11%]	[8.19%,8.97%]
Return On Assets (ROA)	8.33%	[0.00%,100.00%]	[0.00%,100.00%]	[0.00%,100.00%]	[0.00%,100.00%]	[0.00%,100.00%]
Net Loans / Tot Assets NLTA	8.33%	[8.07%,17.88%]	[8.14%,10.28%]	[5.88%,9.55%]	[3.06%,10.98%]	[8.26%,9.83%]
Liquid Assets / Tot Assets LATA	8.33%	[8.15%,11.01%]	[8.04%,16.18%]	[6.01%,10.66%]	[5.79%,12.69%]	[7.60%,8.36%]
Risk Weighted Assets / Tot Assets RWTA	16.67%	[11.31%,17.12%]	[11.68%,17.06%]	[15.26%,20.29%]	[14.09%,18.80%]	[16.55%,18.35%]

When compared to the pre-specified weights of each category of criteria, it is obvious that the ranking of banks is very sensitive to the capital adequacy index in 2009 and 2010. The asset quality dimension is very critical mainly in 2010 and 2012. On the other hand, the relative importance of the management dimension is likely to alter the rating of banks mainly in 2012. Overall, the ratings in 2008 and 2012 seem to be the most sensitive to changes in the relative importance of the criteria categories, since the

obtained bounds are generally closer to the pre-specified weights, with the exception of ROA.

4.4.4 GAIA Analysis

The information including k criteria can be represented in a k-dimensional space. The GAIA plane is obtained by projecting the information on a plane in a way that little information is lost. The GAIA analysis highlights the difference or similarities between banks and whether they can be clustered into similar banks. At the same time, the GAIA plane shows conflicting criteria as well as criteria expressing similar preferences (VPSolutions, 2013).

Figures 49 to 53 show the GAIA plane for the years 2008 to 2012 respectively. The banks are represented by points and those with similar profiles will be closer to each other in the GAIA plane. The criteria are represented by axes drawn from the center of the plane and the orientation of these axes indicates how closely the criteria are related to each other. For example, criteria with similar preference are pointed to the same direction, while conflicting criteria are pointed in opposite direction.

In the year 2008 (Figure 49), for example, Byblos Bank and Bank of Beirut can be considered as similar to each other. Bank Audi and Banque Libano Francaise can be considered as well similar to each other. However, the remaining banks are different from each other since they appear far away from each other in the GAIA plane. As for the criteria, those expressing similar preferences are represented by axes oriented in similar directions. That is the case of net loans to total assets ratio, the risk weighted assets over total assets ratio, and the total capital ratio. Therefore, banks with high NLTA have also high RWATA and high TCR. The growth in assets and the assets quality index represent as well a subset of criteria expressing similar references. Moreover, the cost to income ratio, the liquid assets over the total assets and the loan loss reserve ratio represent similar criteria. The return on Equity has a direction different than all other criteria so it cannot be clustered with any other criteria. Finally the return

on assets is represented by a point at the center of the plane which confirms the result mentioned previously that any change in the ROA does not affect the banks scores.

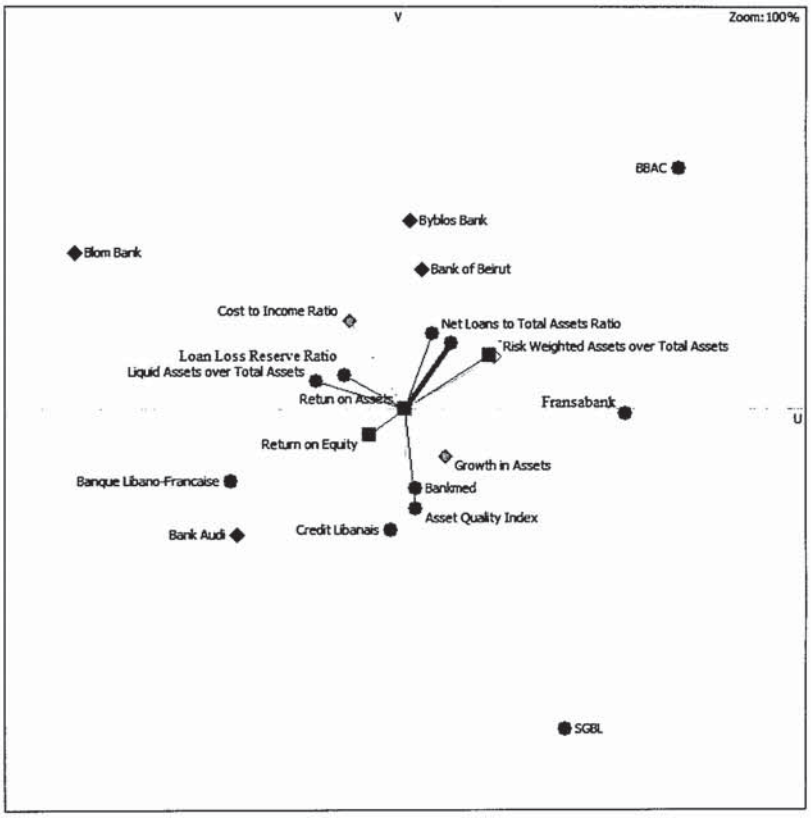


Figure 49: Gaia Plane for year 2008

In 2009 reported in Figure 50, Fransabank, Credit Libanais and Banque Libano Francaise can be considered as similar to each other. Bank Audi and Bank of Beirut can be considered as well similar to each other. However, the remaining banks are different from each other due to their locations in the GAIA plane. As for criteria, the net loans to total assets ratio, the cost to income, and the total capital ratio have similar preferences since their related axes have almost same direction. Therefore, banks with high NLTA have also high TCR and high C/I. The liquid assets over total assets and the loan loss reserve ratio have the same preference and finally the return on equity and the risk

weighted assets over total assets can be considered as well a subset of criteria expressing similar preferences.

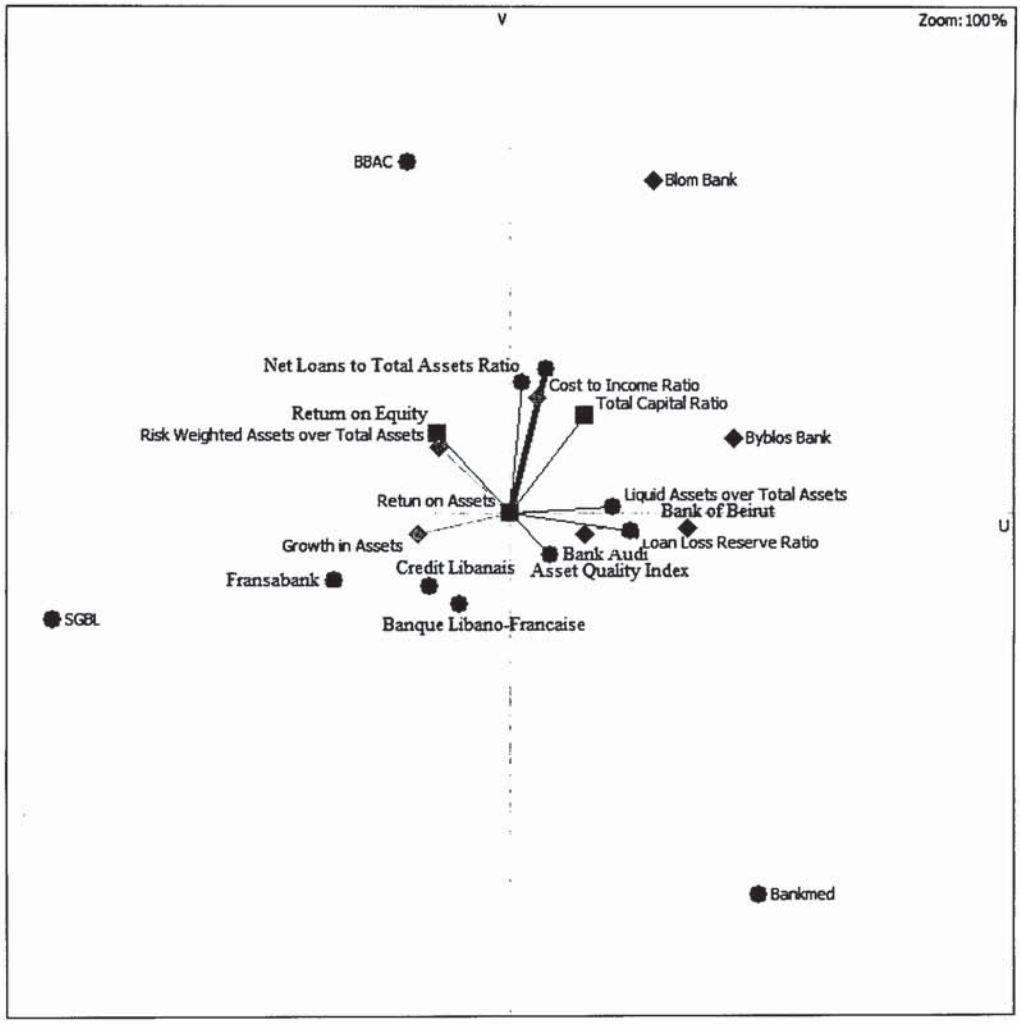


Figure 50: Gaia Plane for year 2009

As shown in Figure 51, in 2010, Byblos Bank and BLOM Bank became close to each other in the GAIA plane, therefore they can be clustered into the same group. However the remaining banks are dispersed all over the GAIA plane and cannot be grouped together. As for the criteria that represent similar preferences, we can consider that banks with high RWATA have also high NLTA since the 2 criteria have almost same

direction. Similarly, GA, the TCR and the C/I are directed to the lower left part of the GAIA plane. Finally the LLR, the LATA and AQI can be considered as one group according to the GAIA plane. Therefore banks that have a good performance in one of the criteria have also good performance in the other criteria of the same group.

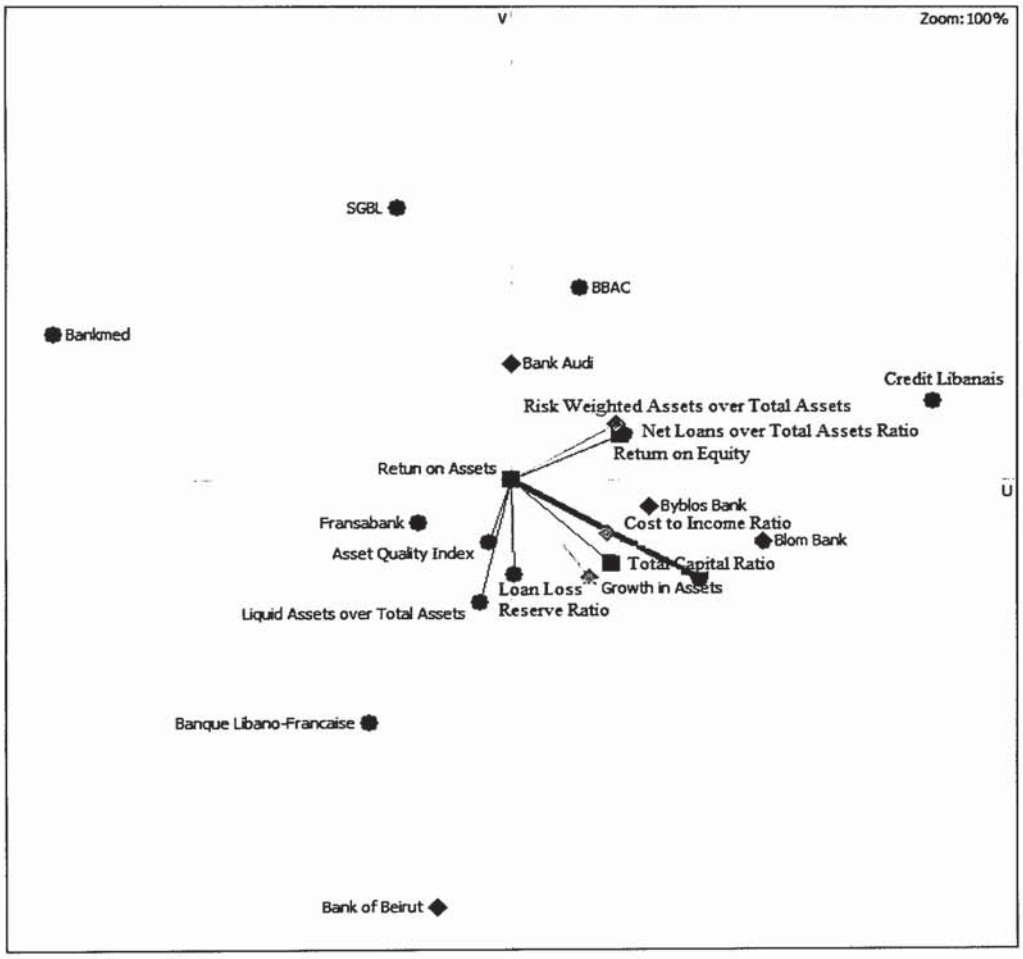


Figure 51: Gaia Plane for year 2010

As shown in Figure 52, in 2011, Bank Audi and Byblos Bank became close to each other, same for Bankmed and Bank of Beirut. As for the criteria that can be considered matching to each other, therefore contributing to a good or bad performance of the bank simultaneously, we can set three groups: the first group is constituted by C/I and TCR,

the second group is constituted by AQI, LLR, LATA and the third one is constituted by the ROE and the NLTA.

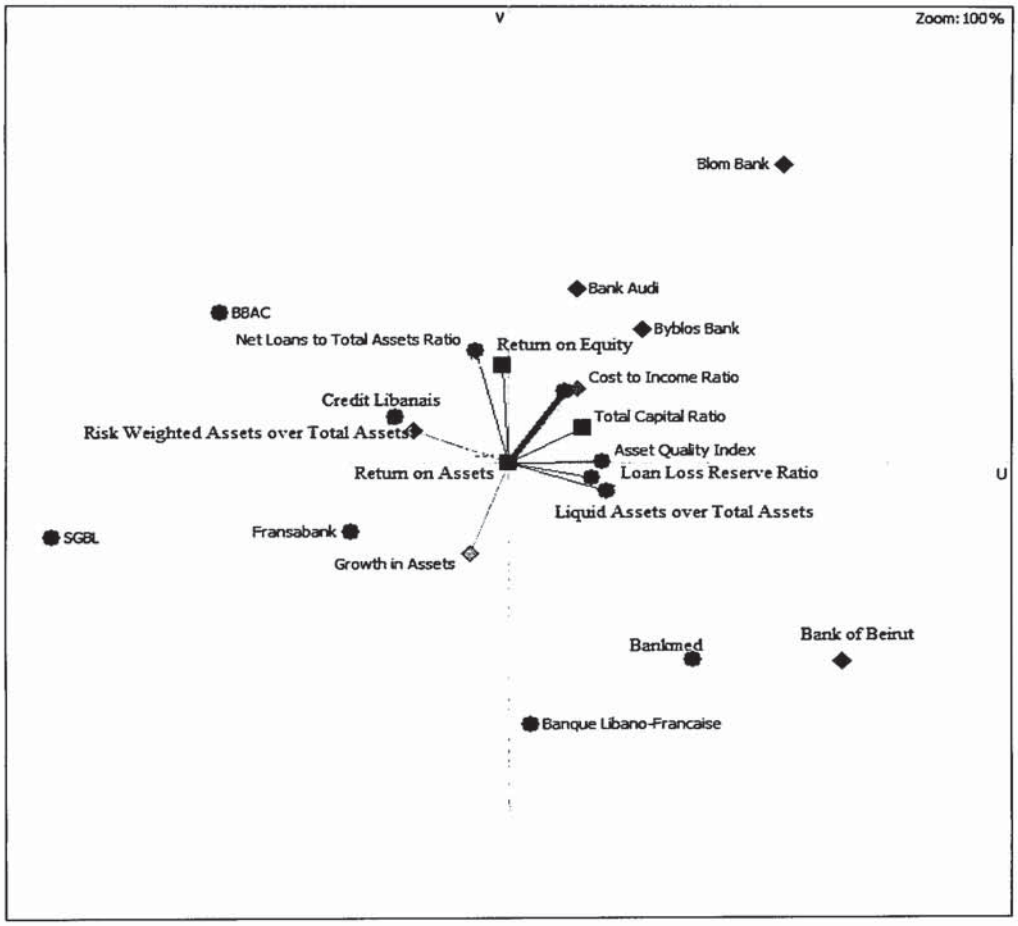


Figure 52: Gaia Plane for year 2011

Finally, in the year 2012 displayed in Figure 53, we can see that the banks can be clustered into three groups: Credit Libanais, Bank Audi and BBAC in the 1st group, BLOM Bank and Byblos Bank in the 2nd group and finally Bankmed and Bank Libano Francaise in the third group. As for the criteria, they can be divided into four groups: ROE and NLTA; C/I and TCR; LATA and AQI; RWATA, LLR and GA.

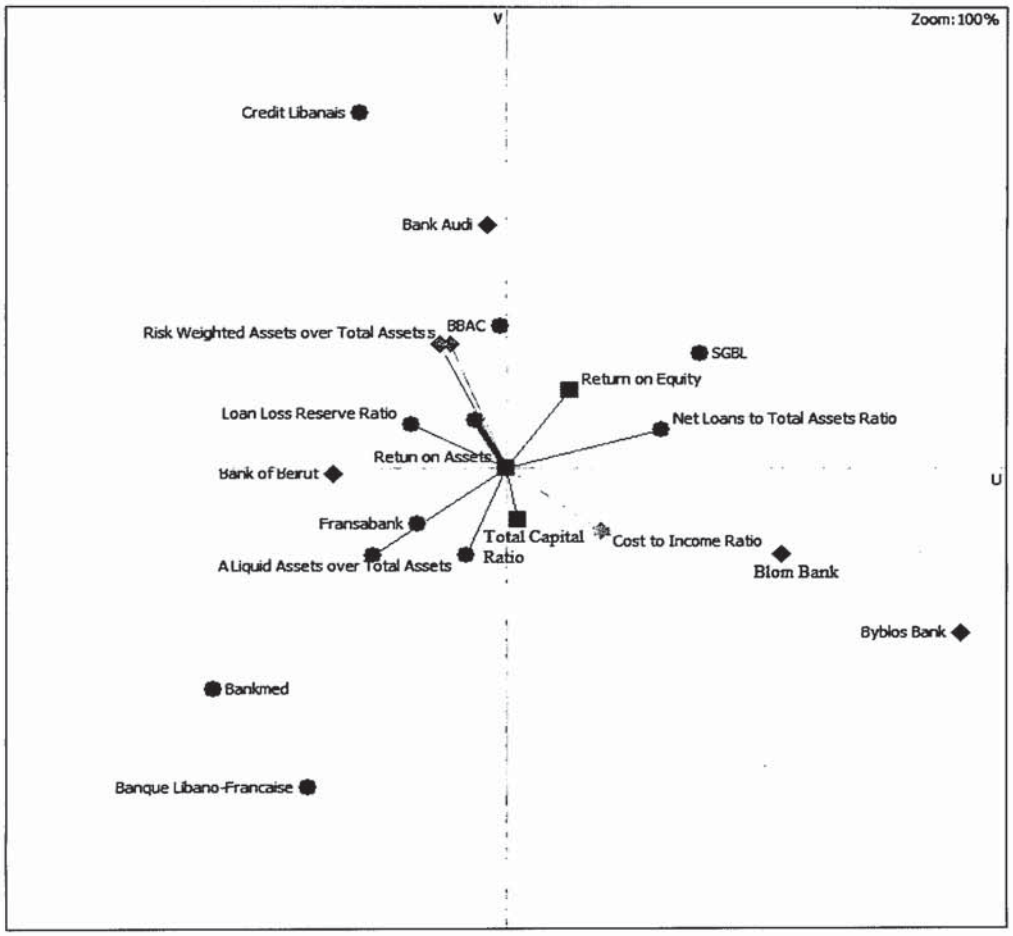


Figure 53: Gaia Plane for year 2012

We can notice from the above that banks' clustering is not constant over the years, but it changes from year to year depending on the performance of each bank relatively to the remaining banks. The only exception is for BLOM Bank and Byblos Bank that were considered as close to each other in the years 2010 and 2012.

4.4.5 Comparisons of Scores

4.4.5.1 Listed vs. Unlisted Banks

To answer Research Questions 3 and 4, this section will compare the performance of listed banks to that of unlisted banks. In case of significant difference, it will assess the

factors that discriminate between them. The dependent variable is the bank score, while the independent variable is "Listed/ Unlisted" where a value of 1 is assigned for listed banks and 2 for unlisted banks.

As mentioned in chapter 3, an independent t-test using SPSS will be used to compare the performance. However, for the t-test to be valid, the six assumptions mentioned in chapter 3 should be tested and met.

- Assumption 1: Continuous Dependent Variable

Since the dependent variable is the bank score, which is measured on a continuous scale, the first assumption is met.

- Assumption 2: Two Categorical Independent Groups

This assumption is satisfied since we are comparing the score between listed and unlisted banks, which are both categorical and independent groups.

- Assumption 3: Independence of Observations

Since banks included in group 1 (listed banks) are not included in group 2 (unlisted banks), this assumption is again met.

- Assumptions 4: No Significant Outliers

The boxplot of banks' scores shown in Figure 54 is a graphic display that has several features. One of them is to identify potential outliers. Outliers are values shown at the lower or upper end that lie apart from the distribution. Figure 54 shows that there are no outliers in the scores values, satisfying the fourth assumption.

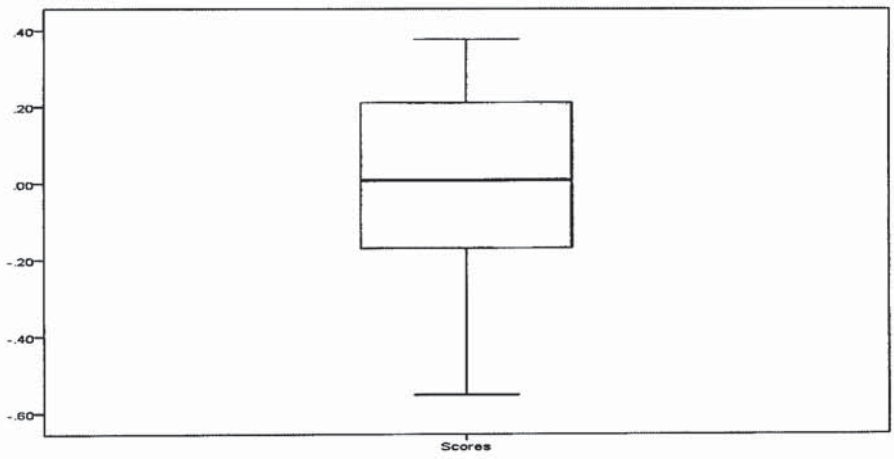


Figure 54: Boxplot of banks scores

- Assumptions 5: Normality of the Dependent Variable

Normality will be tested in two ways: one numerical method and one graphical method. First, for dataset smaller than 2000 observations, the Shapiro-Wilk test will be used; otherwise, the Kolmogorov-Smirnov test should be used. Since our sample consists of only 50 observations (N=50), the Shapiro-Wilk test will be used. The null hypothesis is that the data is normally distributed while the alternative hypothesis is that the data is not normally distributed. (Laerd, 2011b) If the significance value of Shapiro-Wilk test is greater than 5% (0.05), the null hypothesis will be accepted concluding the normality of the data. However, a value below 0.05 suggests that the data significantly deviates from a normal distribution. Table 17 shows the results of the Shapiro-Wilk test using SPSS. The significance values for listed banks and unlisted banks are 0.444 and 0.594, respectively, both greater than 0.05. Therefore we accept the null hypothesis that the data is normally distributed for both listed and unlisted banks.

Table 17: Test of Normality for scores of Listed and Unlisted banks

	ListedUnlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Scores	1.00	.145	20	.200*	.955	20	.444
	2.00	.104	30	.200*	.972	30	.594

In addition to the numerical method, Figures 55 and 56 show the histogram of bank scores for listed and unlisted banks respectively. The bell shape of the histograms confirms the normality of data.

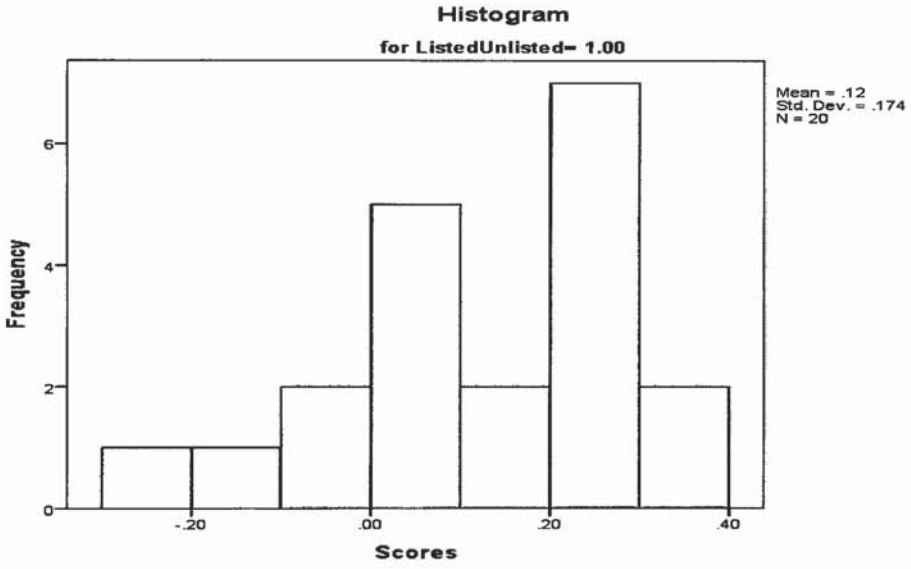


Figure 55: Histogram for scores of Listed Banks

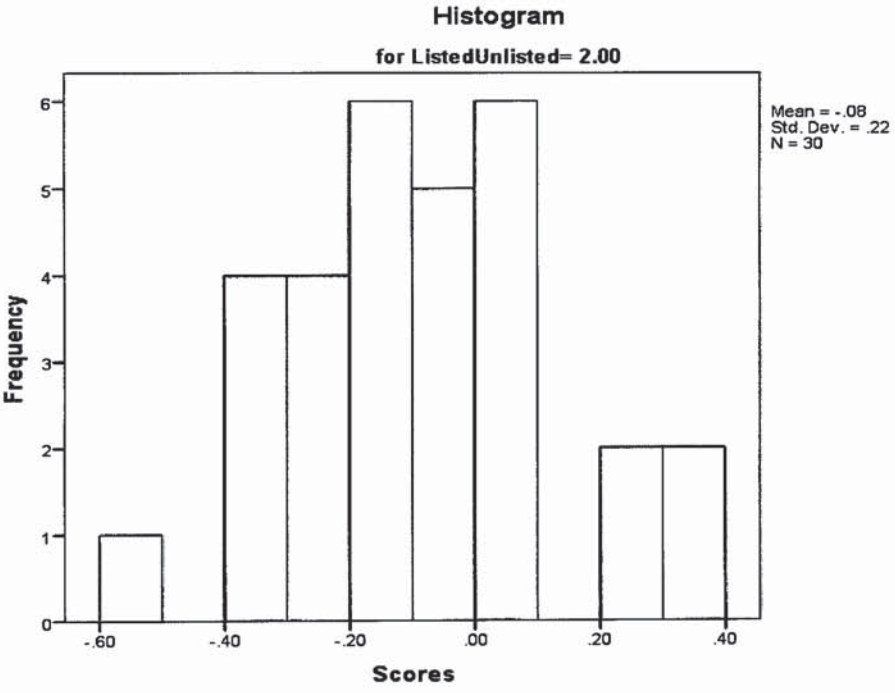


Figure 56: Histogram for scores of Unlisted Banks

- Assumption 6: Homogeneity of Variance

This assumption will be tested using Levene's test after running the t-test on SPSS.

Since these assumptions are met, the independent t-test can be used to test whether banks' scores differ between listed and unlisted banks. Therefore the null and alternative hypotheses are as follows:

$H_{0,3}$: There is no significant difference in scores between listed and unlisted banks in Lebanon: $\mu_{listed} = \mu_{unlisted}$

$H_{a,3}$: There is a significant difference in scores between listed and unlisted banks in Lebanon: $\mu_{listed} \neq \mu_{unlisted}$

Where μ is the mean of banks scores

It is a two tailed test with α level = 0.05 where H_0 is rejected if $p \leq \alpha$.

The output from SPSS is shown in table 18.

Table 18: Test of difference in means of scores between Listed and Unlisted banks

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Scores	Equal variances assumed	.753	.390	3.464	48	.001	.20301	.05861	.08517	.32085
	Equal variances not assumed			3.629	46.454	.001	.20301	.05594	.09044	.31558

Before interpreting the results, the 6th assumption should be tested. "Levene's Test for Equality of Variances" is used to test whether the variability of each group is approximately equal. If this assumption is not met, then a special form of the t-test

should be used. In our case, the significance (p-value) of Levene's test is 0.390, greater than α (0.05), thus concluding that the variances of listed and unlisted banks are equal.

Looking at the t-test result, the "Sig." gives the two-tailed p-value associated with the test. The null hypothesis is rejected if the Sig is lower than 0.05. Table 18 shows a p-value of 0.001 <0.05, rejecting $H_{0,3}$ and concluding that there is a significant difference between the means of the scores of listed and unlisted banks. More specifically, the positive mean difference between listed and unlisted banks indicates that listed banks have higher scores, thus they are more efficient than unlisted banks.

However, it is important to know the factors that contribute to this difference in the scores means between listed and unlisted banks. Therefore, and as explained in chapter 3, we will test which aspect of the CAMELS variables contribute to the difference in the means between listed and unlisted (Hypotheses 4.1-4.6).

Similarly, and before using t-tests, assumptions 4, 5, and 6 should be tested for each of the CAMELS variables. First of all, normality (assumption 5) is tested using Shapiro-Wilk test and results reported in Table 19 show the value of the Shapiro Wilk for each of the variables for the 2 groups of banks. The normality tables extracted from SPSS are found in Appendix C.

Table 19: Summary Table for normality test of variables for Listed and Unlisted banks

VARIABLE	P VALUE SHAPIRO WILK LISTED	P VALUE SHAPIRO WILK UNLISTED	NORMAL DISTRIBUTION
TCR	0.000	0.000	NO
AQI	0.011	0.000	NO
LLR	0.786	0.000	NO
CI	0.256	0.201	YES
GA	0.602	0.000	NO
ROE	0.206	0.011	NO
ROA	0.339	0.016	NO
NLTA	0.144	0.403	YES
LATA	0.276	0.059	YES
RWTA	0.000	0.000	NO

As shown in Table 19, the cost to income, net loans to total assets and the liquid assets over total assets are normally distributed; therefore the t-test will be used in order to compare the means of these variables for the two groups of banks.

Thus, Table 20 summarizes the results of the Levene test (assumption 6) and t-test done only for the variables that are normally distributed. The tables for t-test extracted from the SPSS are shown in Appendix D. The Levene test supports the equality of variances for the three variables (p-value>0.05).

Table 20: Summary Table for difference in mean values for normally distributed variables for Listed and Unlisted banks

VARIABLE	P VALUE FOR LEVENE'S TEST	EQUAL VARIANCES	P VALUE FOR T TEST	HYPOTHESIS H0	DIFFERENCE IN MEANS
CI	0.748	YES	0.000	REJECTED	YES
NLTA	0.238	YES	0.294	ACCEPTED	NO
LATA	0.559	YES	0.005	REJECTED	YES

As we can see in Table 20, at 0.05 level of significance, there is enough evidence to conclude that there is a difference in the mean values of cost to income (hypothesis 4.3) and the liquid assets over total assets (hypothesis 4.5) between listed and unlisted while there is no significant difference in the mean values of net loans over total assets for the two groups of banks (hypothesis 4.5). Therefore, we conclude that the net loans to total assets variable does not contribute to the difference in the mean scores between listed and unlisted while the cost to income and liquid assets over total assets contribute to the difference in the mean scores between listed and unlisted. More specifically, the mean difference between listed and unlisted banks is negative (-8.2), suggesting that the cost to income ratio for listed banks is lower than that of unlisted banks. Similarly, the mean of net loans over total assets for listed banks is lower than the mean of the same variable for unlisted banks since the difference in the mean is -1.36. Finally, listed banks have higher liquid assets over total assets than that of unlisted banks since the difference in means between the two groups is positive, being 4.75. Thus, we can conclude that listed

banks have better cost control and are more liquid (lower net loans ratio and higher liquid ratio), contributing to a higher score and a higher rating.

For the remaining variables that are not normally distributed, Mann Whitney U test will be used. However, the comparison can be based either on the medians (given same distributions for the two variables) or on the means (given different distributions for the two variables). To choose the suitable Mann Whitney test, Kruskall Wallis test will be used, where a p value greater than α suggests that the two groups have the same distribution, while a p value less than α suggests that the two groups do not have the same distribution.

Table 21 summarizes the results of the Kruskal Wallis and Mann Whitney test for all the variables that are not normally distributed. As we can see, the p-values for Total capital ratio, Asset Quality Index, growth of assets, ROE, and Risk Weighted assets/total assets are greater than 0.05, suggesting a similar distribution of these variables between listed and unlisted banks. Therefore the Mann Whitney test will compare the median of these variables between listed and unlisted banks.

As for the remaining non-normal variables, mainly, LLR and ROA, they have a p-value less than 0.05, suggesting a different distribution of these variables, indicating that the Mann-Whitney test will compare the mean of these variables between listed and unlisted banks. Thus, column 4 in Table 21 reports the results of the Mann Whitney test based on median for the TCR, AQI, GA, ROE and RWTA variables and based on mean for the remaining variables. The Kruskal Wallis tables for all variables are shown in Appendix E, while the Mann-Whitney tables are shown in Appendix F.

As shown in table 21, the two tailed sig. value for the Mann Whitney test for TCR is 0.052, greater 0.05 accepting hypothesis H_0 that $\mu_{TCR,\ listed}=\mu_{TCR,\ unlisted}$ (Hypothesis 4.1), concluding that there is no difference in the median of TCR between listed and unlisted banks. Thus, the TCR does not contribute to the difference in scores between the two groups. Similarly, the significance values for asset quality index (Hypothesis 4.2), growth in assets (Hypothesis 4.3), return of equity (Hypothesis 4.4) and the risk

weighted assets over the total assets (Hypothesis 4.6) are greater than 0.05, therefore, accepting the null hypothesis and concluding that these variables do not contribute to the difference in scores between listed and unlisted banks. On the other hand, the CAMELS variables that contribute to the difference in scores between listed and unlisted banks are the loan loss reserve (hypothesis 4.2) with a p-value of 0.0000 and the return on assets (hypothesis 4.4) with a p-value of 0.0000.

Table 21: Summary Table for difference in mean/median values for variables that are not normally distributed for Listed and Unlisted banks

VARIABLE	P VALUE KRUSKAL WALLIS	MEDIANE TEST SCORE EQUAL (SAME DISTRIBUTION)	MANN WHITNEY TEST COMPARES	EXACT SIG. 2 TAILED FOR MANN WHITNEY	HYPOTHESIS H0	DIFFERENCE IN MEANS /MEDIANS
TCR	0.052	YES	MEDIAN	0.052	ACCEPTED	NO
AQI	0.322	YES	MEDIAN	0.164	ACCEPTED	NO
LLR	0.000	NO	MEAN	0.000	REJECTED	YES
GA	0.782	YES	MEDIAN	0.791	ACCEPTED	NO
ROE	0.259	YES	MEDIAN	0.266	ACCEPTED	NO
ROA	0.000	NO	MEAN	0.000	REJECTED	YES
RWTA	0.060	YES	MEDIAN	0.061	ACCEPTED	NO

More specifically, the mean of the loan loss reserve for listed banks is 14.9, being lower than the mean of the loan loss reserve for unlisted banks of 32.53 as shown in table 22. Therefore, listed banks have better asset quality (lower loan loss reserve) than unlisted banks.

Table 22: Descriptive Statistics for Loan Loss Reserve Ratio for Listed and Unlisted banks

Listed/Unlisted		N	Mean Rank	Sum of Ranks
LLR	1.00	20	14.95	299.00
	2.00	30	32.53	976.00
	Total	50		

Moreover, Table 23 shows that the mean of the return on assets for listed banks is 35.40 higher than the mean of the return on assets for unlisted banks which is 18.90. Therefore, listed banks are enjoying higher return on assets than unlisted banks.

Table 23: Descriptive Statistics for Return on Assets for Listed and Unlisted banks

Listed/Unlisted		N	Mean Rank	Sum of Ranks
ROA	1.00	20	35.40	708.00
	2.00	30	18.90	567.00
	Total	50		

In summary, listed banks have significantly higher scores than unlisted banks. However, not all CAMELS variables contribute to this difference. The variables that discriminate between the two groups of banks are the cost to income, the liquid assets over total assets, the loan loss reserve and the return on assets. Listed banks are found to be more efficient in cost control, to have better asset quality, to be more liquid, and to enjoy higher profitability than unlisted banks.

4.4.5.2 Small vs. Large Banks

After comparing listed and unlisted banks, banks' scores will be compared based on banks' size in order to answer research question 5. Banks with total assets above the average total assets will be considered as big banks (assigned a value of 1) while banks below average total assets will be considered as small banks (assigned a value of 2).

Similarly, assumptions 5 and 6 will be tested to check if the two groups are normally distributed and if the variances are equal.

First, concerning normality, Table 24 shows the Shapiro-Wilk test for big and small banks. The significance values are 0.299 and 0.926 for large and small banks respectively. Since they are greater than 0.05, the null hypothesis that the data is normally distributed is accepted for both big and small banks. Similar result is obtained

when using Kolmogorov-Smirnov. Therefore, a t-test can be used to check whether there is a significant difference in the mean scores between big and small banks.

Table 24: Test of Normality for scores of Big and Small size banks

	Big/Small	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	Df	Sig.
Scores	1.00	.132	25	.200	.953	25	.299
	2.00	.105	25	.200	.982	25	.926

Second, concerning the equality of variances, Table 25 shows that the significance (p-value) of Levene's test is 0.039, which is smaller than α (0.05), suggesting that the variances of big and small banks are not equal. Thus, t-test will be based on the assumption of no equal variance. Results in Table 25 show a p-value of 0.524 (equal variances not assumed), higher than 0.05, accepting $H_{0,5}$. Therefore, there is no significant difference between the means of the scores of big and small banks, concluding that banks' score is not affected by the size.

Table 25: Test of difference in means of scores between Big and Small size banks

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Scores	Equal variances assumed	4.486	.039	-.643	48	.523	-.04109	.06393	-.16963	.08744
	Equal variances not assumed			-.643	42.997	.524	-.04109	.06393	-.17001	.08783

4.5 Comparison of Results

So far, two approaches were developed to evaluate the performance of ten Lebanese banks over a five year period (i) a traditional CAMELS approach and (ii) a PROMETHEE approach. While the traditional CAMELS approach has been developed using spreadsheets to find banks' scores, the PROMETHEE approach has been developed using a software that calculates the scores.

This section will try to provide an answer to Research question 2 by comparing the results of both methods. Moreover, banks in Lebanon are rated based on Capital Intelligence Financial Strength (CIFS) Rating given by Bankscope, while they are ranked based on total assets. Thus, this section will also compare the current ranking based on total assets to the CIFS (Research Question 6).

4.5.1 Comparisons between PROMETHEE and Traditional CAMELS ranking

Tables 8 and 15 shown previously displayed the ranking for all banks from 2008 to 2012 using the traditional and the multi-criteria approach, respectively. This section will compare the results drawn from the two approaches and will identify the factors that might promote one over the other. For this purpose, Figures 57 to 66 show the evolution of the ranking over time for each of the ten banks using both the PROMETHEE and the traditional CAMELS methodology.

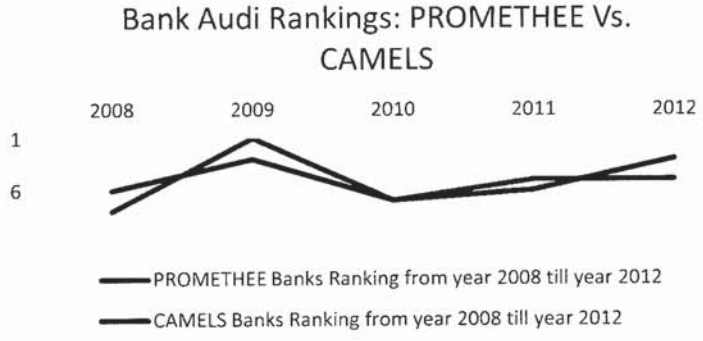


Figure 57: Evolution of Bank Audi Ranking using PROMETHEE and traditional CAMELS methods

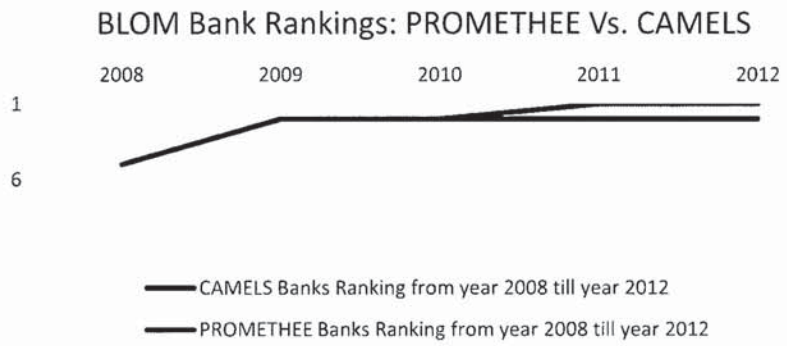


Figure 58: Evolution of Blom Bank Ranking using PROMETHEE and traditional CAMELS methods

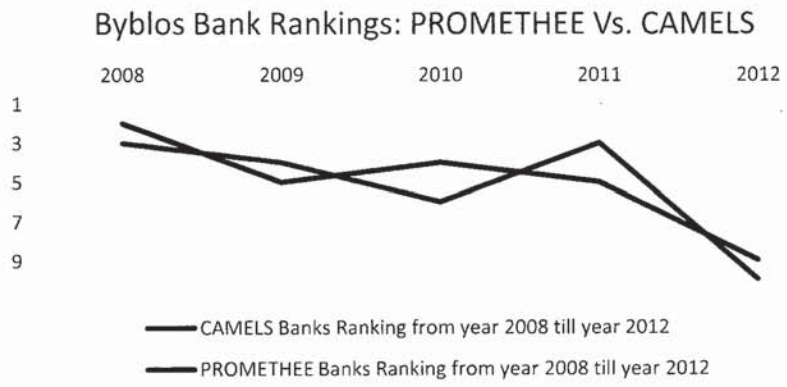


Figure 59: Evolution of Bank Byblos Ranking using PROMETHEE and traditional CAMELS methods

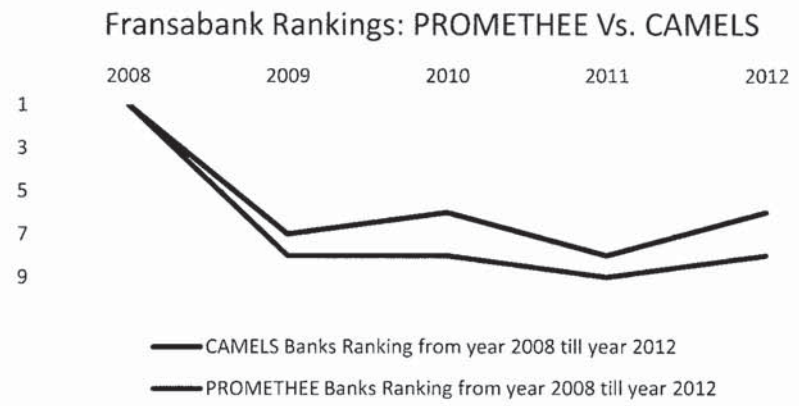


Figure 60: Evolution of Fransabank Ranking using PROMETHEE and traditional CAMELS methods

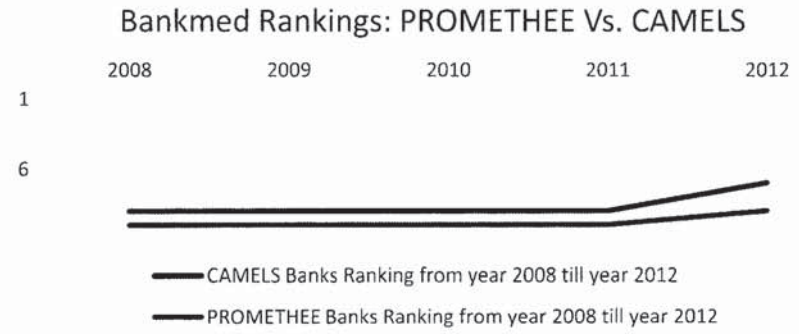


Figure 61: Evolution of Bankmed Ranking using PROMETHEE and traditional CAMELS methods

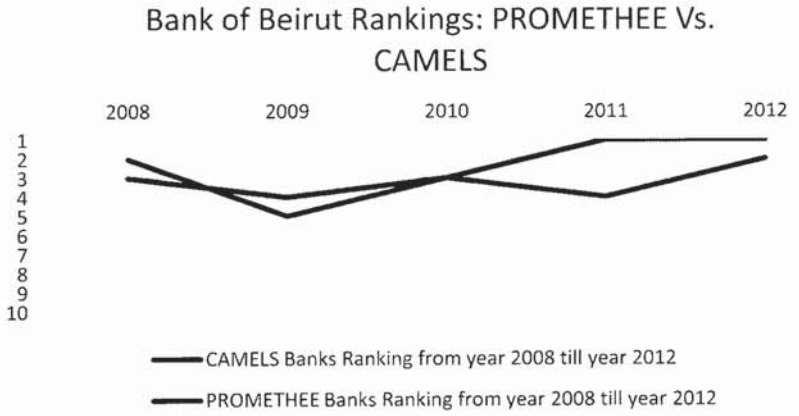


Figure 62: Evolution of Bank of Beirut Ranking using PROMETHEE and traditional CAMELS methods

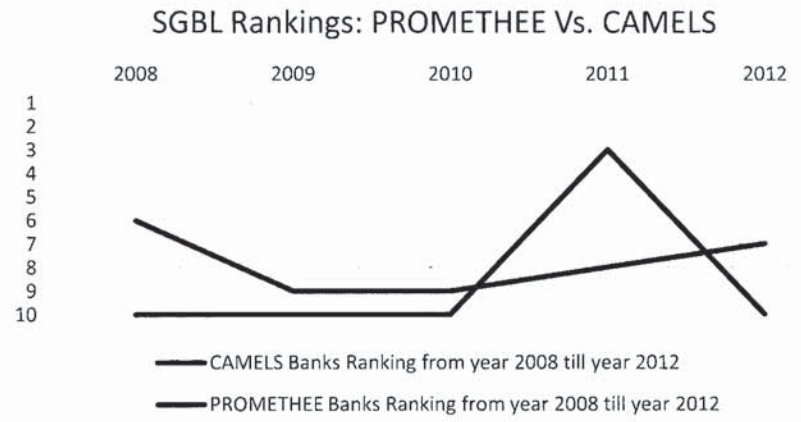


Figure 63: Evolution of SGBL Ranking using PROMETHEE and traditional CAMELS methods

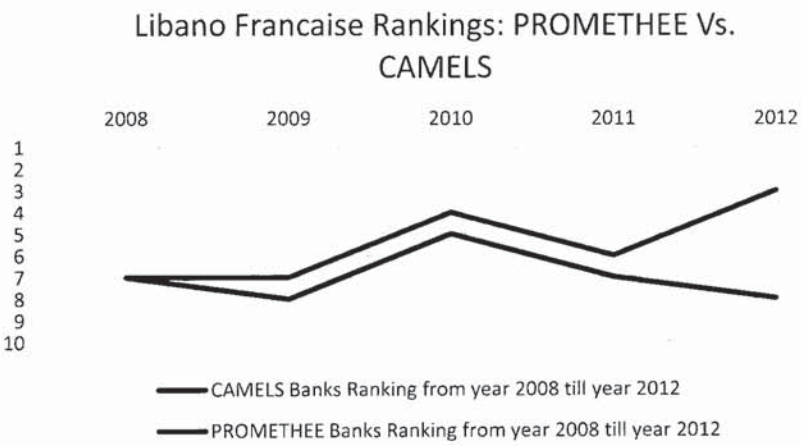


Figure 64: Evolution of Libano Francaise Ranking using PROMETHEE and traditional CAMELS methods

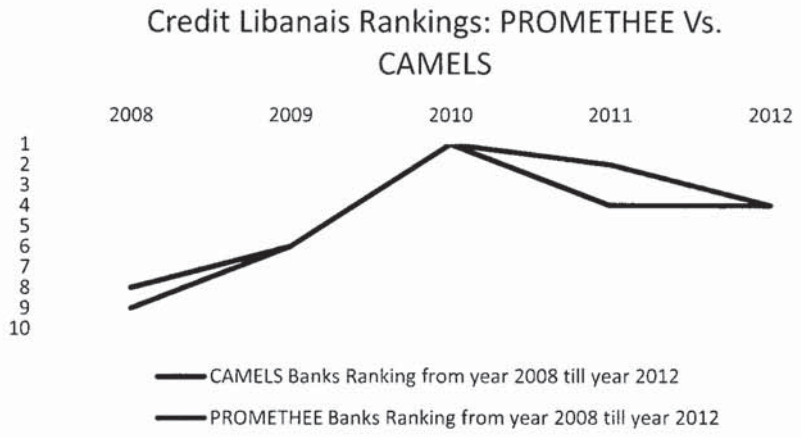


Figure 65: Evolution of Credit Libanais Ranking using PROMETHEE and traditional CAMELS methods

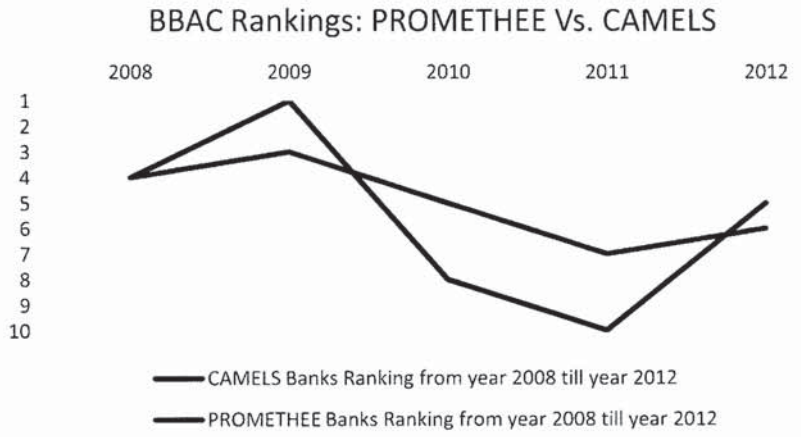


Figure 66: Evolution of BBAC Ranking using PROMETHEE and traditional CAMELS methods

While the ranking given by the two approaches is not totally the same every year since the graphs are not overlapping, banks' ranking using both approaches has in general a relatively similar trend of change through time. In other words, when the performance of a bank enhances from one year to another using the PROMETHEE approach, its performance enhances as well using the traditional CAMELS approach. However, SGBL is an exception; while it made a big improvement in 2011 based on traditional CAMELS approach (ranked 3), it had only a slight change based on the PROMETHEE

(ranked 8). Similarly, its ranking decreased in 2012 based on traditional CAMELS, while it increased based on PROMETHEE.

Thus, we might conclude that banks' efficiency and scores are to some extent similar when measured using the traditional way (CAMELS framework) and using the multi-criteria approach (PROMETHEE framework), thus accepting $H_{0,2}$. However, PROMETHEE methodology is preferred over the traditional CAMELS one due to many advantages. First, a sensitivity analysis to check the effect of the change in the weight of one of the criteria on the overall banks' scores can be conducted in the PROMOTHEE software. Ranking of banks is influenced by the weights allocated to each criterion. However, it is very difficult to allocate weights in an objective manner. In the traditional method, equal weights were given to each of the criterion to calculate the score without taking into consideration how a change in the weight of one variable can affect the obtained scores. Although in the PROMETHEE method, we have also allocated equal weights for each of the CAMELS variables to get the banks' scores, a sensitivity analysis was performed to see the impact of the change in the weights assigned to each variable on the obtained scores. The results were shown and discussed in section 4.4.3.

Second, the GAIA plane within the PROMETHEE can be used to show differences or similarities between banks and whether they can be clustered into similar groups. At the same time, the GAIA plane shows conflicting criteria as well as criteria expressing similar preferences. So, if two criteria are close to each other in the GAIA plane, we can say that if a certain bank made a progress in one of the two criteria, it will make as well a jump forward in the other criterion.

Finally, the PROMETHEE is a powerful tool that can be used to asses a multi-criteria decision problem and as described in the literature review it has many advantages over many other tools dedicated to solve multi-criteria problems.

4.5.2 Capital Intelligence Financial Strength Rating

Capital Intelligence Financial Strength (CIFS) ratings provide an opinion of a bank's inherent financial strength, soundness and risk profile. They take into account the bank's operating environment including the economy, the structure, the strength and stability of

the financial system, the legal system, and the quality of banking regulation and supervision (Capital Intelligence, n.d.).

The financial strength ratings are divided based on the following scale:

- AAA: It means that, financially, a bank is in extremely strong condition with positive financial trends and significant strengths in other non-financial areas. The operating environment is likely to be highly attractive and stable.
- AA: It means that, financially, a bank is in a very strong condition and has significant strengths in other non-financial areas. The operating environment is likely to be very attractive and stable.
- A: It signals that a bank has strong financial fundamentals and very favorable non-financial considerations. The operating environment may be unstable but the institution's market position and/or financial strength more than compensate.
- BBB: It indicates that overall, a bank is basically sound with slight weaknesses in financial and non-financial factors which could be remedied fairly easily. It may be limited by unstable operating environment.
- BB: It indicates that a bank has one or two significant weaknesses in the bank's financial makeup, which could cause problems. It may be characterized by a limited franchise and other factors may not be sufficient to avoid a need for some degree of temporary external support in cases of extraordinary adversity. It is more likely to have unstable operating environment.
- B: It means that fundamental weaknesses are present in the bank's financial condition or trends, and other factors are unlikely to provide strong protection from unexpected adversities; in such an event, the need for external support is likely. Bank may be constrained by a weak market position and/or volatile operating environment.
- C: It suggests a very weak financial condition, either with immediate problems or with limited capacity to withstand adversities. The bank may be operating in a highly volatile operating environment.
- D: It refers to extremely weak financial condition and may be in an untenable position.

Capital Intelligence appends "+" and "-" signs to their financial strength ratings in the categories from "AA" to "C" to indicate that the strength of a particular institution is, respectively, slightly greater (+) or lower (-) than that of similarly rated peers.

Table 26 shows the CIFS ratings for the ten banks in this study from the year 2008 till the year 2012 as obtained from Bankscope.

Table 26: Capital Intelligence Financial Strength Rating for banks from 2008 to 2012

Capital Intelligence Financial Strength Rating for banks from year 2008 till year 2012					
Bank/Year	**2008**	**2009**	**2010**	**2011**	**2012**
Bank Audi	BBB-	BBB-	BBB-	BBB-	BBB-
BLOM Bank	BBB-	BBB-	BBB-	BBB-	BBB-
Byblos Bank	BBB-	BBB-	BBB-	BBB-	BBB-
Fransabank	BB+	BB+	BB+	BB+	BB+
Bankmed	B	B	B	B	B
Bank of Beirut	B	B	B	B	B
SGBL	B	B	B	B	B
Banque Libano Francaise	B	B	B	B	B
Credit Libanais	BB+	BB+	BB+	BB+	BB+
BBAC	BB+	BB+	BB+	BB+	BB+

Although the Capital Intelligence Financial Strength rating is an international rating system that rates banks according to specific standards, Table 26 shows that banks' rating is not changing from year to year. Therefore we cannot tell whether the bank's performance has improved or not from year to year. Moreover, Bank Audi, BLOM Bank, and Byblos Bank are rated BBB- without knowing which bank is the best. The same problem is found for Bankmed, Bank of Beirut, SGBL and Libano Francaise which are all rated B on one side, and for and Credit Libanais and BBAC which are rated BB+, on the other side. Thus, while this rating indicates that Bank Audi (BBB-) is better than Bankmed (B), this rating fails to rank banks having same scale.

Therefore, it is extremely important to choose a rating system that differentiates the ratings among banks on a yearly basis as well as the rating of the same bank from year to year. Thus, the PROMETHEE ranking that designates a score for each bank enabling us to rank banks' performance from the best to the worst one could be a solution.

4.5.3 Ranking Based on Total Assets vs. CIFS Rating

The conventional method used in Lebanon to measure banks' performance and to rank banks is based on the total assets. While the total assets can be an indicator for the bank's efficiency, it is not the only indicator and cannot offset the omission of other important variables that should be taken into account in order to correctly rank the Lebanese banks. As mentioned earlier in chapter 2 section 2.4.1, there is no agreement regarding the impact of banks' size on their performance. While some studies found that the largest the bank is, the more is its efficiency, other studies found that smallest banks are the most efficient.

Table 27 shows the banks' ranking from the year 2008 till the year 2012 based on the total assets. These rankings were extracted from Bankscope.

Table 27: Ranking based on Total Assets for banks from 2008 to 2012

Total Assets Banks Ranking from year 2008 till year 2012					
Bank/Year	**2008**	**2009**	**2010**	**2011**	**2012**
Bank Audi	1	1	1	1	1
BLOM Bank	2	2	2	2	2
Byblos Bank	3	3	3	3	3
Fransabank	4	4	4	4	4
Bankmed	5	5	5	5	5
Bank of Beirut	7	7	7	8	6
SGBL	9	9	9	6	7
Banque Libano Francaise	6	6	6	7	8
Credit Libanais	8	8	8	9	9
BBAC	10	10	10	10	10

By comparing the ranking based on the total assets to the CIFS ratings shown in the previous section, we can notice some discrepancies between results.

For example, while BankMed, Bank of Beirut, and SGBL have the lowest rate based on CIFS rating from 2008 till 2012 (B Rating), they do not have the lowest rank based on

total assets from 2008 till 2012. For example, based on total assets, Bank Med is ranked 5 over 10 in all years, while Bank of Beirut is ranked either 6 or 7. Surprisingly, BBAC, the lowest ranked bank in all years based on total assets is rated BB+ based on CIFS, which is better than the B scale assigned to three other banks. Similarly, Credit Libanais has BB+ rate based on CIFS, which is better than SGBL with a B scale; however, SGBL is ranked higher than Credit Libanais based on total assets with a three and two rank difference in year 2011 and 2012, respectively.

Therefore, we can say the two methods used in Lebanon (the capital intelligence rating and the ranking based on total assets) are not in conformance which supports the need to develop a multi-criteria approach to ranks banks in Lebanon, thus justifying the purpose of this thesis.

Moreover, using assets to rank banks where a higher rank is given to banks with higher assets is inconsistent given the previous findings in section 4.4.5.2 that bank size doesn't play a role in banks score since the t test shows that there is no significant difference in the means between big and small banks.

In conclusion, there are many factors that might affect banks' performance. This thesis used CAMELS variables (capital adequacy, asset quality, management, earnings, liquidity and sensitivity to market risk) in order to calculate the score of the Lebanese banks and therefore to rank them. For this purpose, two methodologies using CAMELS variables have been developed. The first one is the traditional CAMELS score and the second one is based on the multi-criteria decision analysis that calculate banks' score based on the PROMETHEE methodology. While both methods gave close results, PROMETHEE method is preferred due to its powerful way to (i) conduct feasibility studies to change the weights of the variables and to check their effects on the overall rating and (i) to cluster banks and variables.

Chapter 5

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter will summarize the main findings of the study and will answer the research questions formulated in chapter 3 to see whether hypotheses are accepted or rejected. Then, it will present the limitations of this study, followed by practical implications. Finally, recommendations for further studies will be provided.

5.2 Main Findings

The banking sector is important for almost all Lebanese sectors, so its performance and soundness is very important for the Lebanese economy. Thus, a quantitative evaluation of commercial banks is an important task to keep a high performance of the banking sector. The study's main research questions were as follows:

1. What are the scores and ranks of Lebanese banks based on two methods: Traditional CAMELS and PROMETHEE Methodology?
2. Are the scores based on traditional CAMELS approach in conformance with those based on multi-criteria approach using PROMETHEE methodology?
3. Is there a significance difference in PROMETHEE scores between listed and unlisted banks?
4. In case of significant difference between listed and unlisted banks, what factors discriminate between listed and unlisted banks?
5. Is there a significance difference in PROMETHEE scores between big and small size banks?
6. Are the actual ranking of banks based on their total assets in conformance with their Capital Intelligence Financial Strength Rating given by Bankscope?

Thus, this study's objectives were to come up with a new multi-criteria ranking approach for Lebanese banks that can provide commercial banks' customers and financial analysts with a better tool which is not based only on one criterion ; i.e. the total assets of the banks.

In order to answer the research questions, we utilized two tools: (i) a traditional approach and (ii) a multi-criteria approach. The sample consisted of ten Lebanese banks over a time period of 5 years between 2008 and 2012. Under both approaches, the selected variables included in this study were related to CAMELS criteria and they are: Total capital ratio measuring Capital Adequacy (C); Asset quality index and Loan Loss Reserve ratio measuring Asset Quality (A); Cost to Income and Growth in assets measuring Management (M); Return on Equity and Return on Assets measuring Earnings (E); Net Loans to total assets and Liquid Assets to total assets measuring Liquidity (L); and Risk Weighted Assets over Total Assets measuring Sensitivity to Market Risk (S)

The scores of the ten Lebanese banks based on both methods (the traditional CAMELS and the PROMETHEE approaches) were calculated and their rankings were obtained. The following conclusions can be deduced from the findings of this study.

Although there are some differences between the results obtained using the two approaches, the overall results suggest that the scores based on traditional CAMELS approach are in conformance with those based on multi-criteria approach using PROMOTHEE methodology (Research Question 2).

To investigate whether there is a significant difference between listed and unlisted banks (Research Question 3), a t-test was run and results obtained confirmed the expectation that listed banks have higher scores than unlisted banks. Therefore, hypothesis $H_{a,3}$ formulated in chapter 3 is accepted. However, not all the variables presented in this study discriminated between listed and unlisted banks. The variables that affect the

scores of the two groups of banks are the cost to income, the liquid assets over total assets, the loan loss reserve and the return on assets. More specifically, listed banks have better cost control translated into lower cost to income ratio, are more liquid having a higher liquid assets over total assets, have better asset quality reflected by lower loan loss reserve, and have higher return on assets than unlisted banks. These factors contributed to a higher score for listed banks versus unlisted banks. The remaining criteria do not affect the difference in the mean scores of listed and unlisted banks (Research Question 4).

Finally, to check whether there is a difference in scores between big and small banks (Research Question 5), a t-test was done and results suggested no significant difference between big and small sized banks. Therefore we can say that hypothesis H_5 formulated in chapter 3 is rejected.

This last result strengthens the statement that the rank of Lebanese banks based on total assets cannot be the only indicator for measuring bank's efficiency. Total assets alone cannot offset the omission of other important variables that should be taken into account in order to correctly rank the Lebanese banks.

Moreover, results show that banks' rating based on capital intelligence financial strength rating which is an international rating system used by the Bankscope is not appropriate to rank Lebanese commercial banks since it does not differentiate the ratings among banks on a yearly basis and does not differentiate the rating of the same bank from year to year.

In conclusion, the research advocates the use of many factors to measure banks' performance. The CAMELS variables can be used as a benchmark to rank Lebanese banks since they deal with multiple criteria such as the capital adequacy, the asset quality, banks' management, their earnings, their liquidity and finally their sensitivity to market risk. The traditional CAMELS scores and the multi-criteria decision based on the PROMETHEE methodology are two methods that can be used to rank Lebanese banks. However PROMETHEE method is preferred due to its powerful way to conduct

feasibility studies to change the weights of the variables, to check their effect on the rating, and to cluster banks and variables.

5.3 Limitations of the study

This study suffers from some limitations, which deserve some consideration.

The first limitation is the small sample size of banks that were selected and the short time period for the data used. Only ten banks were included and data was considered only for the period of 2008-2012. This is due to undertaking this research as a part of an academic degree; thus the timeframe of the study did not allow for getting results from a larger sample and a longer period.

The second limitation is the quantitative nature of the variables since it was very difficult to collect and quantify qualitative data. The exclusion of qualitative factors might affect the accuracy and the generalization of the results.

Finally, the choice of the variables was based only on CAMELS method, thus it may not cover all the factors that might affect the scores used to rank the Lebanese commercial banks. It is possible that other factors than the ones included in this research might have an impact on bank efficiency and ranking. Furthermore, some variables were replaced by other variables due to unavailability of data. For example, sensitivity (S) was measured by Risk Weighted Assets over Total Assets (RWTA) instead of rate sensitive assets/rate sensitive liabilities due to missing information.

5.4 Implications

This research was motivated by the need toward measuring and monitoring Lebanese bank performance. Since in Lebanon, commercial banks are the major lender of the government, their efficiency is a crucial issue. The methodology implemented to evaluate banks' efficiency and to rank them is the PROMETHEE approach. Currently, Lebanese banks are being ranked solely according to the asset size. However, the

ranking based on total assets is different than the one based on more than one factor. For example a bank with high total assets may be very sensitive to market risk. Therefore, any market fluctuation may significantly affect its performance. Moreover, a bank with high total assets might have low liquidity, which can make it more vulnerable to a financial crisis. The developed approach captures the strengths and weaknesses of banks and can help in finding ways to improve them. Therefore, this research is presenting a multi-criteria methodology aiming toward evaluating banks' efficiency, which is important to depositors, bank analysts, managers, potential investors, government, and regulators. First, since depositors are interested in the stability of banks, they can use bank rating and ranking based on PROMETHEE to measure the stability of banks. As for bank analysts, they can use the multi-criteria approach as supportive tools for monitoring and evaluating the performance of banks. Bank managers should take care about the improvement of some aspects in order to improve the bank's efficiency, score, and ranking. As for potential investors, they can rely on the PROMETHEE results in order to measure the best compromise between how much risk they are willing to bear versus the return that they might earn. The government being the major borrower of the commercial banks has a big interest in banks' ranking based on the PROMETHEE. Banks play a vital role in the Lebanese economy and their performance is of big importance to keep the country safe economically. Finally, the regulators can use the outcome of this thesis in order to build necessary measures to keep banks safe and sound.

5.5 Recommendations

This research supports the use a multi-criteria approach to rate and rank banks. However, a more rigorous assessment is needed to understand the financial sector. Therefore, the following recommendations and directions toward which future research could be directed are drawn.

First, efforts should be made to collect qualitative data through performing an interview primarily with the banks' management to understand the management quality aspects.

Second, to develop and validate this approach, it is recommended for future work to consider a larger sample, to cover a longer period of time, and to integrate qualitative variables.

Third, the consideration of macroeconomic variables could improve the analysis regarding the impact of external factors on banks' performance.

Fourth, the inclusion of quantitative variables other than those related to CAMELS could be examined.

Fifth, it is also recommended to apply the PROMETHEE methodology for economic sectors other than banks such as insurance companies to see its validity in other sectors.

Finally, another potential research could involve developing an early-warning system capable of identifying banks which are likely to face problems.

REFERENCES

Abata, M. A. (2014). Asset Quality and Bank Performance: A Study of Commercial Banks in Nigeria *Research Journal of Finance and Accounting, 5*(18), 39-44.

Allen, L., & Rai, A. (1996). Bank Charter Values and Capital Levels: An International Comparison. *Journal of Economics and Business, 48*(3), 269-284.

Al-Taani, K. S., & Al-Slehat., Z. A. (2014). The Impact of Change in Owned Capital and Deposits on the Performance of Banks: An Empirical Study on the Commercial Banking Sector in Jordan. *Journal of Finance and Accounting, 2*(2), 24-29. doi: 10.11648/j.jfa.20140202.12

Altan, M., Yusufazari, h., & Beduk, A. (2014, October 28). *Performance Analysis of Banks in Turkey Using CAMEL Approach.* Paper presented at the 14th International Academic Conference, Malta.

Armenta, M. W. (2007). The Financial Sector and Economic Development: Banking on Human Capital. *Journal of Public and International Affairs, 18*, 188-203.

Association of Banks in Lebanon. (2013). Lebanese Banking Sector: Main Characteristics. Retrieved March 2, 2014, from http://www.abl.org.lb/subPage.aspx?pageid=360

Atkas, C., & Tas, B. K. O. (2007). The Bank Lending Channel in Turkey: Effect of Capital Adequacy Ratio. *Journal of BRSA Banking and Financial Markets, 1*(1), 61-74.

Balasubramanyan, L., & Haubrich, J. G. (2013). What Do We Know about Regional Banks? An Exploratory Analysis. *Working Paper*, 1-27. Retrieved from: http://ssrn.com/abstract=2377367

Bank Audi. (n.d.). Corporate Profile. Retrieved May 2, 2014, from http://www.bankaudigroup.com/group/corporate-profile

Bank of Beirut. (n.d.). History. Retrieved May 2, 2014, from http://www.bankofbeirut.com/Corporate/en/History

Banker. (2013). Top 150 Banks Worldwide Ranked By Asset Size. Retrieved from: http://www.cba.ca/contents/files/statistics/stat_bankranking_en.pdf

Bankmed. (n.d.). Profile. Retrieved May 2, 2014, from http://www.bankmed.com.lb/AboutUs/Profile.aspx

Barker, D., & Holdsworth, D. G. (1993). *The Causes of Bank Failures in the 1980s*. New York: Federal Reserve Bank of New York.

Barr, R. S., Killgo, K. A., Siems, T. F., & Zimmel, S. (2002). Evaluating the Productive Efficiency and Performance of US Commercial Banks. *Managerial Finance, 28*(8), 3-25. doi: 10.1108/03074350210767988

BBAC. (n.d.). Our Story. Retrieved May 2, 2014, from https://www.bbacbank.com/about-us/our-story

BDL. (2012). Financial Markets Handbook. Retrieved November 3, 2014, from http://www.bdl.gov.lb/files/tabs/SectionI2012.pdf

BDL. (n.d.). Banking and Finance History. Retrieved December 19, 2014, from http://www.bdl.gov.lb/banking-and-finance.html

Bencivenga, V. R., & Smith, B. D. (1991). Financial Intermediation and Endogenous Growth. *Review of Economics Studies, 58*, 195-209.

Berger, A. N., & Humphrey, D. B. (1992). *Output Measurement in the Service Sectors*. Chicago: University of Chicago Press.

Berger, A. N., Hunter, W. C., & Timme, S. G. (1993). The Efficiency of Financial Institutions: A Review and Preview of Research Past, Present and Future. *Journal of Banking & Finance, 17*(2-3), 221-249.

Berger, A. N., & Mester, L. J. (1997). Inside the Black Box: What Explains the Differences in the Efficiencies of Financial Institutions? *Journal of Banking and Finance, 21*(7), 895-947. doi: 10.1016/S0378-4266(97)00010-1

Berthélemy, J.-C., Dessus, S., & Nahas, C. (2007). Exploring Lebanon's Growth Prospects. *Policy Research Working Paper 4332*. Retrieved from: https://openknowledge.worldbank.org/bitstream/handle/10986/7316/wps4332.txt?sequence=2

Bikker, J. (2010). Measuring performance of banks: An assessment. *Journal of Applied Business and Economics, 11*(4), 141-159.

BLF. (n.d.). Profile & Corporate Strategy. Retrieved May 2, 2014, from http://www.eblf.com/en/A-bank-of-long-term-vision-Profile-and-corporate-strategy

BLOM. (n.d.). Profile. Retrieved May 2, 2014, from http://www.blombank.com/english/Profile

Bollard, A. (2011). *The Role of Banks in the Economy - Improving the Performance of the New Zealand Banking System after the Global Financial Crisis*. Paper presented at the New Zealand Shareholders Association Annual Meeting, Tauranga. Paper retrieved from http://www.rbnz.govt.nz/research_and_publications/speeches/2011/4487145.pdf

Brans, J.-P., & Mareschal, B. (2005). PROMETHEE Methods *Multiple criteria decision analysis: state of the art surveys* (pp. 163-196): Kluwer Academic Publishers.

Buerger, L. M. (2011). CAMELS RATINGS: What They Mean and Why They Matter. Retrieved from: http://www.schiffhardin.com/File%20Library/Other%20PDFs/CAMELS-Ratings---Lori-Buerger---March-2012.pdf

Byblos Bank. (2013). Annual Report 2013 (pp. 266). Beirut.

Capital Intelligence. (n.d.). Financial Strength Ratings. Retrieved January 13, 2014, from http://www.ciratings.com/page/rating-definitions/financial-strength-ratings

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the Efficiency of Decision-Making Units. *European Journal of Operational Research, 2*(6), 429-444.

Chemrat, O. (2014). *Credit Rating Agencies Liabilty in the Light of the Global Financial Crisis of 2007-2008.* (MA), Central European University, Budapest. Retrieved from http://www.etd.ceu.hu/2014/chemrat_olena.pdf

Chen, T. Y., & Yeh, T. L. (1998). A study of efficiency evaluation in Taiwan's banks. *International Journal of Service Industry Management, 9*(5), 402-415. doi: 10.1108/09564239810238820

Chorafas, D. N. (2004). *Economic Capital Allocation with Basel II : Cost, benefit and implementation procedures* Elsevier.

Clark, J. M., & Hockey, L. (1981). *Research for Nursing*. Chichester: John Wiley & Sons.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education*. New York: Routledge.

Coker, D. (2010). Measuring Bank Capital and Bank Financial Health. Retrieved from: http://www.hg.org/article.asp?id=19073

Cole, R. A., & Gunther, J. W. (1998). Predicting Bank Failures: A Comparison of On- and Off-Site Monitoring Systems. *Journal of Financial Services Research, 13*(2), 103-117.

Collier, C., Forbush, S., Nuxoll, D. A., & O'Keefe, J. (2003). The SCOR System of Off-site Monitoring: Its Objectives, Functioning, and Performance. *FDIC Banking Review, 15*(3), 17-32.

Corrente, S. (2013). *Hierarchy and Interaction of Criteria in Robust Ordinal Regression.* (PhD PhD), University of Catania. Retrieved from http://archivia.unict.it/bitstream/10761/1312/1/CRRSVT82S28B202M-Final%20Thesis%20-%20Salvatore%20Corrente.pdf

Credit Libanais. (n.d.). Group Profile. Retrieved May 2, 2014, from http://www.creditlibanais.com.lb/GroupProfile/AboutUs

Creswell, J. W. (2014). *Educational Research : Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. Boston: Pearson.

Dibeh, G. (2005). The Political Economy of Postwar Reconstruction in Lebanon (pp. 30). Helsinki: World Institute for Development Economics Research.

Doumpos, M., & Zopounidis, C. (2009). A Multicriteria Bank Rating System. *European Working Group "Multiple Criteria Decision Aiding", Series 3*, 17-19. Retrieved from: http://www.cs.put.poznan.pl/ewgmcda/pdf/SW_DoumposZopounidis.pdf

Doumpos, M., & Zopounidis, C. (2010). A Multicriteria Decision Support System for Bank Rating. *Decision Support Systems, 50*(1), 55-63. doi: 10.1016/j.dss.2010.07.002

Drake, L., & Hall, M. J. B. (2003). Efficiency in Japanese banking: An empirical analysis. *Journal of Banking & Finance, 27*(5), 891–917. doi: 10.1016/S0378-4266(02)00240-6

Druart, J. M. (2010). Banks & Insurance. Retrieved from First Lebanon website: http://www.1stlebanon.net/editouk/banks.html.

Dzeawuni, W. A., & Tanko, M. (2008). CAMELs and Banks Performance Evaluation: The Way Forward Retrieved from: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1150968&download=yes

Ellis, N. S., Fairchild, L. M., & D'Souza, F. (2012). Is Imposing Liability on Credit Rating Agencies a Good Idea?: Credit Rating Agency Reform in the Aftermath of the Global Financial Crisis. *Stanford Journal of Law, Business & Finance, 17*(2), 175-222.

Eltony, N. (2003). Quantitative Measures of Financial Sector Reform in the Arab Countries. 36. Retrieved from: http://www.arab-api.org/images/publication/pdfs/259/259_wps0303.pdf

Estrella, A., Park, S., & Peristiani, S. (2000). Capital Ratios as Predictors of Bank Failure. *Economic Policy Review, 6*(2), 33-52.

Feng, G., & Serletis, A. (2010). Efficiency, Technical Change, and Returns to Scale in Large US Banks: Panel Data Evidence from an Output Distance Function Satisfying Theoretical Regularity. *Journal of Banking & Finance, 34*(1), 127-138. doi: 10.1016/j.jbankfin.2009.07.009.

Ferrouhi, E. M. (2014). bank Liquidity and Financial Performance: Evidence from Morrocan Banking Industry. *Business: Theory and Practice, 15*(4), 351-361. doi: 10.3846/btp.2014.443

Financial Advisor. (2014). RIA Survey & Ranking 2014. 12. Retrieved from: http://www.fa-mag.com/userfiles/2014_FA_Issues/July_2014/RIA2014_OnlineRanking1.pdf

Finger, H., & Hesse, H. (2009). *Lebanon-Determinants of Commercial Bank Deposits in a Regional Financial Center* (Vol. 9-195). Washington D.C.: International Monetary Fund.

Fransabank. (n.d.). Group Profile. Retrieved May 2, 2014, from http://www.fransabank.com/English/GroupProfile/Pages/The-Group.aspx

Gale. (2012). Lebanon Overview *Worldmark Encyclopedia of the Nations* (13 ed.). Detroit: Timothy L. Gall and Derek M. Gleason.

Ginevičius, R., & Podviezko, A. (2013). The Evaluaton of Financial Stability and Soundness of Lithuanian Banks. *Economic Research, 26*(2), 191-208.

Goldberg, L. G., & Rai, A. (1996). The Structure-Performance Relationship for European Banking. *Journal of Banking & Finance, 20*(4), 745-771.

Greenwood, J., & Jovanovic, B. (1990). Financial Development, Growth, and the Distribution of Income. *Journal of Political Economy, 95*(5), 1076-1107.

Guiso, L., Jappelli, T., Padula, M., & Pagano, M. (2004). Financial Market Integration and Economic Growth in the EU. *Economic Policy, 19*, 523–577.

Halkos, G. E., & Salamouris, D. S. (2004). Efficiency Measurement of the Greek Commercial Banks with the Use of Financial Ratios: a Data Envelopment Analysis Approach. *Management Accounting Research, 15*(2), 201–224.

Hancock, M. (2013, May 01). Lebanese Banks Look Further a Field for Growth. *The Banker.* Retrieved February, 24, 2014, from http://www.thebanker.com/content/view/full/137197

Hasan, I., & Marton, K. (2003). Development and efficiency of the banking sector in a transitional economy: Hungarian experience. *Journal of Banking & Finance, 27*(12), 2249-2271. doi: 10.1016/S0378-4266(02)00328-X

Hays, H. F., Stephen, A., & Arthur, H. (2009). Efficiency Ratios and Community Bank Performance. *Journal of Finance and Accountancy, 5*(2), 1-15.

Hinkel, T. (2010). CAMELS Ratings and Financial Regulatory Reform: The Management Element. *Safe Systems Newsletter,* (8). Retrieved from: http://news.safesystems.com/2010/08/camels-ratings-and-financial-regulatory-reform-the-management-element

Hughes, J. P., Mester, L. J., & Moon, C. G. (2001). Are Scale Economics in Banking Elusive or Illusive? Incorporating Capital Structure and Risk-Taking into Models of Bank Production. *Journal of Banking and Finance, 25*(12), 2169-2208.

Hunjak, T., & Jakovčević, D. (2001, August 2-4, 2001). *AHP Based Model for Bank Performance Evaluation and Rating.* Paper presented at the 6th ISAHP, Berne, Switzerland.

Isik, I., & Hassan, M. K. (2002). Technical, Scale and Allocative Efficiencies of Turkish Banking Industry. *Journal of Banking & Finance, 26*(4), 719–766.

Jackson, T. H., & Kronman, A. T. (1979). Secured Financing and Priorities among Creditors. *The Yale Law Journal, 88*(6), 1143-1182. doi: 10.2307/795626

Jeremic, V., Bulajic, M., Martic, M., Markovic, A., Savic, G., Jeremic, D., & Radojicic, Z. (2012). An Evaluation of European Countries' Health Systems through Distance Based Analysis. *Hippokratia, 16*(2), 170-174.

Jokipii, T., & Monnin, P. (2013). The Impact of Banking Sector Stability on the Real Economy *Journal of International Money and Finance, 32*, 1-16.

Kablan, S. (2007). *Measuring bank Efficiency in developing Countries: The Case of WAEMU (West African Economic Monetary Union).* Paper presented at the African Economic Conference Opportunities and Challenges of Development for Africa in the Global Arena", Ethiopia. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Knowledge/25038351-EN-MESURE-DE-LA-PERFORMANCE-DES-BANQUES-UEMOA.PDF

Kaya, Y. T. (2001). Camels Analysis in the Turkish Banking Sector. *BRSA Working Paper: 2001/6.*

Kayaa, T., & Kahraman, C. (2011). A fuzzy approach to e-banking website quality assessment based on an integrated AHP-ELECTRE method. *Technological and Economic Development of Economy, 17*(2), 313-334. doi: 10.3846/20294913.2011.583727

Kenourgios, D., & Samitas, A. (2007). Financial Development and Economic Growth in a Transition Economy: Evidence for Poland. *Journal of Financial Decision Making, 3*(1), 35-48.

Keyser, W. D., & Peeters, P. (1996). A Note on the Use of PROMETHEE Multicriteria Methods. *European Journal of Operational Research, 89*(3), 457-461.

Khoury, M. E. (2008). *Credit Rating Agencies and their Potential Impact on Developing Countries.* Paper presented at the United Nations Conference on Trade and Development, Buenos Aires, Argentina.

King, R. G., & Levine, R. (1993). Finance and Growth: Schumpeter Might be Right. *Quarterly Journal of Economics, 108*(3), 717-737.

Kirshenblatt-Gimblett, B. (2006). What is Research Design? *Performance Studies Methods* (pp. 1-16). New York: NYU.

Konstandina, N. V. (2007). *Measuring Efficiency and Explaining Failures in Banking: Application to the Russian Banking Sector.* (Doctor of Philosophy), Oregon State University, Corvallis. Retrieved from http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/5963/KonstandinaNatalia.pdf?sequence=1

Kosmidou, K., & Zopoudinis, C. (2008). Measurement of Bank Performance in Greece. *South-Eastern Europe Journal of Economics, 6*(1), 79-95.

Kumbirai, M., & Webb, R. (2010). A financial Ratio Analysis of Commercial Bank Performance in South Africa. *African Review of Economics and Finance, 2*(1), 30-53.

Kuosmanen, T. (2001). DEA with Efficiency Classification Preserving Conditional Convexity. *European Journal of Operational Research, 132*(2), 326-342.

Laerd. (2011a). Independent T-Test using SPSS. *SPSS Tutorials.* Retrieved February 17, 2015, from https://statistics.laerd.com/spss-tutorials/independent-t-test-using-spss-statistics.php

Laerd. (2011b). Testing for Normality using SPSS Statistics. *SPSS Tutorials.* Retrieved February 17, 2015, from https://statistics.laerd.com/spss-tutorials/testing-for-normality-using-spss-statistics.php

Laerd. (2011c). Mann-Whitney U Test using SPSS. *SPSS Tutorials.* Retrieved February 17, 2015, from https://statistics.laerd.com/spss-tutorials/mann-whitney-u-test-using-spss-statistics.php

Laerd. (2011d). Kruskal-Wallis H Test using SPSS Statistics. *SPSS Tutorials.* Retrieved February 17, 2015, from https://statistics.laerd.com/spss-tutorials/kruskal-wallis-h-test-using-spss-statistics.php

Lang, G., & Welzel, P. (1996). Efficiency and Technical Progress in Banking Empirical Results for a Panel of German Cooperative Banks. *Journal of Banking & Finance, 20* (6), 1003-1023.

Levine, R., & Zervos, S. (1998). Stock Markets, Banks and Economic Growth. *American Economic Review, 88*, 537-558.

Mahajan, N., & Verma, S. (2014). Financial Development and Economic Growth: A Case of Indian Economy. *International Journal of Economics, Finance and Management, 3*(1), 15-21.

Mareschal, B., & Mertens, D. (1992). BANKS: A Multicriteria Decision Support System for Financial Evaluation in the International Banking Sector. *Journal of Decision Systems, 1*(2-3), 175-189.

Matthews, K. (1996). Capital Adequacy Ratios for Banks. *Reserve Bank Bulletin, 59* (2), 7. Retrieved from: http://www.rbnz.govt.nz/research_and_publications/reserve_bank_bulletin/1996/1996jun59_2Matthews.pdf

Meslier-Crouzille, C., Banos, J. L., Nys, E., & Sauviat, A. (2008). *Philippines Rural Banks and Regional Economic Development*. Paper presented at the 21st Australasian Finance and Banking Conference, Sydney, Australia. http://www.univ-orleans.fr/gdre09/articles/Meslier%20Crouzille.pdf

Mihalovic, N., Bulajic, M., & Savic, G. (2009). Ranking of Banks in Serbia. *Yugoslav Journal of Operations Research, 19*(2), 323-334. doi: 10.2298/YUJOR0902323M

Miller, S. M., & Noulas, A. G. (1996). The Technical Efficiency of Large Bank Production. *Journal of Banking and Finance, 20*(3), 495-509.

Ministry of Finance. (2013). *Lebanon Country Profile 2013*. Beirut: Retrieved from http://www.finance.gov.lb/en-US/finance/ReportsPublications/DocumentsAndReportsIssuedByMOF/Documents/Sovereign%20and%20Invensment%20Reports/Country%20Profile/Lebanon%20Country%20Profile%202013.pdf.

Moussu, C., & Petit-Romec, A. (2013). ROE in Banks : Myth and Reality. Retrieved from: http://ssrn.com/abstract=2374068

Nahas, C. (2007). Mobilizing Capital for Development. 21. Retrieved from: http://www.charbelnahas.org/textes/Economie_et_politiques_economiques/ReportHDRfinal25oct2000Ajouts1.pdf

Ngo, D.-T. (2012). Measuring the Performance of the Banking System Case of Vietnam (1990-2010). *Journal of Applied Finance & Banking, 2*(2), 289-312.

Olagunju, A., David, A., & Samuel, O. (2011). Liquidity Management and Commercial Banks' Profitability Nigeria. *Research Journal of Finance and Accounting, 2*(7/8), 24-38.

Orlitzky, M., Schmidt, F. L., & Rynes, S. L. (2003). Corporate Social and Financial Performance: A Meta-analysis. *Organization Studies, 24*(3), 403-441. doi: 10.1177/0170840603024003910

Osman, I. H., Hitti, A., & Al-Ayoubi, B. (2008). *Data Envelopment Analysis: A Tool for Monitoring the Relative Efficiency of Lebanese Banks*. Paper presented at the European and Mediterranean Conference on Information Systems 2008 (EMCIS2008), Dubai.

http://www.researchgate.net/profile/Aline_Hitti/publication/228454965_Data_envelopment_analysis_a_tool_for_monitoring_the_relative_efficiency_of_Lebanese_banks/links/09e4150b651125dbc9000000.pdf

Öztorul, G. (2011). *Performance Evaluation of Banks and Banking Groups: Turkey Case.* (Master of Science in the Department of Economics), Middle East Technical University. Retrieved from https://etd.lib.metu.edu.tr/upload/12613821/index.pdf

Peters, D. W., Raad, E., & Sinkey, J. F. (2004). The Performance of Banks in Post-war Lebanon. *International Journal of Business, 9*(3), 259-285.

Petersen, M. A., & Schoeman, I. (2008, July 2 - 4). *Modeling of Banking Profit via Return-on-Assets and Return-on-Equity.* Paper presented at the World Congress on Engineering WCE 2008 London, U.K.

Revell, J. (1980). *Costs and Margins in Banking: An International Survey*. Paris: Organisation for Economic Co-operation and Development.

Rime, B., & Stiroh, K. J. (2003). The Performance of Universal Banks: Evidence from Switzerland. *Journal of Banking & Finance, 27*(11), 2121-2150. doi: 10.1016/S0378-4266(02)00318-7

Rose, P. S., & Hudgins, S. C. (2013). *Bank Management & Financial Services* (9th ed.). New York: McGraw-Hill.

Saaty, T. L., & Vargas, L. G. (2012). *Models, Methods, Concepts & Applications of the Analytic Hierarchy Process* (2 ed. Vol. 175). New York: Springer US.

Said, M.-J. B., & Saucier, P. (2003). Liquidity, Solvency, and Efficiency? An Empirical Analysis of the Japanese Banks Distress. *Journal of Oxford, 5*(3), 354-358.

Samad, A. (2004). Performance of Interest-free Islamic banks vis-à-vis Interest-based Conventional Banks of Bahrain. *International Journal Economics, Management and Accounting, 12*(2), 1-15.

Sangmi, M.-u.-D., & Nazir, T. (2010). Analyzing Financial Performance of Commercial Banks in India: Application of CAMEL Model. *Journal of Commerce and Social Sciences, 4*(1), 40-55.

Sarantakos, S. (2005). *Social Research* (3rd ed.): Palgrave Macmillan.

Sathye, M. (2001). X-efficiency in Australian Banking: An Empirical Investigation. *Journal of Banking and Finance, 25*(3), 613–630.

Seiford, L. M., and Zhu, J.. (1999). Profitability and Marketability of the Top 55 US Commercial Banks. *Management Science, 45*(9), 1270-1288. doi: 10.1287/mnsc.45.9.1270

SGBL. (2012). Annual Report 2012 (pp. 69). Beirut: Société Générale de Banque au Liban.

Sohaimi, A. N. A. (2013). Liquidity Risk and Performance of Banking System in Malaysia. *Social Science Research Network.*

Srivastava, P. (1999). Size, Efficiency and Financial reforms in Indian Banking. *Working Paper No. 49*, 1-39. Retrieved from: http://icrier.org/pdf/Pradeep1.PDF

Stathas, O., Kosmidou, K., Doumpos, M., & Zopounidis, C. (2002). A Multicriteria Approach to Assess Banking Performance: The Case of Greece. In C. Zopounidis (Ed.), *New Trends in Banking Management* (pp. 53-68): Physica-Verlag HD.

Stiglitz, J. (1998). *The Role of the Financial System in Development.* Paper presented at the 4th Annual Bank Conference on Development in Latin America and the Caribbean, San Salvador, El Salvador. http://www.kleinteilige-loesungen.de/globalisierte_finanzmaerkte/texte_abc/s/stiglitz_financial_system_in_development.pdf

Stockburger, D. W. (2013). *Introductory Statistics: Concepts, Models, and Applications* (3rd ed.). Missouri Missouri State University.

Styrin, K. (2005). What Explains Differences in Efficiency Across Russian Banks? *Economics Education and Research Consortium*, 29. Retrieved from: http://www.eerc.kiev.ua/default/download/creater/working_papers/file/ad46b02284737f59bdcf04de3712c219c87c99b1

Tomić, V., Marinković, Z., & Janošević, D. (2011). PROMETHEE Method Implementation with Multi-criteria Decisions. *Mechanical Engineering Series, 9*(2), 193 - 202.

Trautmann, P. Y. (2006). CAMELS Ratings. 1-49. Retrieved from: http://pdf.usaid.gov/pdf_docs/PNADQ079.pdf

Trefis. (2015). A Look At Common Equity Tier 1 Capital Ratios For The Largest U.S. Banks. *Forbes*. Retrieved from: http://onforb.es/1aQ3or1

Uzar, C. (2013). Financial Performance Test of Public Banks in Turkey: An Application of Promothee. *International Journal of Economics and Finance Studies, 5*(2), 1-9.

VPSolutions. (2013). Visual PROMETHEE 1.4 Manual (Version 1.4). Retrieved from http://www.promethee-gaia.net/documents.html

Wall, L. D. (2013). Measuring Capital Adequacy Supervisory Stress Tests ina Basel World. *Working Paper*. Retrieved from: https://www.econstor.eu/dspace/bitstream/10419/101003/1/wp1315.pdf

Walter, J. (1991). Loan Loss Reserves. *FRB Richmond Economic Review, 77*(4), 20-30.

Warshavsky, M. (2012). Analyzing Earnings Quality as a Financial Forensic Tool. Financial Valuation and Litigation Expert Journal(39), 16-20

Welton, E. (2014). Does Bigger Mean More Efficient? *Sageworks Blog*. Retrieved from: http://www.sageworks.com/blog/post/2014/09/29/Does-bigger-mean-more-efficient.aspx

Wheelock, D. C., & Wilson, P. W. (1995). Evaluating the Efficiency of Commercial Banks: Does our View of what Banks do Matter? *Review: Federal Reserve Bank of St Louis*, 39-52. Retrieved from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.197.6964&rep=rep1&type=pdf

Wheelock, D. C., & Wilson, P. W. (2012). Do large banks have lower costs? New estimates of returns to scale for U.S. banks. *Journal of Money, Credit and Banking, 44*, 171–199.

Whelan, B. M., & McBratney, A. B. (2000). The "Null Hypothesis" of Precision Agriculture Management. *Precision Agriculture, 2*(3), 265-279. doi: 10.1023/A:1011838806489

White, L. J. (2010). Markets: The Credit Rating Agencies. *The Journal of Economic Perspectives, 24*(2), 211-226. doi: 10.1257/jep.24.2.211

Yeh, Q.-J. (1996). The Application of Data Envelopment Analysis in Conjunction with Financial Ratios for Bank Performance Evaluation *The Journal of the Operational Research Society, 47*(8), 980-988. doi: 10.2307/3010406

Yue, P. (1992). Data Envelopment Analysis and Commercial Bank Performance: A Primer with Applications to Missouri Banks. 31-45. Retrieved from: http://research.stlouisfed.org/publications/review/92/01/Data_Jan_Feb1992.pdf

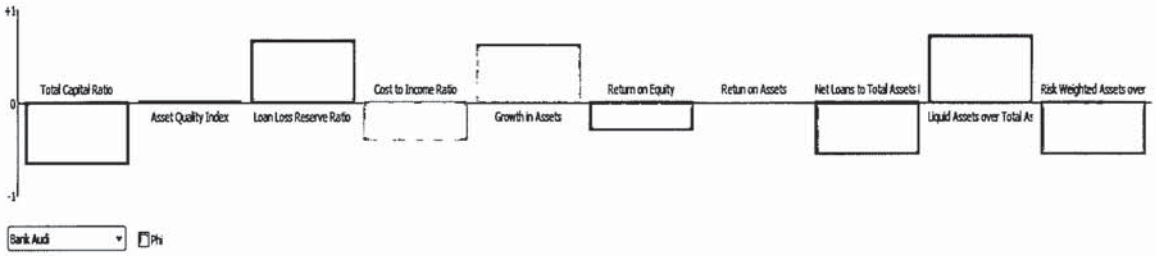
Zeitun, R., & Benjelloun, H. (2013). The Efficiency of Banks and the Financial Crisis in a Developing Economy: The Case of Jordan. *Journal of Finance, Accounting and Management, 4*(1), 1-20.

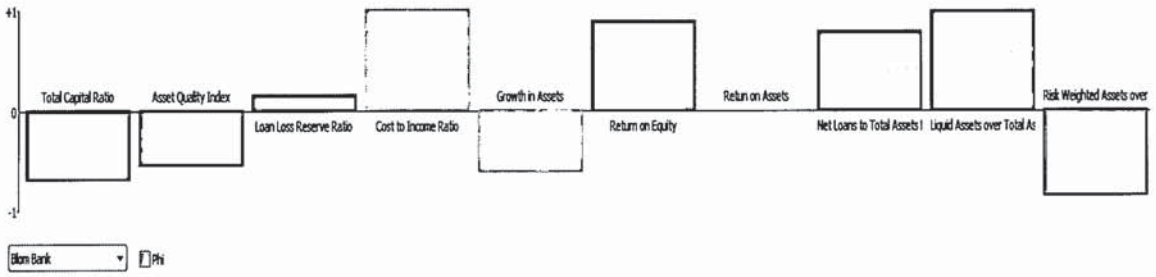
Zhang, Y. (2013). A Portfolio Management Decision Support System for Transit Projects. *Civil Engineering Dissertations*. Retrieved from: http://hdl.handle.net/2047/d20003368

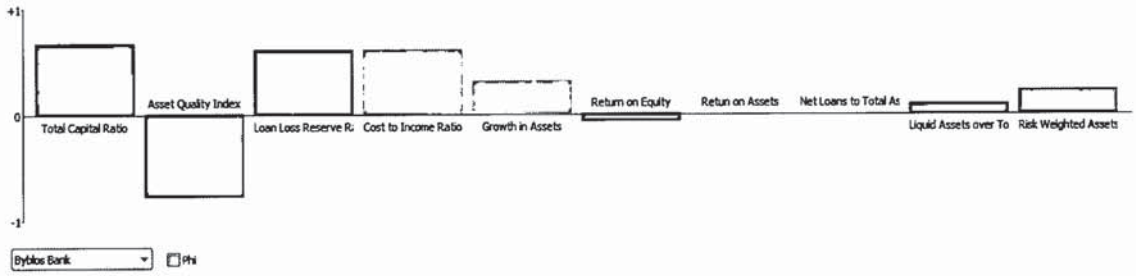
Zreika, M., & El Kanj, N. (2011). Banking Efficiency in Lebanon: An Empirical Investigation. *Journal of Social Sciences, 7*(2), 199-208.

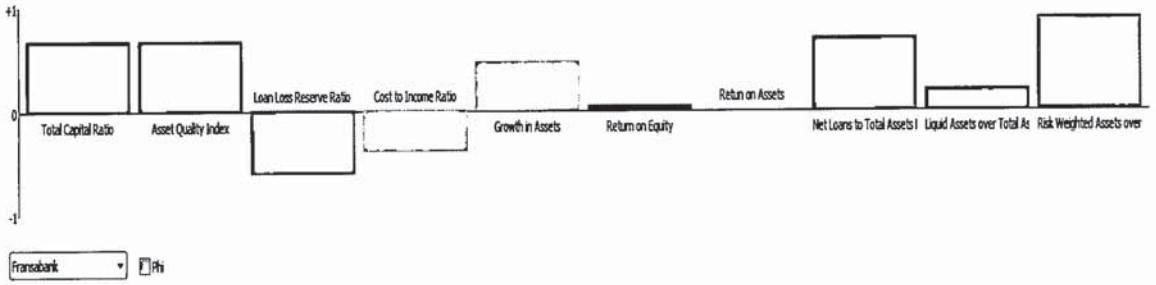
Appendix A: Position of banks according to CAMELS variables

Year 2008:

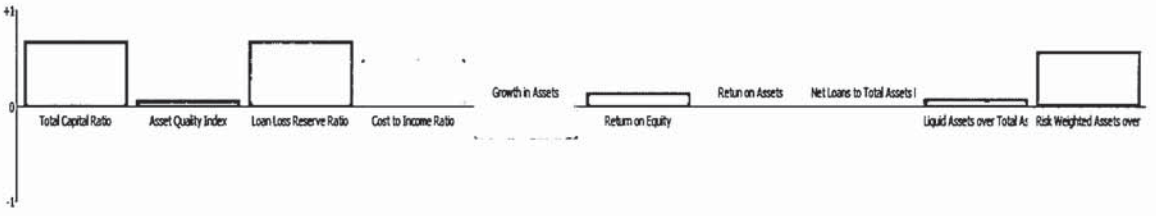


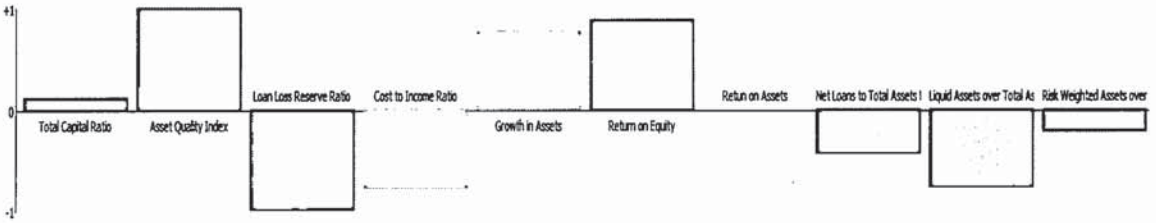


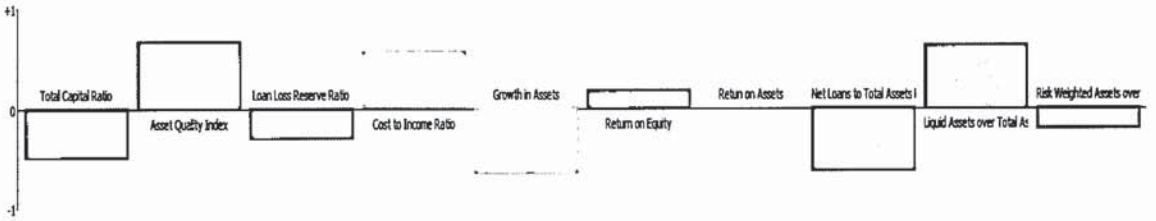




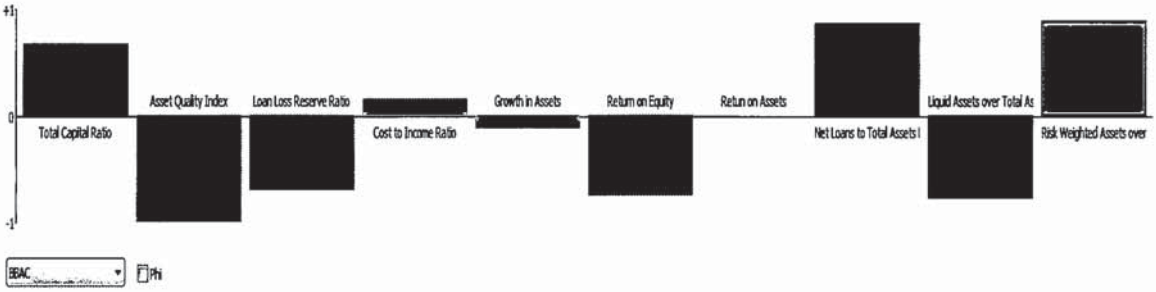

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Bankmed
Phi


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Bank of Beirut
Phi

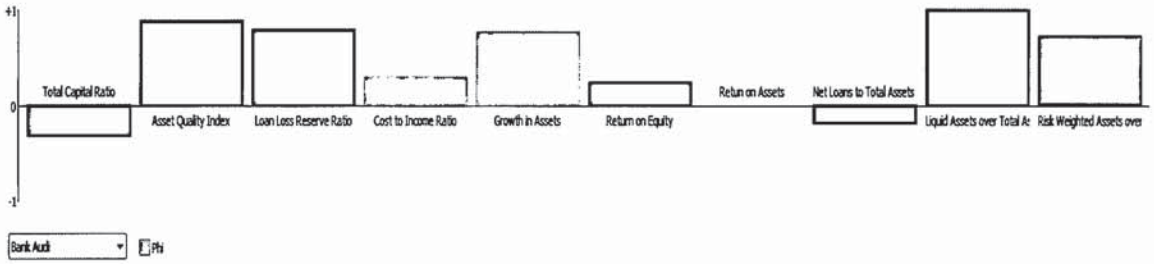

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
SGBL
Phi

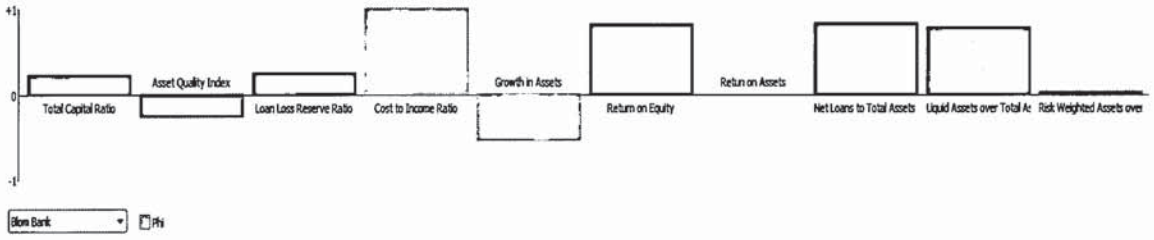

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Banque Libano-Francaise
Phi

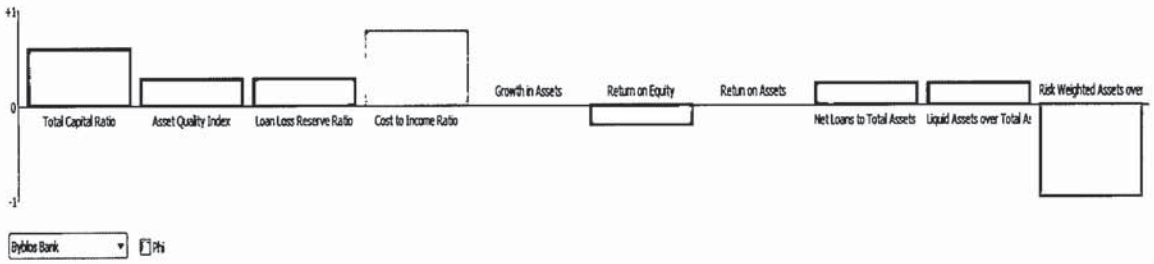

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Credit Libanais
Phi

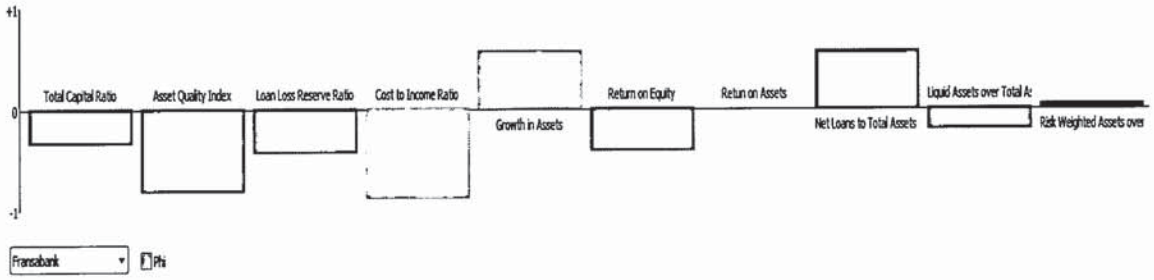

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
EBAC
Phi

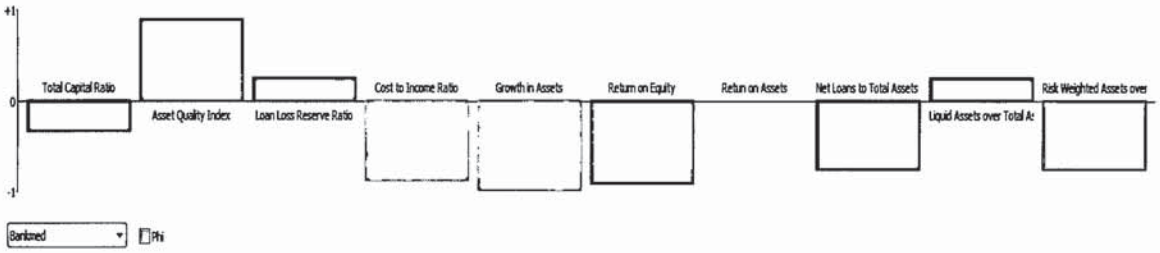
Year 2009:

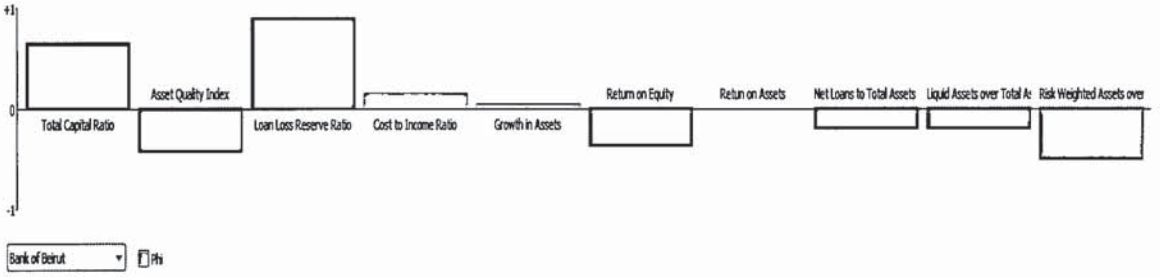

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Bank Audi
Phi

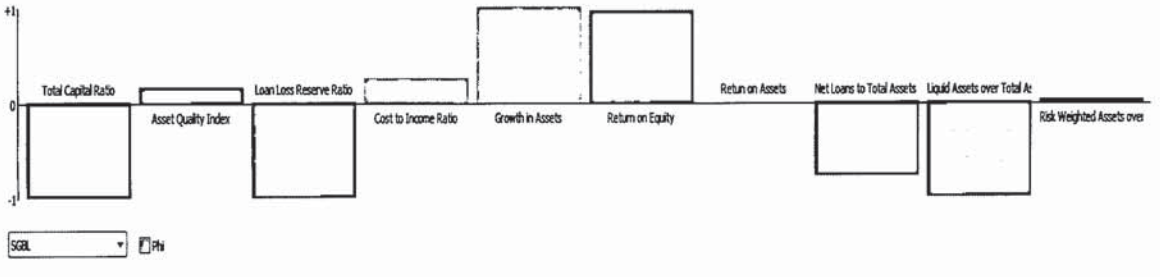

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Blom Bank
Phi

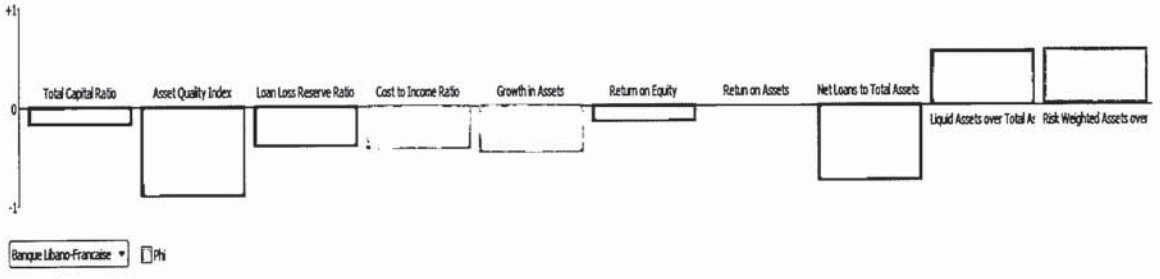

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Byblos Bank
Phi

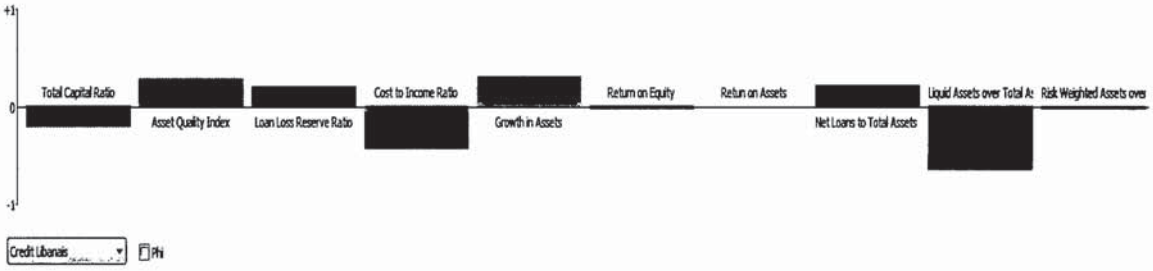

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Transbank
Phi

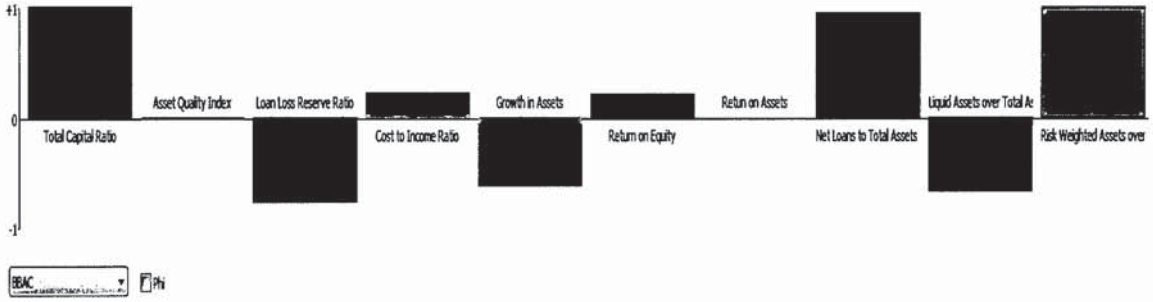

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Bankmed
Phi


+1
0
-1
Asset Quality Index
Total Capital Ratio
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Bank of Beirut
Phi

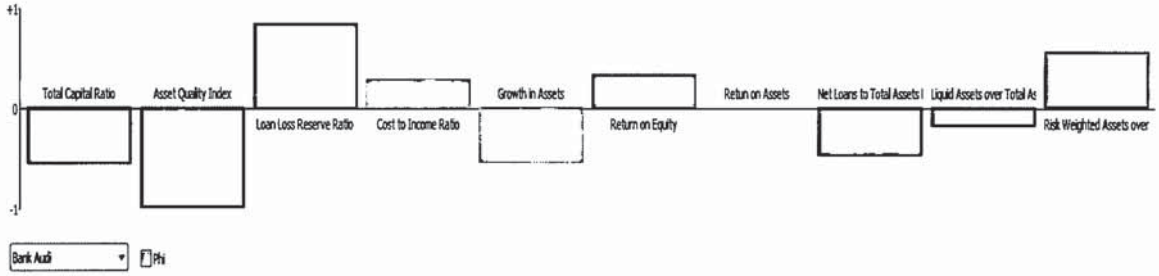

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
SGBL
Phi

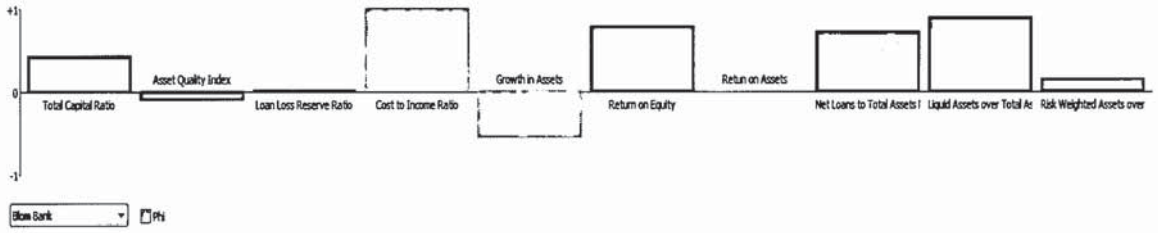

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Banque Libano-Francaise
Phi

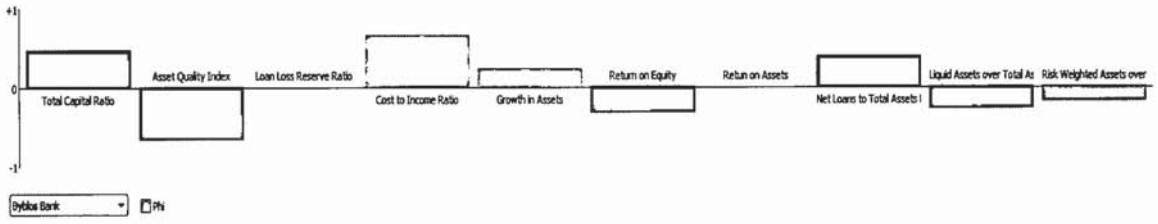

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Credit Libanais
Phi

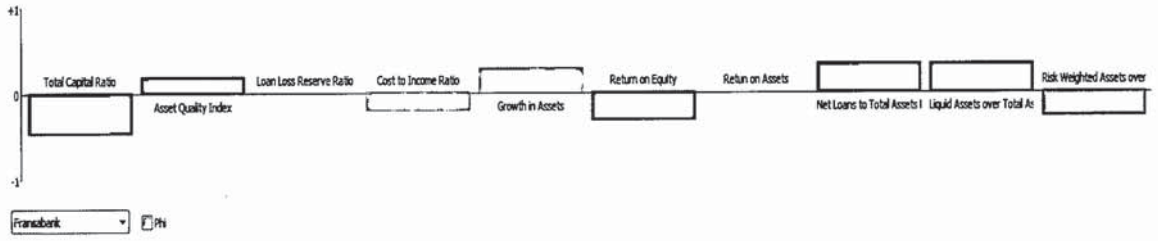

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
BBAC
Phi

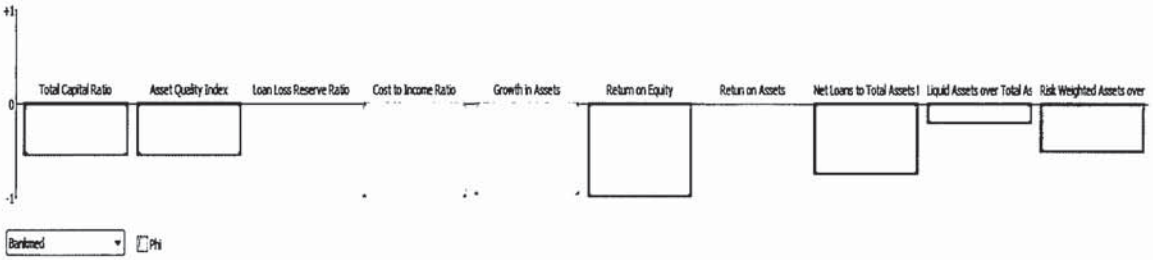
Year 2010:

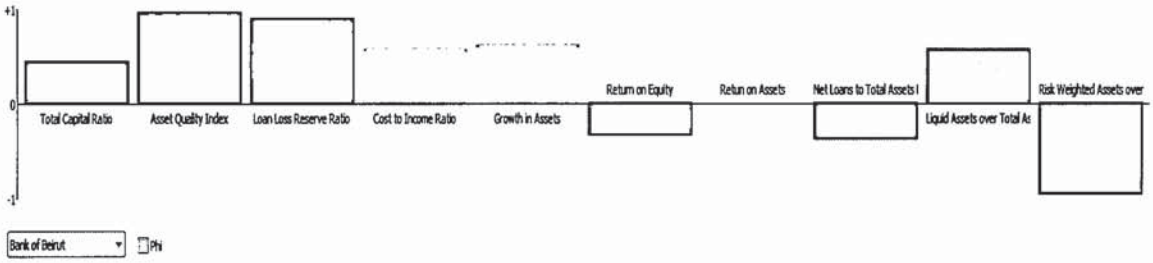

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Bank Audi
Phi

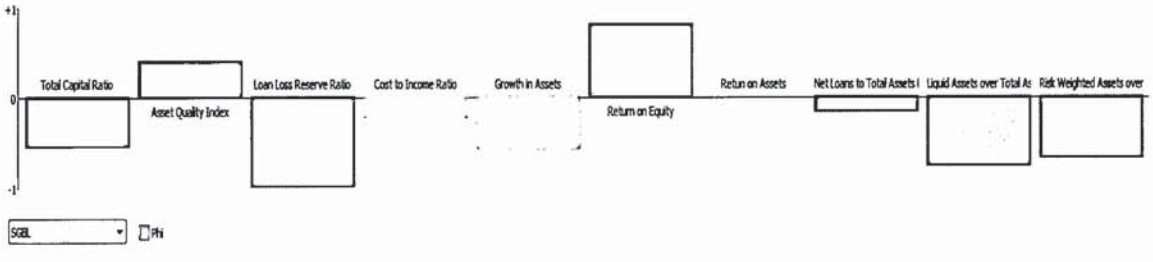

+1
0
-1
Asset Quality Index
Total Capital Ratio
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Blom Bank
Phi

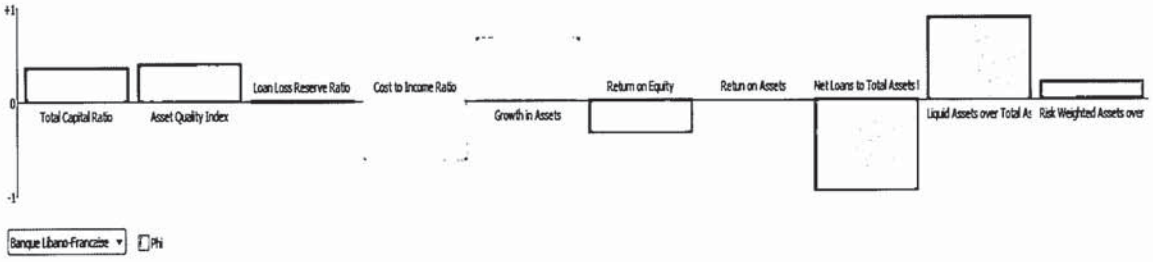

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Byblos Bank
Phi

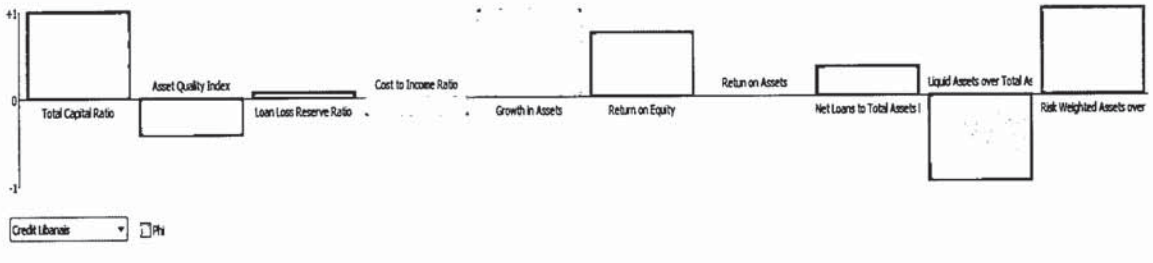

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Fransabank
Phi


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Banksmed
Phi


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Bank of Beirut
Phi

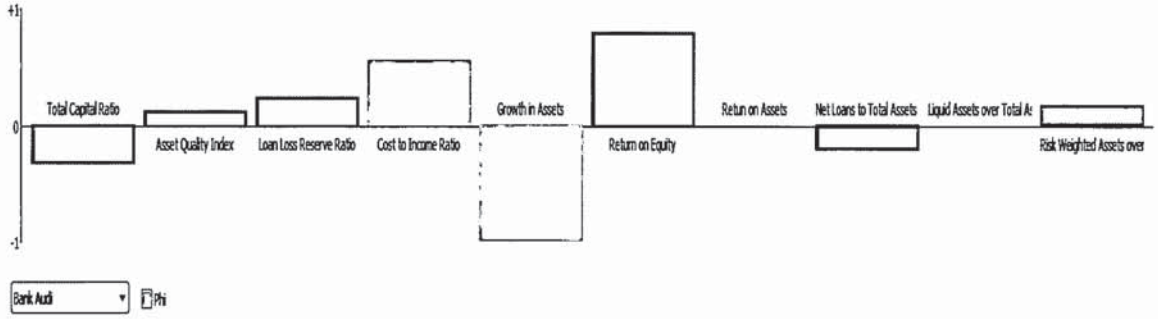

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
SGBL
Phi

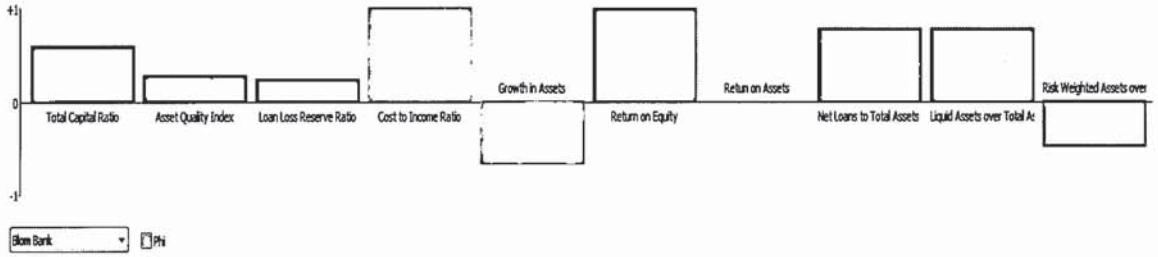

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Banque Libano-Francaise
Phi

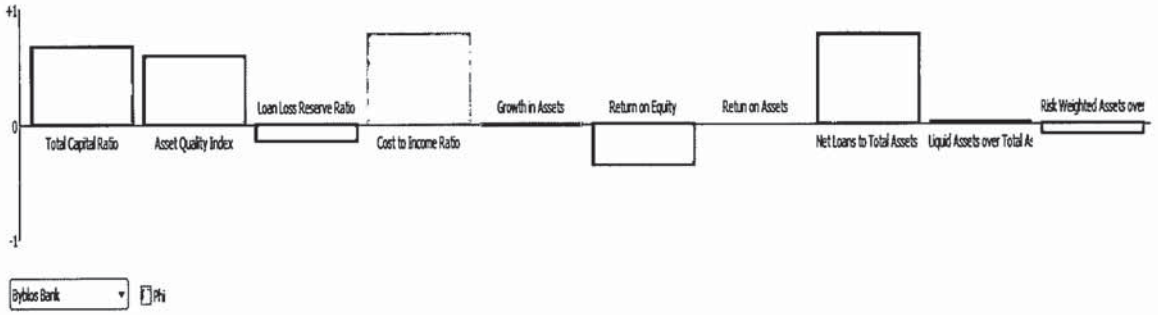

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
Credit Libanais
Phi

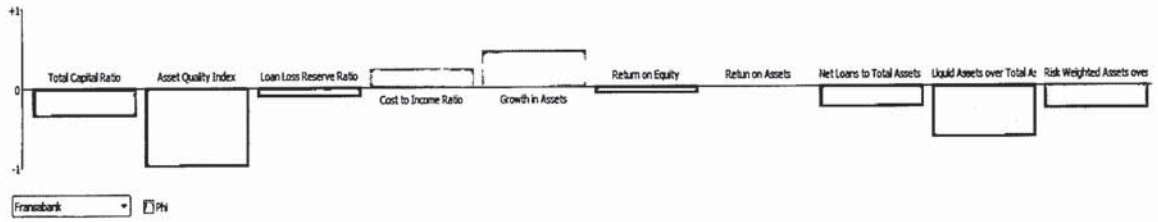

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets I
Liquid Assets over Total As
Risk Weighted Assets over
EBAC
Phi

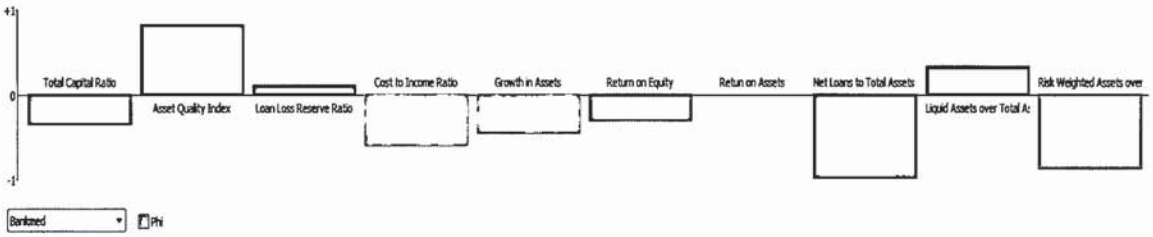
Year 2011:

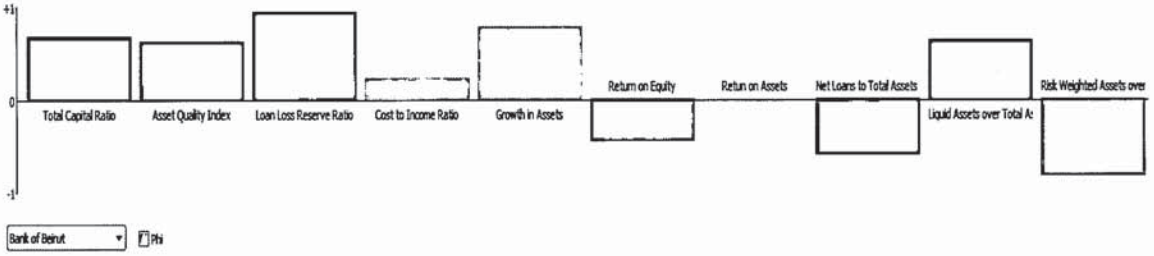

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Bank Audi
Phi

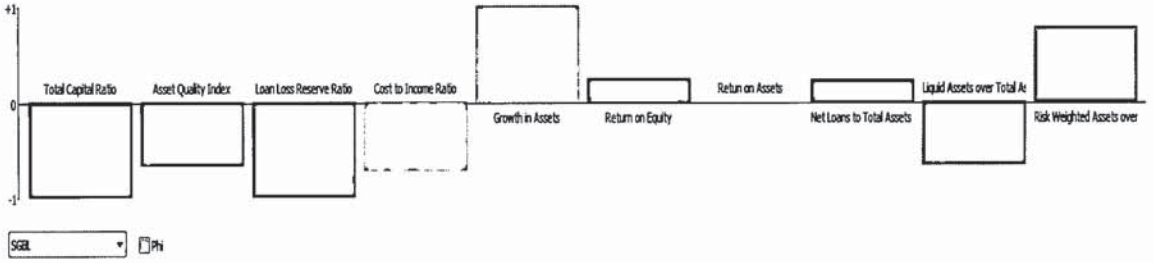

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Blom Bank
Phi

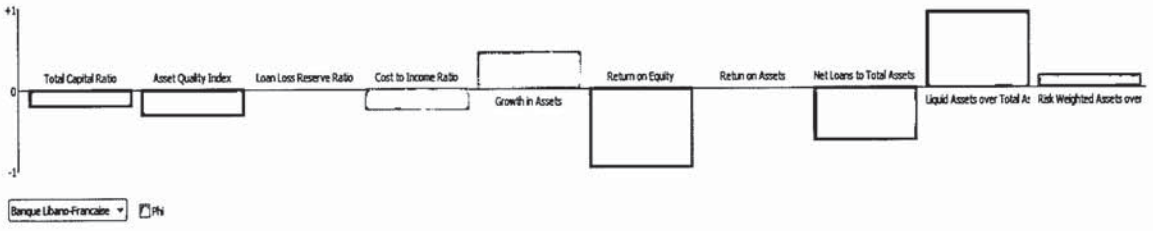

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Byblos Bank
Phi

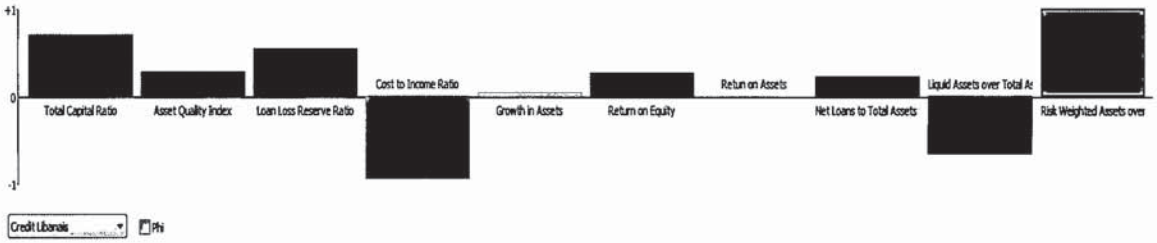

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Fransabank
Phi

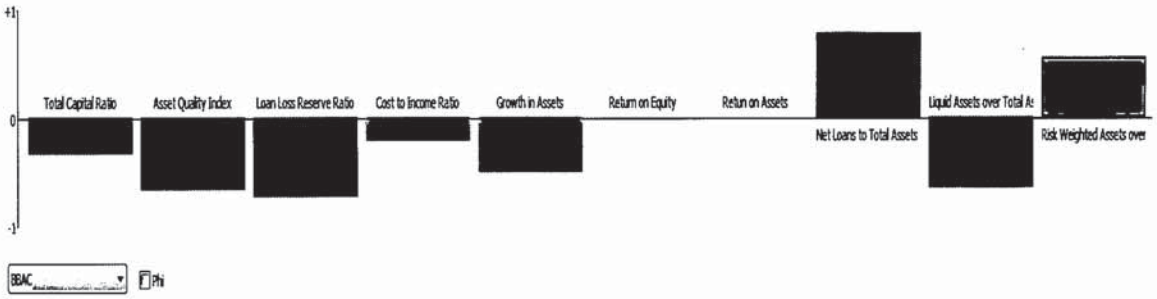

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Bankmed
Phi


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Bank of Beirut
Phi

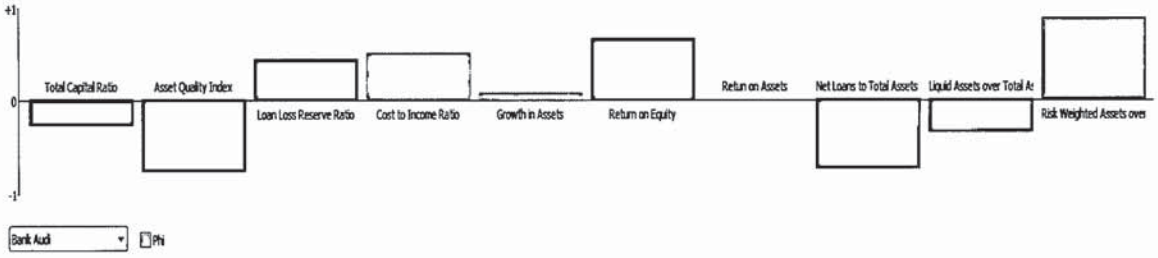

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
SGBL
Phi

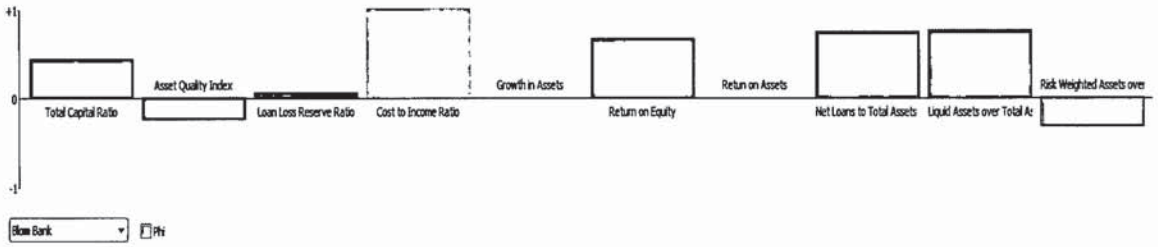

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Banque Libano-Francaise
Phi

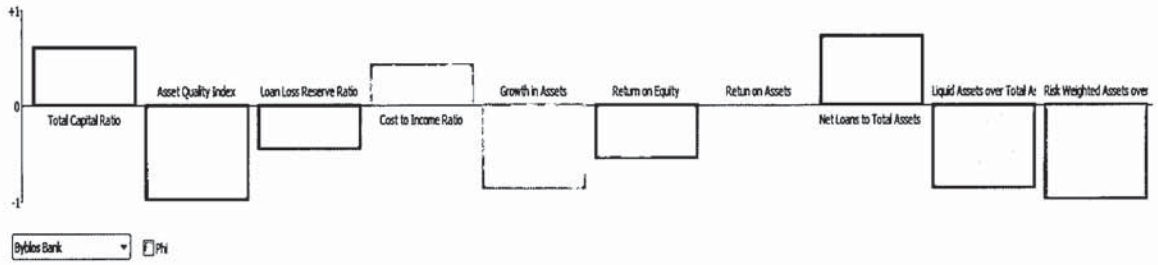

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Credit Libanais
Phi

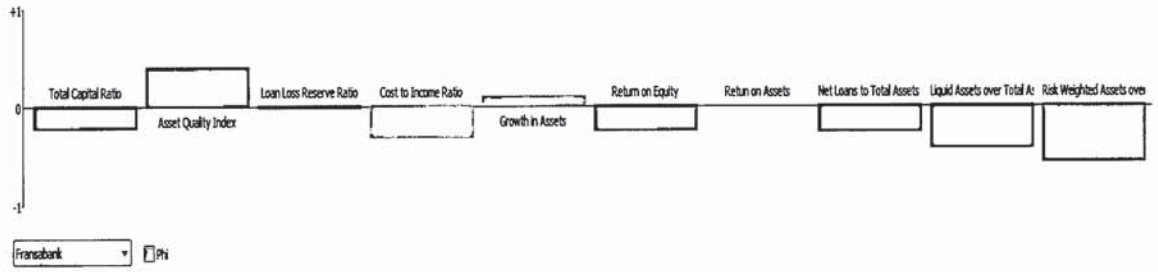

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
BBAC
Phi

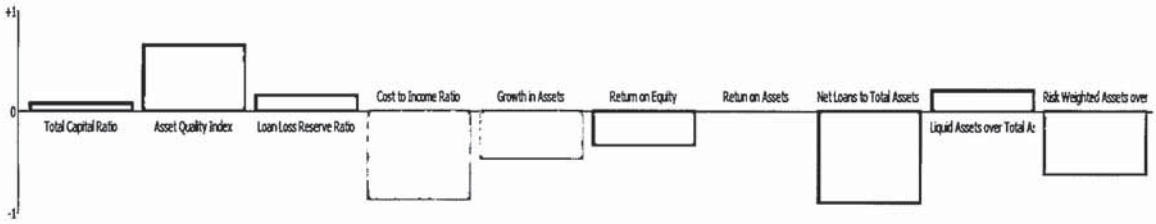
Year 2012:


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Bank Audi
Phi

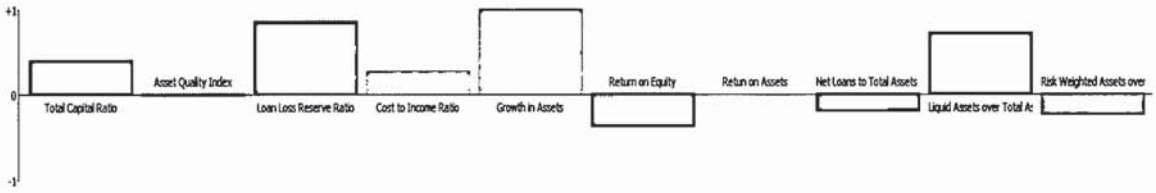

+1
0
-1
Asset Quality Index
Total Capital Ratio
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Blom Bank
Phi

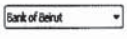

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Byblos Bank
Phi

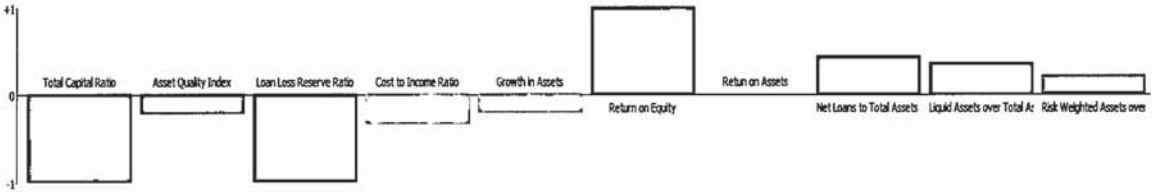

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Fransabank
Phi


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total Ac
Risk Weighted Assets over

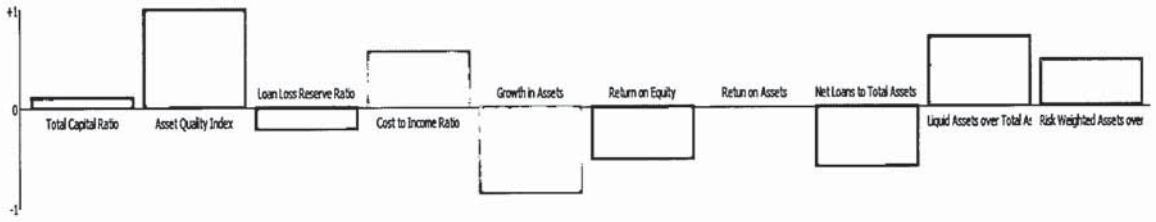

Bankseed
Phi

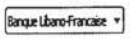

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total Ac
Risk Weighted Assets over

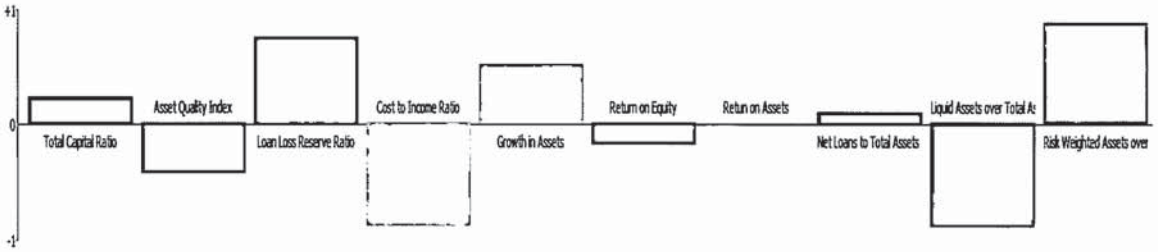

Bank of Beirut
Phi

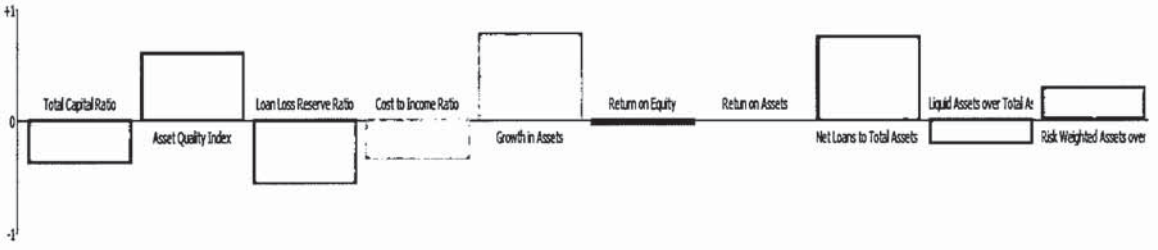

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total Ac
Risk Weighted Assets over


SGBL
Phi


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total Ac
Risk Weighted Assets over

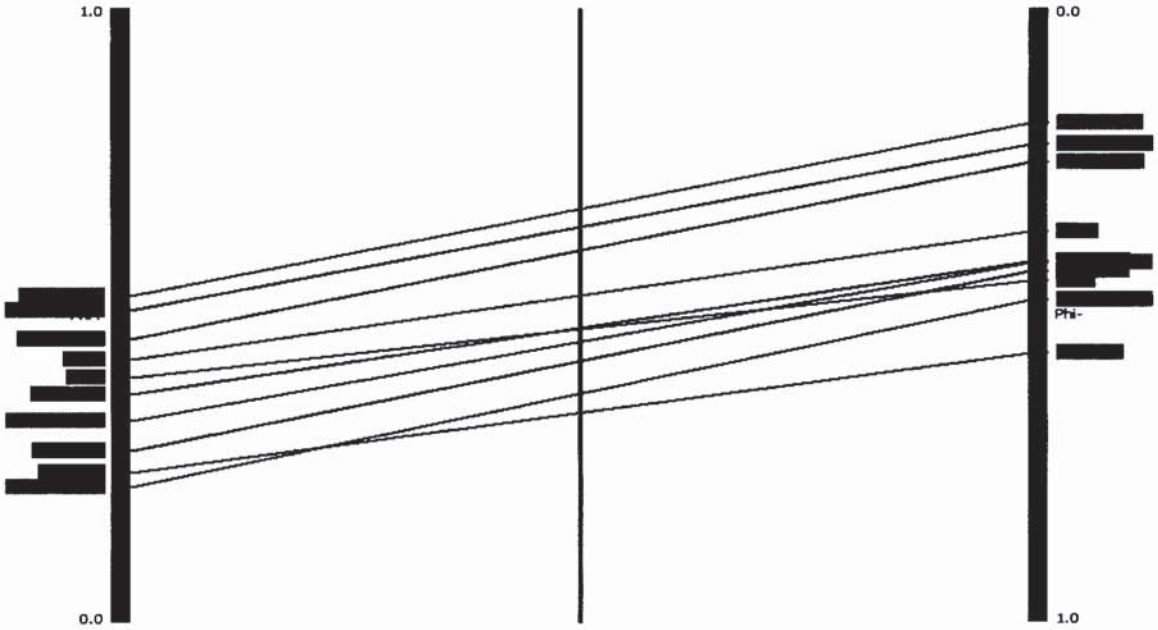

Banque Libano-Francaise
Phi


+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
Credit Libanais
Phi

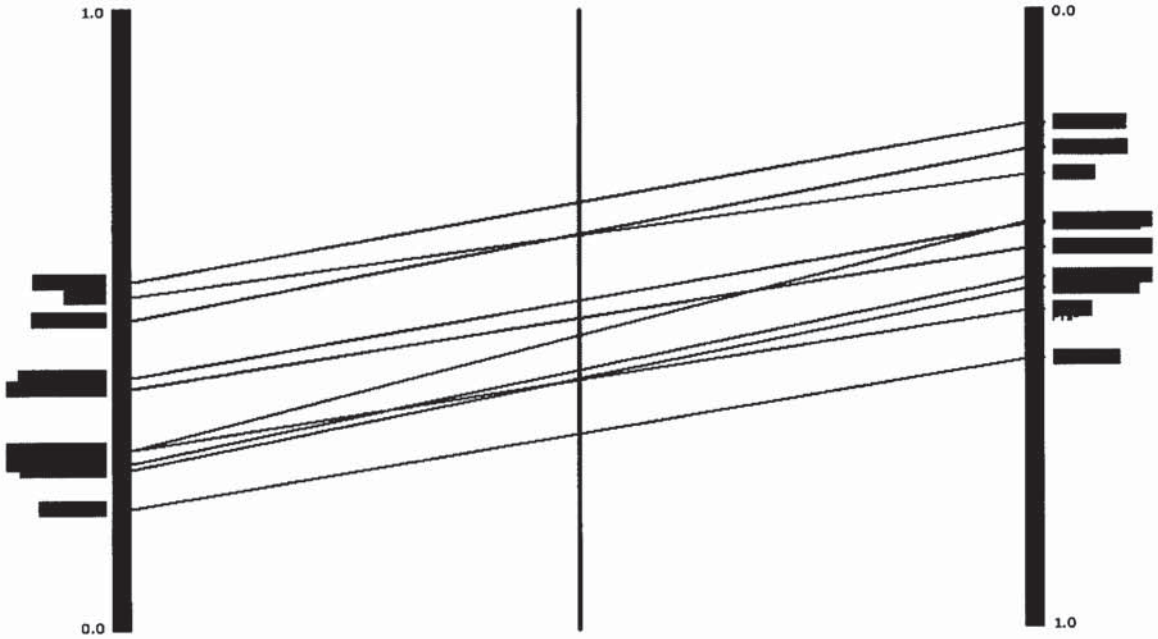

+1
0
-1
Total Capital Ratio
Asset Quality Index
Loan Loss Reserve Ratio
Cost to Income Ratio
Growth in Assets
Return on Equity
Return on Assets
Net Loans to Total Assets
Liquid Assets over Total As
Risk Weighted Assets over
BBAC
Phi

Appendix B: PROMETHEE I partial ranking

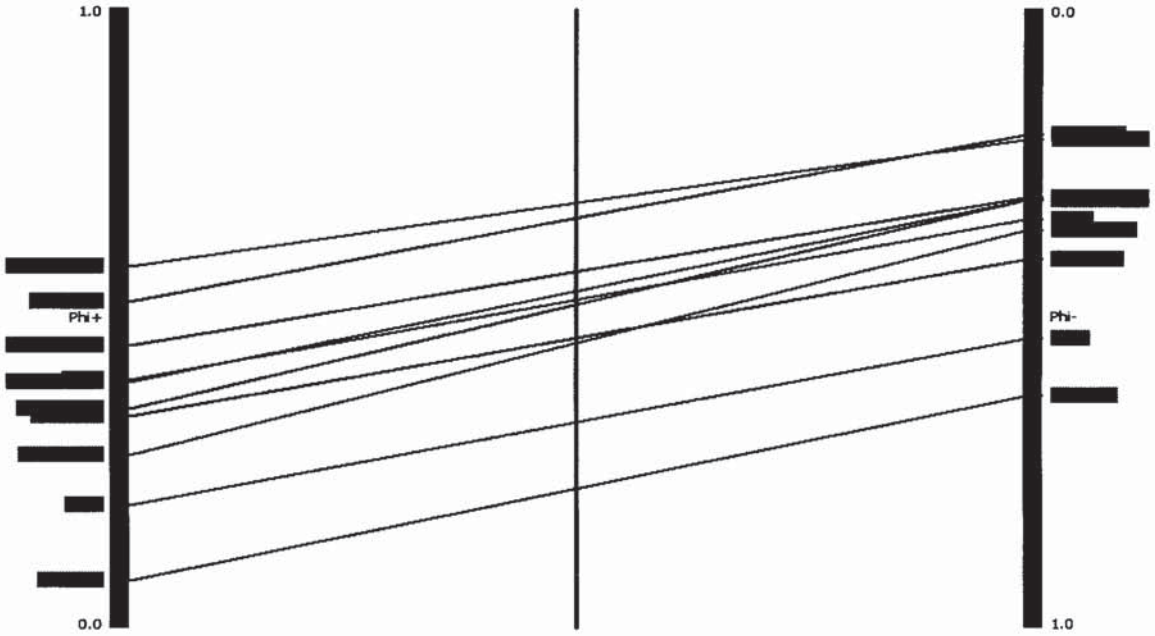
Year 2008



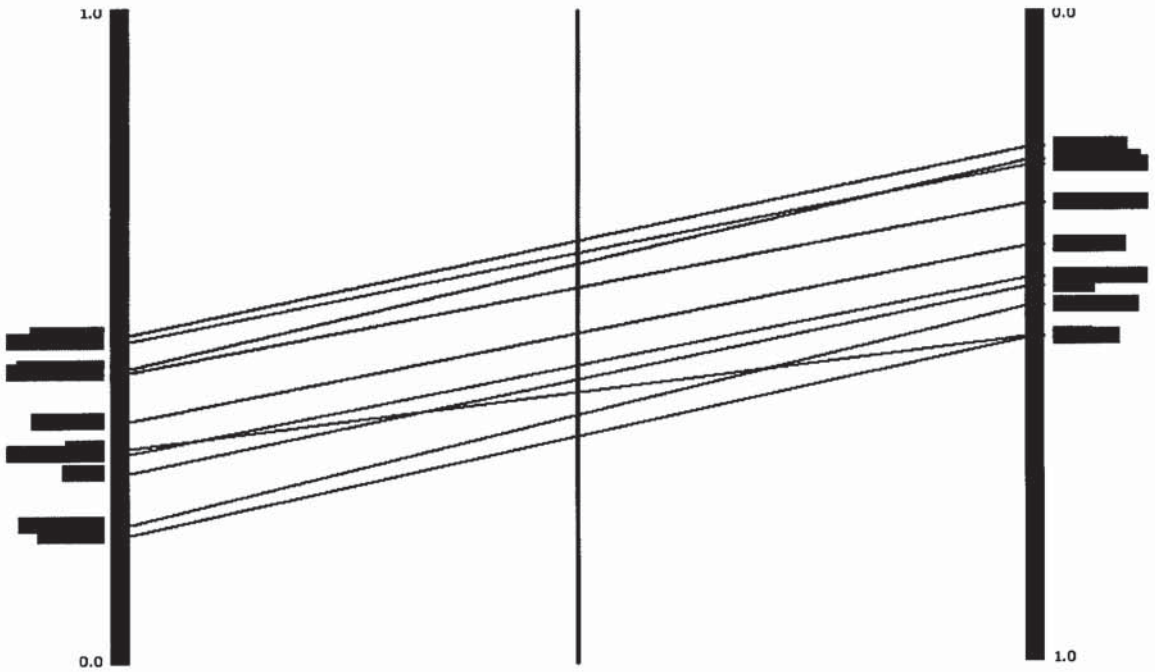
Year 2009



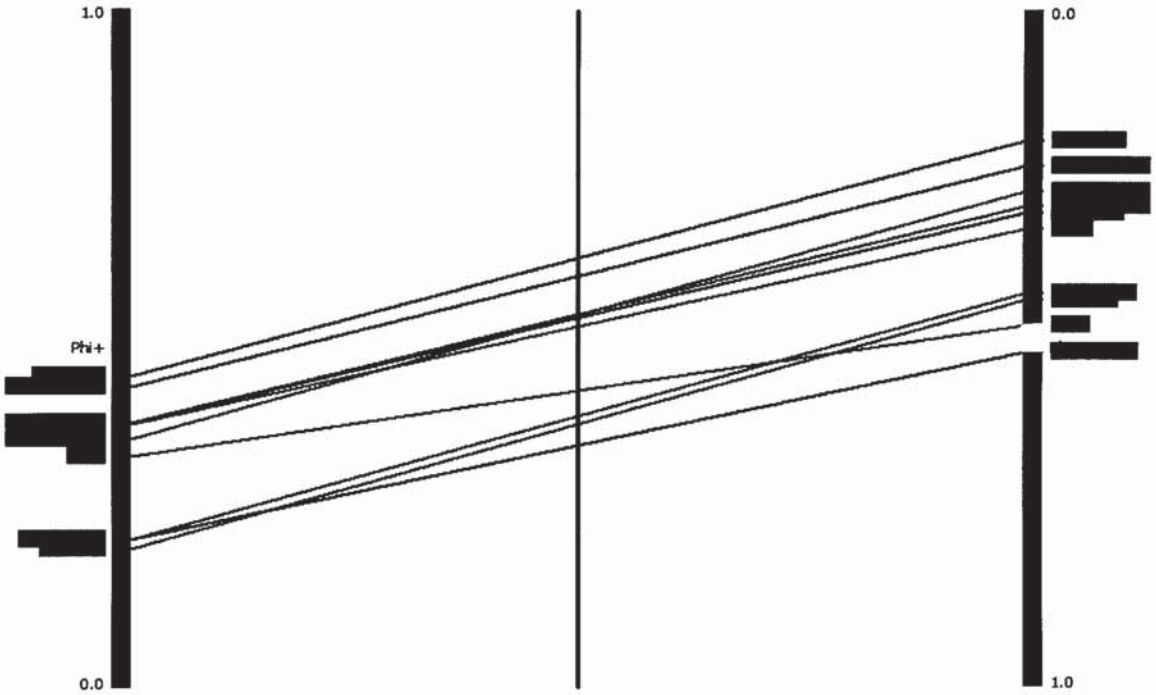
Year 2010



Year 2011



Year 2012



Appendix C: Normality Test

Total Capital Ratio

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
TCR	1.00	.277	20	.000	.712	20	.000
	2.00	.242	30	.000	.831	30	.000

Asset Quality Index

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
AQI	1.00	.165	20	.155	.869	20	.011
	2.00	.157	30	.056	.827	30	.000

Loan Loss Reserve

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
LLR	1.00	.127	20	.200*	.971	20	.786
	2.00	.250	30	.000	.763	30	.000

Cost to Income

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
CI	1.00	.220	20	.012	.941	20	.256
	2.00	.149	30	.090	.953	30	.201

Growth in Assets

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
GA	1.00	.178	20	.097	.963	20	.602
	2.00	.309	30	.000	.539	30	.000

Return on Equity

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
ROE	1.00	.142	20	.200*	.937	20	.206
	2.00	.185	30	.010	.905	30	.011

Return on Assets

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
ROA	1.00	.196	20	.043	.948	20	.339
	2.00	.164	30	.039	.911	30	.016

Net Loans over Total Assets

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
NLTA	1.00	.182	20	.082	.928	20	.144
	2.00	.107	30	.200*	.965	30	.403

Liquid Assets over Total Assets

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
LATA	1.00	.132	20	.200*	.943	20	.276
	2.00	.144	30	.113	.933	30	.059

Risk Weighted Assets over Total Assets

	Listed/Unlisted	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
RWTA	1.00	.252	20	.002	.767	20	.000
	2.00	.205	30	.002	.824	30	.000

Appendix D: Independent Sample Test

Cost to Income

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
CI	Equal variances assumed	.104	.748	-6.174	48	.000	-8.20007	1.32822	-10.87063	-5.52950
	Equal variances not assumed			-6.111	39.436	.000	-8.20007	1.34183	-10.91323	-5.48691

Net Loans over Total Assets

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
NLTA	Equal variances assumed	1.429	.238	-1.062	48	.294	-1.36757	1.28774	-3.95673	1.22160
	Equal variances not assumed			-1.111	46.346	.272	-1.36757	1.23056	-3.84406	1.10893

Liquid Assets over Total Assets

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
LATA	Equal variances assumed	.345	.559	2.914	48	.005	4.75327	1.63093	1.47407	8.03247
	Equal variances not assumed			2.971	43.459	.005	4.75327	1.59987	1.52781	7.97873

Appendix E: Kruskal Wallis Test

Total Capital Ratio

	TCR
Chi-Square	3.766
df	1
Asymp. Sig.	.052

Asset Quality Index

	AQI
Chi-Square	.981
df	1
Asymp. Sig.	.322

Loan Loss Reserve

	LLR
Chi-Square	17.463
df	1
Asymp. Sig.	.000

Growth in Assets

	GA
Chi-Square	.077
df	1
Asymp. Sig.	.782

Return on Equity

	ROE
Chi-Square	1.274
df	1
Asymp. Sig.	.259

Return on Assets

	ROA
Chi-Square	15.376
df	1
Asymp. Sig.	.000

Risk Weighted Assets over Total Assets

	RWTA
Chi-Square	3.539
df	1
Asymp. Sig.	.060

Appendix F: Mann Whitney Test

Total Capital Ratio

	TCR
Mann-Whitney U	202.000
Wilcoxon W	667.000
Z	-1.941
Asymp. Sig. (2-tailed)	.052
Exact Sig. (2-tailed)	.052
Exact Sig. (1-tailed)	.026
Point Probability	.001

Asset Quality Index

	AQI
Mann-Whitney U	250.000
Wilcoxon W	715.000
Z	-.990
Asymp. Sig. (2-tailed)	.322
Exact Sig. (2-tailed)	.328
Exact Sig. (1-tailed)	.164
Point Probability	.002

Loan Loss Reserve

	LLR
Mann-Whitney U	89.000
Wilcoxon W	299.000
Z	-4.179
Asymp. Sig. (2-tailed)	.000
Exact Sig. (2-tailed)	.000
Exact Sig. (1-tailed)	.000
Point Probability	.000

Growth in Assets

	GA
Mann-Whitney U	286.000
Wilcoxon W	496.000
Z	-.277
Asymp. Sig. (2-tailed)	.782
Exact Sig. (2-tailed)	.791
Exact Sig. (1-tailed)	.396
Point Probability	.008

Return on Equity

	ROE
Mann-Whitney U	243.000
Wilcoxon W	708.000
Z	-1.129
Asymp. Sig. (2-tailed)	.259
Exact Sig. (2-tailed)	.266
Exact Sig. (1-tailed)	.133
Point Probability	.004

Return on Assets

	ROA
Mann-Whitney U	102.000
Wilcoxon W	567.000
Z	-3.921
Asymp. Sig. (2-tailed)	.000
Exact Sig. (2-tailed)	.000
Exact Sig. (1-tailed)	.000
Point Probability	.000

Risk Weighted Assets over Total Assets

	RWTA
Mann-Whitney U	205.000
Wilcoxon W	670.000
Z	-1.881
Asymp. Sig. (2-tailed)	.060
Exact Sig. (2-tailed)	.061
Exact Sig. (1-tailed)	.030
Point Probability	.001